博士論文

Doctoral Thesis

A Reluctant Space Safety Services Provider:
The Role of the Military in Space Traffic Management

（消極的な宇宙安全サービス提供主体：宇宙交通管制における軍の役割）

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Dedication

To H.N.

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Abstract

The aim of this thesis is to restore the place of the military in space traffic management (STM) studies. Although the militaries of advanced space powers are among the largest satellite operators in the world and have considerable influence over their respective domestic space policymaking processes, they are largely overlooked in the STM literature. Deriving hypotheses from established civil-military relations, public choice and bureaucratic politics theories, this study analyses the contribution of the American, French and Japanese armed forces in their respective domestic space safety and sustainability discussions. Using an adapted version of the three-model framework developed by Graham Allison in *Essence of Decision*, this study shows that the military only reluctantly involves in space safety and sustainability affairs. While it can perform tactical incursions in space safety when required, it generally favours retaining a support function to a civilian lead. The study also demonstrates the growing importance of highly specialised 'space military technologists' in shaping the military establishment's views on space safety and sustainability issues. This study provides important contributions to theory, by bringing novel civil-military relations perspectives to STM studies, and to practice, military considerations being the missing piece for the development of realistic proposals for the creation of an international regime for space safety and sustainability.

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List of Frequent Abbreviations

AF/A3	Air Staff's Office of Operations, Plans and Requirements
AFSPC	Air Force Space Command
AFSPC/A3	AFSPC's Directorate of Air, Space and Information Operations
AFSPC/A5	AFSPC's Directorate of Requirements
AGI	Analytical Graphics, Inc.
AIAA	American Institute of Aeronautics and Astronautics
AIS	Automated Identification System
APSDC	Advisory Panel on Security and Defense Capabilities
ASAT	Anti-satellite
ASDF	Air Self-Defense Forces
BMD	Ballistic Missile Defence
BSGC	Bisei Space Guard Centre
CAESAR	Conjunction Analysis and Evaluation Service, Alerts and Recommendations
CCSDS	Consultative Committee for Space Data Systems
CDE	Commandement de l'Espace
CFE Pilot Program	Commercial and Foreign Entities Pilot Program
CIE	Commandement Interarmées de l'Espace
CIRO	Cabinet Intelligence and Research Office
CMR	Civil-Military Relations
CNES	Centre National d'Études Spatiales
CNO	Chief of Naval Operations
CONFERS	Consortium for Execution of Rendezvous and Servicing Operations
COSMOS	Centre Opérationnel de Surveillance Militaire des Objets Spatiaux
CSIS	Center for Strategic and International Studies
CSISE	Cabinet Satellite Intelligence Centre
CSO	Chief of Space Operations
CSpOC	Combined Space Operations Center
CSSI	AGI's Centre for Space Standards and Innovation
DAF	Department of the Air Force
DARPA	Defense Advanced Research Projects Agency
DASD	Deputy Assistant Secretary of Defense
DGA	Délégation Générale pour l'Armement

DNI	Director of National Intelligence
DNRO	Director of the NRO
DoC	Department of Commerce
DoC/OSC	DoC's Office of Space Commerce
DoD	Department of Defense
DoS	Department of State
DoS/AVC	DoS's Bureau of Arms Control, Verification and Compliance
DoS/OES	DoS's Bureau of Oceans and International Environmental and Scientific Affairs
DoT	Department of Transportation
DPJ	Democratic Party of Japan
EEAS	European External Action Service
ESA	European Space Agency
EU SST	European Union Space Surveillance and Tracking (SST) Support Framework
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAA	Federal Aviation Administration
FAA-AST	FAA Office of Commercial Space Transportation
FCC	Federal Communications Commission
FOIA	Freedom of Information Act
GEO	Geostationary Orbit
GoJ	Government of Japan
GPS	Global Positioning System
GRAVES	Grand Réseau Adapté la VEille Spatiale
GSSAP	Geosynchronous Space Situational Awareness Program
GVS	Global VSAT Forum
HASC	House Committee on Armed Services
IAA	International Academy of Astronautics
IAASS	International Association for the Advancement of Space Safety
IADC	Inter-Agency Space Debris Coordination Committee
ICAO	International Civil Aviation Organisation
IDA	Institute for Defense Analyses
IGS	Intelligence-Gathering Satellite
ISAS	Institute of Space and Astronautical Science
ISO	International Organisation for Standardisation
ITU	International Telecommunication Union

JAXA	Japan Aerospace Exploration Agency
JCG	Japan Coast Guard
JCS	Joint Chiefs of Staff
JDA	Japan Defense Agency
JMS	Joint Space Operations Center Mission System
JS	Joint Staff
JS/J8	JS's Directorate of Force Structure, Resources and Assessment
KSGC	Kamisaibara Space Guard Centre
LDP	Liberal Democratic Party
LEO	Low Earth Orbit
LOS	Loi sur les Opérations Spatiales
LTS Guidelines	Guidelines for the Long-Term Sustainability of Outer Space Activities
MDA	Maritime Domain Awareness
MEAE	Ministère de l'Europe et des Affaires Étrangères
MELCO	Mitsubishi Electric Corporation
MESRI	Ministère de l'Éducation Supérieure, de la Recherche et de l'Innovation
METI	Ministry of Economy, Trade and Industry of Japan
MEXT	Ministry of Education, Culture, Sports, Science and Technology of Japan
MIC	Ministry of Internal Affairs and Communication of Japan
MILAMOS	Manual on International Law Applicable to Military Uses of Outer Space
MINARM	Ministère des Armées
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MOD	Ministry of Defense of Japan
MOFA	Ministry of Foreign Affairs of Japan
MSDF	Maritime Self-Defense Forces
MTDP	Mid-Term Defense Program
NAL	National Aerospace Laboratory of Japan
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency
NATO	North Atlantic Treaty Organization
NDAA	National Defense Authorization Act
NDPG	National Defense Program Guidelines
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NRO	National Reconnaissance Office

NSC	National Security Council
NSpC	National Space Council
NSPC	National Space Policy Committee
NSPS	National Space Policy Secretariat
NSS	National Security Strategy
OADR	Open Architecture Data Repository
ODMSP	Orbital Debris Mitigation Standard Practices
OIG	Orbital Information Group
ONERA	Office National d'Études et de Recherches Aérospatiales
OOS	On-Orbit Servicing
OSD	Office of the Secretary of Defense
OSD/GC	DoD General Counsel
OSD/SP	Office of the Deputy Assistant Secretary of Defense for Space Policy
OSTP	Office of Science and Technology Policy
OUSD(P)	Office of the Deputy Assistant Secretary of Defense for Space Policy
RPO	Rendezvous and Proximity Operations
SAF/GC	DAF General Counsel
SAF/IA	DAF International Affairs
SARPs	Standards and Recommended Practices
SASC	Senate Committee on Armed Services
SATAM	Système d'Acquisition et de Trajectographie des Avions et des Munitions
SATCAT	Satellite Catalogue
SCS	Space Control Squadron
SDA	Space Domain Awareness
SDA	Space Data Association
SDF	Self-Defense Forces
SDS	Space Defense Strategy
SHSP	Strategic Headquarters for Space Policy
SJAC	Society of Japanese Aerospace Companies
SPADOC	Space Defense Operations Center
SPD	Space Policy Directive
SSA	Space Situational Awareness
SSC	Space Safety Coalition
SSN	United States Space Surveillance Network
SST	Space Surveillance and Tracking

STA	Science and Technology Agency
STM	Space Traffic Management
STPI	Science and Technology Policy Institute
STSC	UNCOPUOS Scientific and Technical Subcommittee
SWF	Secure World Foundation
TCBMs	Transparency and Confidence Building Measures
TLE	Two-Line-Element
UCS	Union of Concerned Scientists
UNCOPUOS	United Nations Committee for the Peaceful Uses of Outer Space
USAF	United States Air Force
USCG	United States Coast Guard
USG	United States Government
USN	United States Navy
USSF	United States Space Force
USSPACECOM	US Space Command
USSTRATCOM	US Strategic Command
VCJCS	Vice Chairman of the Joint Chiefs of Staff

Chapter 1. Introduction

If we lose the war in the air, we lose the war and we lose it quickly

Field Marshal The Viscount Montgomery of Alamein[1]

Without even noticing it, we rely on outer space for almost every aspect of our modern lives. An action as innocent as looking for one's itinerary on a smartphone application involves the three facets of space technology. The background map of the application was likely obtained using satellite imagery, the little dot indicating one's position was generated using a satellite positioning system like the American Global Positioning System (GPS) and all the data available on the museum, restaurant or government building one is planning to visit is available around world thanks to satellite communication. Taking a plane, ordering a taxi, watching international TV channels, etc.: all this would be impossible without space technology. Beyond futile aspects of our lives, our over-reliance on space technology even includes critical issues for our safety and security. Modern troops could not be guided on the battlefield without GPS, the happening of a deadly typhoon could not properly forecasted without geostationary meteorological satellites, airplanes and ships would not know their precise position. A list of all the hazards currently mitigated by space technologies could easily fill this entire dissertation. Governments of advanced countries are perfectly aware of their over-reliance on space technology and are developing targeted countermeasures. To avoid being dependent on the GPS in case of conflict with the US, Russia, China,[2] India or European countries developed their own satellite positioning systems (respectively GLONASS, BeiDou, NAVIC and Galileo). To have access to their own Earth imaging capabilities, most advanced space countries have their own remote sensing satellites for civil or military uses. However, such countermeasures are only aimed at preventing the denial of space utilisation services by a third country but are missing one very important issue: the situation of the outer space environment.

[1] Field Marshall Montgomery, 'The Role of Science in Warfare of the Future', *Engineering and Science* 18, no. 3 (1 December 1954): 20–28.
[2] In this dissertation, the use of *China* corresponds to the *People's Republic of China*. If mentioned, the *Republic of China* will be called *Taiwan*.

The use of space technology in jeopardy

Space technology utilisation as we know it is jeopardised. The rise of the number of launches, the increasing number of actors in space, and the existing important population of space debris put us on the verge of a disaster. The prophetic view of NASA scientist Joseph Kessler of an uncontrollable chain-reaction with space debris colliding with each other, generating more debris, colliding again, and making critical orbits unusable for decades or centuries is becoming more tangible every day.[3] But, as one can assume, there may be rules to govern the traffic of satellites and rockets in space. When we ride a plane, a train or a ship, we legitimately assume that there exist rules guaranteeing our safety. Therefore, knowing the critical importance of preserving space assets, we could also legitimately assume that there are an unquantifiable number of rules regulating every aspects of space activities. Surprisingly for the lay reader, we could not be more wrong. While advanced space powers have strict domestic regulations for managing their national activities in outer space, there is almost no international traffic rule[4] in space. Noticing the absurdity and the extreme danger of the situation, researchers and decision-makers around world have started to investigate the possibility to establish traffic rules in space, mostly from the early years of the 21st century. Better late than never.

Point of entry: the civilian focus of space traffic management studies

Most studies, articles and reports published provide very insightful analyses of the current situation of debris in outer space and propose various – sometime conflicting – solutions to organise space traffic. They clearly outline the future challenges of the growing commercialisation of space utilisation and the dire need for coordination. Most, not to say all, of them however tend to overlook a key actor. Voluntarily or – that is concerning – involuntarily, solutions provided are what can be called civil space traffic management (CSTM) and do not take into account military activities in space. While it is legitimate to focus on the future dominant players from the commercial side, outer space is before all a warfighting domain, not only congested with space debris, but as often hammered out “competitive and contested”. The United States Department of Defense (DoD), for example, is considered to be the second largest satellite operator in the world (after Elon Musk’s SpaceX) and “the single

[3] Donald J Kessler et al., ‘The Kessler Syndrome: Implications to Future Space Operations’, *Advances in the Astronautical Sciences* 137 (2010): 47–61.
[4] ‘Rule’ is used here in a broad sense and includes norms, norms of behaviour, best practices, etc., as clarified throughout the dissertation.

largest customer for the satellite industry".[5] Therefore, thinking about drafting international rules for space traffic without considering the expectations, role or even influence of the militaries of advanced space powers seems inconsiderate, to say the least. Prominent players having benefited from space technologies for communication, positioning or intelligence gathering for more than half-a-century, these militaries may not be absolutely passive actors when their civilian counterparts decide to set up rules of good behaviour. Such observation was the point of entry of the author on this doctoral work: what role and influence do the militaries of advanced space powers have in the development of a potential international regime for STM?

STM inside-out: military role and influence in domestic decision-making

Historically opposed to rulemaking in outer space, the militaries of advanced space powers may have to revise their position based on a quickly changing landscape. Beyond environmental issues like the proliferation of space debris and an increasing traffic – mostly commercial – in outer space, the rise of new military competitors such as China and India, having demonstrated anti-satellite (ASAT) capabilities in, respectively, 2007[6] and 2019,[7] could create a desire for rules in American and European minds. Whether it is to legitimately avoid future catastrophes or simply to maintain a beneficial *status quo*, a certain level of regime-making seems unavoidable, even for the strongest defendants of military freedom in outer space. Currently, the militaries of advanced space powers, thanks to their extensive space surveillance capabilities, unmatched among civil space agencies, tend to be considered solely as technical support to STM. As precisely explained later in this dissertation, an STM regime could consist of a set of norms, rules or principles, relying on a technical backbone provided by, *inter alia*, the ability to monitor the traffic in outer space. Such service is currently being provided mostly by military forces, and in particular by the US military, the downside of this situation being that armed forces are often restricted to this technical role. Thanks however to their technical expertise, not only on space surveillance but also on space operations, they are the main bodies of pragmatic knowledge about STM. This study therefore tries to restore the place of the military in STM policymaking.

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[5] Paul Dykewicz, 'U.S. Military Remains Big Focus of Satellite Operators', SpaceNews.com, 2 May 2005, https://spacenews.com/us-military-remains-big-focus-satellite-operators/.

[6] TS Kelso, 'Analysis of the 2007 Chinese ASAT Test and the Impact of Its Debris on the Space Environment' (Advanced Maui Optical and Space Surveillance Technologies Conference 2007, Maui, Hawaii, 2007).

[7] Brian Weeden and Victoria Samson, 'Op-Ed | India's ASAT Test Is Wake-up Call for Norms of Behavior in Space', SpaceNews.com, 8 April 2019, https://spacenews.com/op-ed-indias-asat-test-is-wake-up-call-for-norms-of-behavior-in-space/.

Instead of thinking about the establishment of a civilian-oriented STM regime, hoping that it would not be opposed too strongly by the military, it is critical to do a full stakeholder analysis of STM, including not only civilian governmental agencies and commercial actors but also the military. Understanding its role, its expectations, its values regarding the preservation of a safe and sustainable space environment and its interactions with other national and international actors, and combining these findings with existing CSTM studies is the only way to design an STM regime that would be acceptable for most countries, that would be efficient and that would be sustainable. Therefore, compared to the initial question proposed at the end of the previous section focussing on international regime-making, the centre of attention here should rather be on domestic decision-making processes and civil-military relations.

In fact, one of the most important lessons of modern literature on international relations is the close intricacy between domestic and international decision-making spheres. In particular, Robert Putnam's two-level game brought a new understanding to the "reciprocal causation" between the two spheres, going beyond the unidirectional analysis that characterised previous attempts.[8] What is true for all international negotiation processes is even truer for issues involving the military, which is by definition very discreet on the international stage, leaving the way to official diplomats. Based on this, keeping a macroscopic perspective would fail to reveal the true influence of the military, hence the need to investigate domestic processes.

Therefore, the initial question proposed above can be replaced by numerous new ones, taking into account both the domestic roots of the issues, as well as the specificities of civil-military relations: what are the role and influence of the military in domestic decision-making processes on space safety and sustainability? What are the incentives for the military to engage in space safety and sustainability activities? What is the level of awareness of armed forces with regards to space safety and sustainability? Etc.

Building working hypotheses

Understanding the role played by the military in domestic decision-making processes and therefore its interactions with its civilian counterparts is the core of the field of Civil-Military Relations (CMR). Thus, it is primordial for the development of viable working hypotheses to set up a coherent conceptual framework based on a commonly accepted interpretation of CMR. In particular, CMR is characterised by an original dichotomy between the views of Samuel P.

[8] Robert D. Putnam, 'Diplomacy and Domestic Politics: The Logic of Two-Level Games', *International Organization* 42, no. 3 (1988): 433.

Huntington and Morris Janowitz, outlined respectively in *The Soldier and the State* in 1957 and *The Professional Soldier* in 1960.[9] The dissertation chooses to adopt the framework developed by Janowitz, in order to derive working hypotheses and confront them to empirical evidence on civil-military relations with regards to space safety and sustainability. This choice was not made randomly but based on the fact that even a superficial observer of space security would notice the extremely close intricacy of civilian and military actors in policymaking: space military projects are dealt with by legions of internal civilian experts, numerous prominent space officers have been recruited from civilian universities without following the traditional Air Force Academy path (e.g. Generals Hyten and Raymond) and finally, domestic and international discussion fora see a heavy participation from military officers with expertise in space law and policy. Hence, Janowitz idea of civilianisation of the military seems *a priori* more relevant than Huntington's professional military under "objective" civilian control.

Specifically, this dissertation decides to hypothesise the behaviour of the militaries of advanced space powers following Janowitz's concept of *constabulary force*, force which is "continuously prepared to act, committed to the minimum use of force, and seeks viable international relations, rather than victory".[10] Considering the full scope of military capabilities from the most destructive to the most benign ones, Janowitz explains that "the constabulary concept recognizes that there are strategic and tactical dimension at each end of the range".[11] While at the time Janowitz focussed on nuclear issues or guerrilla wars, this dichotomy is valid for a contemporary issues such as space safety and sustainability. The military has a strategic interest in the long-term *sustainability* of outer space in order to ensure that it will be able to continue using assets on which it is over-reliant in the decades and centuries to come. On a tactical level, the military has interest in preventing incidents and accidents in space that could have a direct negative impact on their activities. In other words, there is a tactical interest for space *safety*, beyond the obvious interest for the protection of military assets against malicious attacks, which goes without saying. Even with the recognition of these two levels of military interest for respectively, space safety and sustainability, does it however mean that the military would be willing to directly intervene to protect these interests?

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[9] Samuel P Huntington, *The Soldier and the State: The Theory and Politics of Civil Military Relations* (Cambridge, Massachusetts & London, England: The Belknap Press of Harvard University Press, 1957); Morris Janowitz, *The Professional Soldier* (New York: The Free Press, 1964).
[10] Janowitz, *The Professional Soldier*, 418.
[11] Janowitz, 419.

Contrary to the enduring view of bureaucracies as imperialist,[12] workforce- or budget-maximising entities[13] developed in the 1970s-1980s, contemporary public choice theory provides interesting inputs on this question, such as Patrick Dunleavy's *bureau shaping model*.[14] To oversimplify a complex model, Dunleavy states that senior bureaucrats, those actually having the power and influence to pursue budget-maximisation strategies, have little incentive in doing so, and would instead "place more emphasis upon non-pecuniary utilities".[15] It includes the demonstration of excellent performances by a bureau based on the focus on its core mission, which can require to "export responsibility for functions inconsistent with senior officials' agency-type ideal".[16] In fact, before Dunleavy, Graham Allison and Morton Halperin insisted on the strong inclination of the military for uncertainty avoidance, and therefore the preference given to clear institutional boundaries (hence autonomy) rather than unclear budget increases:

> "Where autonomy is not possible, the primary environment (relations with other organizations comprising the government) is stabilized by such arrangements as agreed budgetary splits, ***accepted areas of responsibility***, and established practices" (emphasis added).[17]

In the case of space safety responsibilities, a clear cut between pure military responsibilities (e.g. space domain awareness, cataloguing) and activities relying on regulatory and promotional

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[12] Gordon Tullock, *The Vote Motive*, Hobart Paperback 9 (London, UK: The Institute of Economic Affairs, 1976), 29, https://iea.org.uk/wp-content/uploads/2016/07/The%20Vote%20Motive.pdf.
[13] Respectively in: Morris P. Fiorina and Roger G. Noll, 'Voters, Bureaucrats and Legislators: A Rational Choice Perspective on the Growth of Bureaucracy', *Journal of Public Economics* 9, no. 2 (1 April 1978): 239–54, https://doi.org/10.1016/0047-2727(78)90045-2; and William A Niskanen, *Bureaucracy: Servant or Master? Lessons from America*, Hobart Paperback (London, UK: The Institute of Economic Affairs, 1973), 8; Both cited in: Patrick Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science* (Hemel Hempstead, UK: Harvester Wheatsheaf, 1991), 154.
[14] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*.
[15] Dunleavy, 200; Dunleavy cites: Morton H Halperin, *Bureaucratic Politics and Foreign Policy*, 1st ed. (Washington, DC: Brookings Institution Press, 1974); and John W Kingdon, *Agendas, Alternatives, and Public Policies* (United States: Little, Brown and Company, 1984).
[16] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*, 204.
[17] Graham T Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 2nd ed. (New York: Addison-Wesley-Longman, 1999), 170; Allison quotes Morton H Halperin and Priscilla A Clapp, *Bureaucratic Politics and Foreign Policy*, 2nd ed. (Washington, DC: Brookings Institution Press, 2006), 51: "In particular, priority is attached to maintaining control over budgets. Organizations are often prepared to accept less money with greater control rather than more money with less control. Even with fewer funds, they are able to protect the essence of their activities. The priority attached to autonomy is shown by the experiences of various secretaries of defense. Robert McNamara caused great consternation in the Pentagon in 1961 by instituting new decision procedures that reduced the autonomy of the armed services, despite the fact that he increased defense spending by $6 billion and did not directly seek to alter their roles and missions. Melvin P. Laird, in contrast, improved Pentagon morale in 1969 by increasing service autonomy in budget matters while reducing the defense budget by more than $4 billion".

aspects (space safety *stricto sensu*) that can be dealt with by relevant civilian agencies, would let the military focus and devote its resources to an area of absolute autonomy and control.

The question here is therefore to find the balance between the clear military interest in space safety and sustainability and its preference to focus on its core – warfighting – mission. The solution can be found in Janowitz's distinction between strategic and tactical issues. While it is not its role to ensure the long-term sustainability of outer space – a strategic promotional or regulatory issue – the military could justify an incursion in space safety, precisely through the widespread provision of space safety services, as a tactical, short-term move to protect its space assets, if witnessing a failure of civilian counterparts to do so, be it because of an absence of technical capabilities or officially granted authority. Tactical by definition, this move is to be terminated and responsibilities to be transferred when a legitimate civilian agency manages to gather both technical capabilities and officially granted authority. This leads to hypothesis 1, focussing more generally on national space safety and sustainability efforts, which include both technical aspects (e.g. space safety services) and policymaking (e.g. norms promotion).

Hypothesis 1 [H1]: the military as reluctant leader in space safety and sustainability

[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).

[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

The second major element of Janowitz's constabulary force concept is its implication on the "skill structure of the contemporary military establishment". For him, the need for *civilianisation* of the military and subsequent evolution of the armed forces into constabulary forces "will require more extensive general competence from its military managers and more intensive scientific specialization from its military technologists".[18] By differentiating "military technologists" and "military managers", Janowitz envisions a modification of the skill structure of the military establishment with, respectively, high-level technical experts with close civilian ties focussing on the technical evolution of the military – epitomised by space technology – and

[18] Janowitz, *The Professional Soldier*, 425.

generalist managers with a foot in the political arena. The role of military technologists is particularly important with regards to the military uses of space assets, which level of complexity and implications across areas of military activities are tremendous. In his major article on the *Revolution in Warfare*, Eliot Cohen identifies the "space general" as one of the three rising individuals of modern armed forces, along with the "electronic warfare wizard" and the "expert in missile operations" – closely related to space as this dissertation later explains.[19] Janowitz then proposes approaches for the realisation of his vision on the increased specialisation of military technologists such as the further development of highly specialised technical tracks in military academies and increase of recruitments of career officers from civilian universities through the Reserve Officers Training Corps (ROTC) program, in opposition to its initial purpose: the preparation of reserve officers. Hence, by extending Janowitz's vision to space, one can hypothesise that in order for issues related to space safety and sustainability to be taken into serious consideration by the military establishment, a critical mass of space military technologists would need to be developed within the armed forces.

Hypothesis 2 [H2]: the need for specialised space officers
The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

It is important here to understand that this hypothesis concerns the development of a body of space military technologists, as a formal or informal structure within the military establishment, with individuals that can be clearly identified as space experts based on their training or career orientation. Although it is mentioned throughout the dissertation, choice was made not to build the hypothesis around the related concepts of *military culture,*[20] or *operational culture* and *service identity* as analysed, for example, in Carl Builder's *The Masks of War*.[21]

Beyond identifying a correlation between the existence of a critical mass of military technologists and the inclusion of space safety and sustainability the armed forces' policy agenda, this dissertation also focusses on justifying the causation. How can these military technologists advocate for space safety and sustainability issues? Do they derive it from their

[19] Eliot A Cohen, 'A Revolution in Warfare', *Foreign Affairs* 75, no. 2 (April 1996): 49.
[20] Joseph L Soeters, Donna J Winslow, and Alise Weibull, 'Chapter 14. Military Culture', in *Handbook of the Sociology of the Military*, ed. Giuseppe Caforio, Handbooks of Sociology and Social Research (New York: Springer, 2006), 237–54.
[21] Carl H Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, 1st ed., A RAND Corporation Research Study (Baltimore, Maryland: The Johns Hopkins University Press, 1989).

institutional authority (e.g. Chief of Space Operations or Commander of the US Space Command), from their widely recognised expertise, from their ability to commission research reports or from the public appearances they make in conferences or in congressional hearings?

The two previous hypotheses concerned the potential role of the military and its incentives for intervention in space safety and sustainability, as well as more generally the awareness of the military establishment on those issues. The following interrogation is therefore the actual influence that the militaries of advanced space power can exert in their respective domestic decision-making process. Evaluating the influence of a given agency in its domestic decision-making processes could be done in a quantitative way, for example through the careful analysis of meetings minutes to calculate the actual rate of ideas proposed or opposed by the military that were respectively accepted or rejected at the end of the said process. However, due to both the sensitivity and the novelty of the issue, such study cannot be done in the case of space safety and sustainability. Consequently, it is necessary to design a qualitative approach to the measurement of the military's influence in interagency decision-making processes on space safety and sustainability. As domestic decision-making primarily relies on the identification of a joint position among participating agencies, the influence of a given agency can be measured in the level of consideration that other agencies will give to its position. Therefore, choice is made in this dissertation to evaluate the influence of an agency through the perception of other agencies.

In addition, the way a position is expressed by a given agency has an impact on the way it is perceived by other agencies. Here, choice is made to differentiate between *prescription* and its little used antonym *proscription*, that is to say between the approach consisting in promoting or *prescribing* a certain course of action, and conversely the approach consisting in opposing or *proscribing* one.

Hypothesis 3 [H3]: military as most influential actor in STM policymaking

[H3.1] If the military opposes a position on space safety and sustainability, then this position is perceived as inacceptable by other agencies involved in domestic decision-making (*absolute proscriptive influence*).

[H3.2] Conversely, if the military supports a position on space safety and sustainability, then this position is perceived very favourably by other agencies involved in domestic decision-making (*strong prescriptive influence*).

Testing the hypotheses: theoretical framework, methodology and data

Evaluating the validity of the hypotheses presented in the previous section requires a fine understanding of interagency and intra-agency dynamics and decision-making processes on space safety and sustainability. To achieve this goal, the author chose to follow in this dissertation the framework developed by Graham Allison in his famous 1971 work *Essence of Decision*,[22] later revised with the help of Philip Zelikow.[23] In *Essence*, Allison and Zelikow provide a detailed historical analysis of the event having unfolded during the Cuban Missile Crisis of 1962. In order to explain the rationale behind specific decisions made by both the American and the Soviet sides and to show the limits of the realist vision of government decision-making as the rational thinking process of a unitary state actor (*Model I: Rational Actor Model*), Allison introduced two new models aiming to highlight the role played by subnational actors in state decision-making: the *Organisational Behaviour Model (Model II)* and the *Governmental Politics Model (Model III)*.[24]

This three-model theoretical framework is applied to three case studies of the United States, France and Japan, and how their militaries are approaching the issue of international regime-making for STM. However, are models developed for crisis decision-making applicable to an issue like space safety and sustainability? First of all, Allison himself insists on the "broader implications" of his framework in "arenas beyond foreign affairs", in particular to the "domestic policy of national governments", focus of this study.[25] Apart from similarities between the Cuban Missile Crisis context and the current situation in outer space, such as increasing of warfighting tensions in space[26] and the feeling of urgency to deal with space debris and space traffic management for the long-term sustainability of space, there are numerous

[22] Graham T Allison, *Essence of Decision: Explaining the Cuban Missile Crisis*, 1st ed. (HarperCollins, 1971).
[23] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*.
[24] Model III is called the "Bureaucratic Politics Model" in Graham T Allison, 'Conceptual Models and the Cuban Missile Crisis', *The American Political Science Review* 63, no. 3 (1969): 689–718. This is the name kept in later literature.
[25] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 7.
[26] At an event of the Center for Strategic and International Studies in Washington, DC on 18 November 2019, soon after he was sworn in as the first Commander of the re-established US Space Command, General Jay Raymond declared: "And I think the thing that's driving it [note: the re-establishment of the US Space Command] is one simple sentence. I think there's eleven words in the sentence: *Space is a warfighting domain, just like air, land and sea*. You know, it used to be you couldn't say that in public – space and warfighting in the same sentence. The U.S. wants to keep the space domain safe. And that's still our goal, is to deter any conflict from beginning or extending into space. But we didn't say that publicly. Now, every speech I give I say that, and usually right up front." The full transcript of the event is available at 'A Conversation with General Raymond', Center for Strategic and International Studies, 18 November 2019, https://www.csis.org/analysis/conversation-general-raymond.

examples of Allison's framework has been used extensively for studies of decisions made in 'non-crisis' context. About this, J. Garry Clifford declared that "whether one studies nuclear strategy, the rise of the military-industrial complex, or the United States alliance with Britain, bureaucratic history provides pertinent pieces to the jigsaw puzzle".[27] There is even in the literature an example of Allison's decision-making framework being applied to space-related issues and to STM.[28] However, while it provides a very useful underlying framework with three general approaches, this framework can be refined, updated and adapted to provide the best analysis of the current situation in outer space. Extensive considerations are provided in Chapter 3.

The choice of the United States, France and Japan as the three case studies relies on the fact that they represent a difference perspective on space security and STM. The United States is the unavoidable actor in the space field, having by far the largest budget and the most extensive capabilities, both in the military and civil domains. In STM specifically, the United States is the only country having global space surveillance capabilities and is therefore the natural backbone of a future STM regime. Moreover, the traditional transparency of the US government makes the identification of interviewees and the procurement of official documents – public or restricted – relatively easy. France was chosen as it represents the typical European medium-size space power, along with the UK and Italy. While having similar technical abilities as the United States, it has a much less extensive capabilities due to basic financial constraints. Another interesting aspect of France and a few other European countries is the unclear boundary between civil and military space activities, which provides interesting dynamics of civil-military interactions on space policymaking. The nationality of the author, French, also facilitated the acquisition of important information and the obtention of interviews with key stakeholders in the French government. Finally, Japan was chosen, not only for the convenience of information gathering, the author being based at The University of Tokyo, but also because it provides a unique perspective on the military uses of space. From 1969 to 2008, a strict non-military interpretation of the peaceful uses of outer space led the Japanese Diet to forbid any use of space technology by the Japanese military. Therefore, due the change of this interpretation in the 2008 Basic Space Law, the author had the chance to witness the evolution

[27] J Garry Clifford, 'Bureaucratic Politics', *The Journal of American History* 77, no. 1 (1990): 161–68.
[28] Brian Weeden, 'Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology: The Global Positioning System and Space Traffic Management' (PhD Dissertation, Washington, DC, The George Washington University, 2017), 358.

of the Japanese military towards modernity and the political implications it had, in particular on STM and space surveillance.

An attentive reader would surely notice that all three countries are part of the same traditional bloc of allies, countries qualified by US Vice President Mike Pence, also Chairman of the National Space Council, of "like-minded, freedom-loving nations" during his opening speech at the 70th International Astronautical Congress in October 2019 in Washington, D.C., drawing either support or amusement from the audience.[29] So why focussing on traditional liberal democracies and not doing case studies on China and Russia, being both major space actors and representatives of different approaches to domestic policymaking? The choice not to pursue this way was made by the author, not only based on methodological reasons but also on practical ones. Case study methodology requires the collection of huge quantities of data, in order to be able to draw interesting general conclusions from a unique case. On the other hand, military activities in outer space are among the most sensitive topics for any government. Therefore, while for personal and political reasons, it was possible for the author to conduct intensive interview campaigns in the United States, France and Japan, it was simply impossible in China and Russia. The usual high level of secrecy of these governments makes it almost impossible to identify, *a fortiori* to reach, institutions or individuals in charge of space security, and the low level of rule of law would make a field study on the military uses of space fairly hazardous for the author.

Outline

After the current opening chapter, ***Chapter 2*** sets the scene and clarifies the overall rationale of the study. It starts by introducing all necessary concepts and related definitions, such as STM, its core technical component *space situational awareness* as well as basic notions on international regimes. Then it presents the state of literature on STM international regime-making and demonstrates the need to focus on domestic decision-making. ***Chapter 3*** then precisely details the engine of the study, that is to say the conceptual framework, methodology and data used to unveil the actual role played by the military in space safety and sustainability policymaking and to test the hypotheses. It somewhat overlaps with this introductory chapter and is aimed to provide further details for readers willing to dig deeper into the methodological

[29] 'Remarks by Vice President Pence at the 2019 International Astronautical Congress Opening Ceremony', The White House, 21 October 2019, https://www.whitehouse.gov/briefings-statements/remarks-vice-president-pence-2019-international-astronautical-congress-opening-ceremony/.

complexities of this study. In addition, it proposes an update of Allison's framework to better fit the topic of STM policymaking.

Part I, the core of this dissertation, concentrates on the US military approach to STM. Its first chapter, ***Chapter 4***, answers the question 'is the US military a responsible actor in outer space?' through its degree of compliance with the US Government Orbital Debris Mitigation Standard Practices, in line with the best international standards. After surveying applicable rules, the author analyses the evolution of the DoD's compliance and draws conclusion on the overall view of DoD personnel on space sustainability. ***Chapter 5*** highlights the DoD's position as reluctant space safety services provider with a careful presentation and analysis of the most comprehensive history of the US DoD space surveillance data sharing program to date, based on interviews of key stakeholders of its 20 years of existence. Then, ***Chapter 6*** summarises all the findings on DoD's role and influence in domestic decision-making on space safety and sustainability and concludes on the validity of the three hypotheses in the case of the US.

Part II extends the analysis to the cases of France and Japan. At first, ***Chapter 7*** presents the French Ministry of Armed Forces' approach to space surveillance and to STM. In particular, it analyses the close collaboration between the Ministry and the French space agency, CNES, on space surveillance and is in this regards very different from the clear civil-military boundary observed in the United States. It then analyses the current strategic shift in the French military with regards to space security, epitomised by the 2019 national space defence strategy, and its impact on the French government position on STM. The Japanese case study, third and last of this dissertation, is detailed in ***Chapter 8***, starting with the progressive acceptance of the military uses of space by the Japanese government since the Basic Space Law of 2008 and continuing with the historical developments and future plans of Japan's space surveillance infrastructure, in particular with regards to the US-Japan security cooperation.

Part III is the final part of this dissertation and contains the two concluding chapters focussing respectively on domestic decision-making and international regime-making. First, ***Chapter 9*** provides the main conclusions of the dissertation on military influence on domestic decision-making for space safety and sustainability and identifies a common position within the US bloc. Moreover, the evaluation of the differences of validity of the three hypotheses is used to propose new interpretations or variations of existing CMR and decision-making theories. Finally, ***Chapter 10*** can be seen as a supplementary chapter both going back to the point of entry of this study by presenting the impact of Chapter 9's findings on the creation of an international STM regime, and going forward by providing pragmatic recommendations to be directly used by governments and academic institutions around the world willing to advance STM regime-making, and few words on future research to be done on the topic.

Contributions to scholarship and practice

This study contributes both to scholarship and practice on four aspects outlined thereafter. Firstly, it provides an increased understanding of the intentions and influence of some of the main actors in outer space, largely overlooked in the literature. This first attempt to understand military influence over international regime-making for STM in the United States, France and Japan will hopefully encourage other scholars to enlarge the focus to other key countries such as Russia, China, Canada or India. It is only through this process that the full picture of STM regime-making will appear.

Secondly, the strength of this dissertation resides in the huge quantity of data it unveils to support its empirical methodology. Thanks to the acquisition of unpublished documents and to intensive interview campaigns in the United States, France and Japan, the author was able to collect immense quantities of until-now unavailable data on numerous topics such as the mindset of military personnel with regards to the preservation of the outer space environment, intra-government disagreements on the sharing of space surveillance data or the actual adherence of the US military to space debris mitigation practices.

Thirdly, this dissertation is submitted as part of a doctoral program in international public policy, and therefore envisions to go beyond academic research in order to have a concrete impact on the development of international norms for STM. In *Essence*, Allison and Zelikow define five steps in the work of foreign affairs analysts: "(1) description, (2) explanation, (3) prediction, (4) evaluation, and (5) recommendation".[30] This fifth step constitutes final and foremost expected contribution of this dissertation to public policy practice, by proposing pragmatic approaches to policymaking that would contribute to preserving the interest of all stakeholders and securing their infallible support towards the preservation of a safe and sustainable space environment.

Last but not least, this dissertation ambitions to go beyond its core focus on space policy to reach a wider audience, namely the more traditional international relations, public administration and strategic studies communities, by proposing a valuable perspective on civil-military relations, decision-making and public choice theories.

[30] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, footnote of p. 3.

Chapter 2. Scene-setting and rationale of the study

Space traffic management (STM) is one of the most fashionable topics in contemporary space policy, being closely studied by various actors around the world, be they university research centres, intergovernmental organisations, governmental institutes, academic societies, private companies, non-governmental organisations, or space agencies. While the multiplication of actors and studies should be welcomed as an opportunity to advance STM-related knowledge, it also bears the risk of increasing the confusion on what is STM. There is a natural tendency for each study to propose and defend its own definition of STM, based on its own goals and expectations. Consequently, the existence of various definitions implies the variability of the scope of STM, and the inclusion in STM of various related concepts. It is therefore primordial at the right beginning of this dissertation to try to define STM and related concepts as accurately as possible. After presenting the historical development of the concept of STM in the fields of space law and policy in section 1, section 2 proposes a comparative analysis of various existing definitions of STM and presents the one chosen in this dissertation. The two following sections then develop respectively the technical and regulatory elements of STM. On the one hand, section 3 investigates what is called in this dissertation the *STM system* (technical), the core of which is constituted by space situational awareness (SSA). On the other hand, section 4 introduces the *STM regime* (regulatory) and reviews existing forms of STM regulations in both national and international laws. Then, after an important review of the current state of literature on international regime-making for STM in section 5, section 6 clarifies the rationale behind this study. To do so, it justifies the need to investigate domestic decision-making processes to fully understand military role and influence in STM regime-making before demonstrating and explaining the absence of meaningful considerations in the literature.

1. History and rationale of STM

The prerequisite of thinking about a management system for space traffic is the awareness that there is some traffic in space. During the first decades of the Space Race, the very limited number of launches compared to the perceived vastness of outer space did not make decision-makers imagine the potential crowdedness of useful orbits. In fact, in a 1932 monograph on space law,[1] Czechoslovak jurist Vladimir Mandl, while introducing for the first time the concept of "space traffic rules",[2] by extension of air traffic rules, described them as unnecessary.[3] Later in the 1950s and 1960s, at the peak of early space law and policy research, there were numerous contributions on issues related to STM. In particular, in a 1957 article, Eugène Pépin identified five elements that would require the creation of "regulatory rule[s]" for "circulation" in outer space: (1) the ascension of rockets through sovereign airspace, (2) the re-entry of rocket bodies, (3) unintentional collisions between orbiting satellites, (4) the need for identification of satellites in case of accident and (5) the avoidance of harmful radio-interferences.[4] The latter has been the primary cause of concerns after the first satellites launches during the International Geophysical Year (IGY),[5] and calls for regulations on this particular aspect of STM were numerous in the literature.[6] Other proposals concern restricted issues like launch areas and the "orientation of orbits".[7] The first clear proposal of a set of rules was made by Dr Lubos Perek in his paper *Traffic Rules for Outer Space* during the 25th International Colloquium on Space Law held in Paris in 1982. These rules, while more detailed, roughly corresponded to Pépin's five elements presented in the previous paragraph, a noticeable addition being the mitigation of space debris.[8]

At the time however, STM studies were still in the realm of theory. It was only from the very end of the 20th century that the desire to define and actually implement traffic rules became tangible. This real and definite comeback of the concept of space traffic, associated with the desire to manage it, happened first in 1999 and then in 2001, during the 5th and 6th *International*

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[1] Vladimir Mandl, *Das Weltraum-Recht. Ein Problem Der Raumfahrt* (Mannheim, Berlin, Leipzig, Germany: J. Bensheimer Verlag, 1932); An English translation was later commissioned by NASA: Vladimir Mandl, 'Outer Space Law: A Problem of Astronautics', NASA Technical Memorandum, trans. Kanner (Leo) Associates (National Aeronautics and Space Administration, 1984).
[2] In German: "Raumverkehrsregeln". In: Mandl, *Das Weltraum-Recht. Ein Problem Der Raumfahrt*, 27.
[3] Mandl, 31.
[4] Eugène Pépin, 'Legal Problems Created by the Sputnik', *The McGill Law Journal* 4, no. 1 (1957): 68.
[5] The International Geophysical Year was an international scientific initiative aimed to re-establish scientific cooperation between the West and the East after a decade of interruption due to the Cold War. It included, *inter alia*, aerospace, atmospheric and astronomical research and lasted for more than a year, from 1 July 1957 to 31 December 1958. It has been considered a great success, with tangible outcomes such as the signature in 1959 of the Antarctic Treaty.
[6] Examples include, among many others: Myres S McDougal and Leon Lipson, 'Perspectives for a Law of Outer Space', *The American Journal of International Law* 52 (1958): 417; Eugène Pépin, 'Les Problèmes Juridiques de l'espace', *The McGill Law Journal* 6, no. 1 (1959): 40; Rolando Quadri, 'Droit International Cosmique', in *Scritti Giuridici: I. Diritto Internazionale Pubblico* (Milano, Italy: Dott. A. Giuffrè Editore, 1988), 552, originally published in the following; Rolando Quadri, 'Droit International Cosmique', in *Recueil Des Cours de l'Académie de Droit International de La Haye*, vol. 98, 1959.
[7] "les zones de lancement et l'orientation des orbites", In: Pépin, 'Les Problèmes Juridiques de l'espace', 35.
[8] Lubos Perek, 'Traffic Rules for Outer Space' (International Colloquium on the Law of Outer Space, International Institute of Space Law, 1982).

Space Cooperation workshops of the American Institute of Aeronautics and Astronautics (AIAA), respectively entitled *International Space Cooperation: Solving Global Problems* and *International Space Cooperation: Addressing Challenges of the New Millennium*. These two workshops were the starting points of various initiatives aimed to develop new ideas on STM. They focussed on “orbital management, collision avoidance, relevant orbital debris issues, and regulatory framework needs”.[9] A key outcome of the 2001 workshop was the establishment of an STM working group at the International Academy of Astronautics (IAA). The study was approved on the same year and produced one of the cornerstones of space traffic management literature: the 2006 *IAA Cosmic Study on Space Traffic Management*.[10]

The raise of concerns for space traffic should however not be explained solely by the visible initiatives of the AIAA but by the actual growth of space traffic as well as the emergence of the very closely related issue of space debris mitigation. In 2006, William H. Ailor claimed in a visionary paper that “convergence on and formalization of a structure [for STM]” is conditioned to three triggers: 1) a collision or interference involving a “major space asset”, 2) the growing fear of commercial satellite operators for the safety of their assets, and 3) the recognition of the space debris issue.[11] In fact, all happened and are responsible for the current state of high interest over the establishment of an international STM regime: the 2009 collision between Iridium 33 and Kosmos-2251,[12] the surge of commercial interests in space and the raising awareness about debris. The number of objects in space will increase dramatically in the next decade, primarily driven by the development and spread of affordable small satellite technologies. In its 2019 report, *Satellites to be launched by 2028*, leading space consulting firm Euroconsult declared:

> “Over the next 10 years, Euroconsult anticipates an average of 990 satellites will be launched every year for the next ten years, regardless of their mass. The demand is experiencing a x4 increase with 9,900 satellites to be launched by 2028 compared to the 2,300 satellites launched during the last decade”[13]

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[9] Graham Gibbs and Ian Pryke, ‘International Cooperation in Space: The AIAA-IAC Workshops’, *Space Policy* 19 (2003): 59–60.
[10] Corinne Contant-Jorgenson, Petr Lala, and Kai-Uwe Schrogl, ‘Cosmic Study on Space Traffic Management’ (Paris, France: International Academy of Astronautics, 2006).
[11] William H Ailor, ‘Space Traffic Management: Implementations and Implications’, *Acta Astronautica* 58 (2006): 279–86.
[12] NASA Orbital Debris Program Office, ‘Satellite Collision Leaves Significant Debris Clouds’, *Orbital Debris Quarterly News* 13, no. 2 (April 2009): 1–2.
[13] ‘Satellites to Be Built & Launched by 2028: An Extract’ (Paris, France: Euroconsult, 2019), http://www.euroconsult-ec.com/research/WS319_free_extract_2019.pdf.

Throughout the development of STM studies, there always was a lack of clarity around its definition and scope. In particular, there is a widespread confusion between STM and SSA, which "have been loosely and interchangeably used in the literature".[14] The next section clarifies this issue.

2. Various definitions of STM: a critical analysis

This section reviews and analyses various definitions found across specialised literature in order to select the one that will be used throughout the dissertation. It does not pretend to be exhaustive but instead quotes a few different definitions in order to 1) show the usually blurry boundaries of STM, in particular regarding SSA, seen either as included in or closely related to STM, and 2) outline the progressive evolution of the concept of STM. Table 2-1 shows the definitions presented thereafter.

Table 2-1. Five definition of STM reviewed in this section

Proponent/paper (year)	**Definition**
6th AIAA *International Space Cooperation* workshop (2001)	Space traffic management encompasses all the phases of a space object's life, from launch to disposal. It consists of activities intended to prevent damage in the near term (such as collision avoidance and coordination of reentry), as well as actions that must be taken to reduce the long-term potential for future damage (such as de-orbiting or moving satellites into disposal orbits)
Johnson (2004)	In the final analysis, realistic space traffic management has a single aim: to minimize the potential for electromagnetic or physical interference at any time. The former not only is tractable but also has been and is currently being handled quite successfully, principally via the ITU. The latter is much more difficult and essentially is simple collision avoidance, which has been at the heart of the debate concerning space debris for more than 20 years and has been the focus of recent space traffic management discussions. The reasons for collision avoidance are threefold: (1) mission safety (your spacecraft), (2) safety of second party operations (their spacecraft), and (3) future safety (environment preservation)
IAA Cosmic Study on Space Traffic Management (2006 & 2018)	Space traffic management means the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference

[14] Emily S Nightingale et al., 'Evaluating Options for Civil Space Situational Awareness (SSA)', IDA Paper (Washington, DC: Institute for Defence Analyses, Science and Technology Policy Institute, 2016).

Nightingale (2016)	This report separates the technical aspects related to SSA, and defines STM as actions related to the oversight, coordination, regulation, and promotion of space activities (including preservation of the space environment) at several distinct phases of the mission—launch, operations in space, and return from space
US Space Policy Directive 3 (2018)	Space Traffic Management shall mean the planning, coordination, and on-orbit synchronization of activities to enhance the safety, stability, and sustainability of operations in the space environment. (…) A STM framework consisting of best practices, technical guidelines, safety standards, behavioral norms, pre-launch risk assessments, and on-orbit collision avoidance services is essential to preserve the space operational environment

2.1. Overview of existing definitions

As introduced in the previous section, the real beginning of STM studies happened with the AIAA's *International Space Cooperation* workshops. It is specifically during the 2001 workshop that one of the first definitions of STM was provided. It states that:

> "Space traffic management encompasses all the phases of a space object's life, from launch to disposal. It consists of activities intended to prevent damage in the near term (such as collision avoidance and coordination of reentry), as well as actions that must be taken to reduce the long-term potential for future damage (such as de-orbiting or moving satellites into disposal orbits)"[15]

This first attempt to clarify the role and scope of STM contains interesting points, that still constitute more or less the average understanding of what STM could or should cover. First of all, its main goal is defined as preventing damage to both ongoing space activities and the long-term sustainability of the outer space environment. The scope of STM is defined as the whole lifecycle of the spacecraft, from "launch to disposal". The shortcomings of this definition are twofold. First, if fails to define the nature of STM, and second, it restricts the role of STM to collision avoidance.

A couple of years later, Nicholas L. Johnson corrected the latter by including the mitigation of electromagnetic interferences within the goals of STM:

> "In the final analysis, realistic space traffic management has a single aim: to minimize the potential for electromagnetic or physical interference at any time. The former not only is tractable but also has been and is currently being handled quite successfully, principally via the ITU. The latter is much more difficult and essentially is simple collision avoidance, which has

[15] Ailor, 'Space Traffic Management: Implementations and Implications'; Gibbs and Pryke, 'International Cooperation in Space: The AIAA-IAC Workshops'.

been at the heart of the debate concerning space debris for more than 20 years and has been the focus of recent space traffic management discussions. The reasons for collision avoidance are threefold: (1) mission safety (your spacecraft), (2) safety of second party operations (their spacecraft), and (3) future safety (environment preservation)"[16]

The first definition taking into account the nature of STM can be found in the IAA study group's *Cosmic Study on STM*, published in 2006:

"Space traffic management means the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference"[17]

The main novelty introduced by the IAA experts concerns the nature of STM. For them, it should both cover technical and regulatory aspects. Other parts of the definition are perfectly in line with the previous developments of literature. In the new iteration of its study in 2018, IAA working group members chose to keep the same definition.[18]

The two last definitions presented in this section originate from the same context. In the second half of the 2010s, the United States Government became the first government to officially consider STM as an important issue to be dealt with. First, in August 2016, a team from the Institute for Defense Analyses's Science and Technology Policy Institute (IDA-STPI), federally funded research centre in charge of supporting the White House Office of Science and Technology Policy (OSTP), published a report on Civil Space Situational Awareness (CSSA) in which they insisted on the necessary distinction between SSA and STM and defined the latter as follows:

"This report separates the technical aspects related to SSA, and defines STM as actions related to the oversight, coordination, regulation, and promotion of space activities (including preservation of the space environment) at several distinct phases of the mission—launch, operations in space, and return from space".[19]

It is interesting to see in this definition that contrary to previous ones, the authors considered STM in a purely regulatory sense, without formally including the technical aspects of the traffic issue (in short, the SSA) in its scope.

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[16] Nicholas L Johnson, 'Space Traffic Management Concepts and Practices', *Acta Astronautica* 55 (2004): 803–8.
[17] Contant-Jorgenson, Lala, and Schrogl, 'Cosmic Study on Space Traffic Management'.
[18] Kai-Uwe Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation' (Paris, France: International Academy of Astronautics, 2018).
[19] Nightingale et al., 'Evaluating Options for Civil Space Situational Awareness (SSA)'.

The last definition is the one contained in Space Policy Directive 3 (SPD-3) "National Space Traffic Management Policy," signed by President Donald J. Trump on 18 June 2018, in which the National Space Council (NSpC) unveils the foundations of a future comprehensive national STM policy:

> "Space Traffic Management shall mean the planning, coordination, and on-orbit synchronization of activities to enhance the safety, stability, and sustainability of operations in the space environment. (…) A STM framework consisting of best practices, technical guidelines, safety standards, behavioral norms, pre-launch risk assessments, and on-orbit collision avoidance services is essential to preserve the space operational environment".[20]

While it contains numerous elements, it is a rather vague definition that fits the purpose of a general policy orientation document like SPD-3. In particular, it tends to overlook two important elements of STM: firstly, it does not mention the necessity of managing the post-mission disposal phase for the sustainability of space environment and secondly, it focuses solely on physical interactions – collisions – and forgets electromagnetic interferences (although they are mentioned later in the directive).

The next section presents the definition that is used throughout the dissertation.

2.2. The definition chosen in this study

This dissertation uses the definition provided in the two IAA Studies on STM of 2006 and 2018, as it seems important to the author to consider SSA as an element of STM and not simply as a closely related tool. In particular, the 2018 study distinguishes two elements of a future STM framework: on one hand an "STM system", consisting of an ensemble of technical capabilities necessary for the functioning of STM, mostly relying on SSA, and on the other hand an "STM regime", being a set of institutional and regulatory elements.[21] It is reminded below:

> "Space traffic management means the set of technical and regulatory provisions for promoting safe access into outer space, operations in outer space and return from outer space to Earth free from physical or radio-frequency interference"

[20] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy', *Federal Register*, Presidential Memorandum, 83, no. 120 (18 June 2018): 28969–76.
[21] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation'.

The only criticism that could be made about the IAA's definition concerns the use of "radio-frequency interference", which is inappropriately restrictive from a scientific point of view. The term "electromagnetic interference" used by Johnson would be preferable.[22]

Figure 2-1 sketches the dual structure of STM following the IAA definition and highlights important concepts to be defined in the next part. A recent report of the European Space Policy Institute identifies three components in STM, namely space traffic "monitoring, regulation and coordination", the two latter being included in the *STM regime* of the IAA's conception of STM.[23]

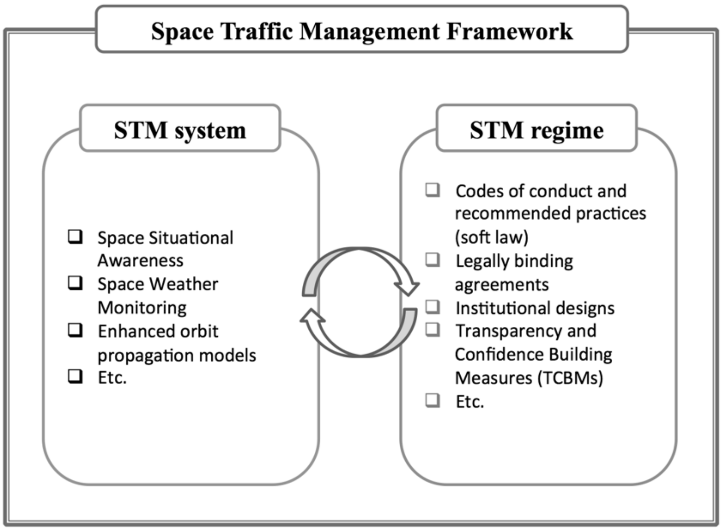

Figure 2-1. Structure of an STM framework

3. The technical components of space traffic management

This part provides further details on the technical side of STM described in previous sections as an "STM system". In particular, it focusses on its main component, space situational awareness, and comments on the latest semantic development occurring at the US Department of Defense (DoD).

3.1. The core of the "STM system": space situational awareness

Space Policy Directive 3 (SPD-3), signed by US President Donald Trump in June 2018, includes the following definition of SSA: "Space Situational Awareness shall mean the knowledge and characterization of space objects and their operational environment to support

[22] Johnson, 'Space Traffic Management Concepts and Practices'.
[23] Sébastien Moranta, Tomas Hrozensky, and Marek Dvoracek, 'Towards a European Approach to Space Traffic Management', ESPI Report (Vienna, Austria: European Space Policy Institute, 2020), 7–8.

safe, stable, and sustainable space activities".[24] The Joint Chiefs of Staff of the US military use a similar definition: "the requisite foundational, current, and predictive knowledge and characterization of space objects and the operational environment upon which space operations depend".[25]

Very similar, these two definitions insist on the knowledge of space environment and of various characteristics of the space objects around the Earth. To be precise, SSA can be divided into three different sequential tasks:

- *Data collection*: using ground-based (large tracking radars, optical telescopes, laser and RF devices) or space-based surveillance and tracking devices, objects in outer space are detected and characterised in various ways, going from size estimation and orbit determination to deeper characterisation such as the nature of the object and its supposed purpose.
- *Data analysis*: based on the data collected on step 1 and using various advanced software, several forecasts can be made: conjunction probability (that is to say the probability of close encounter of two space objects), re-entry risks, etc.
- *Communication to stakeholders*: after having assessed various possibilities, the organisation in charge of SSA communicates with relevant stakeholders – often satellite operators – about the risks or threats encountered by their space assets so that appropriate measures can be taken, such as orbital manoeuvres.

SSA data is traditionally divided into two categories: civil SSA and military SSA. While civil SSA data contains information on the trajectory of the space object and related space weather, useful to reduce *risks* (space safety), military SSA includes necessary information to identify the potential *threats* posed by the object such as its nature, capabilities, etc.[26]

The largest current provider of SSA information in the world is the US Department of Defense. In recent years however, numerous private entities have grown in the field of SSA, complementing, augmenting or even competing with the DoD's services.[27] Among the famous

[24] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[25] 'Joint Publication 3-14 "Space Operations"' (Arlington, Virginia: U.S. Joint Chiefs of Staff, 10 April 2018).
[26] Brian Weeden, 'Space Situational Awareness Fact Sheet (Updated May 2017)' (Washington, DC: Secure World Foundation, 2017).
[27] Nightingale et al., 'Evaluating Options for Civil Space Situational Awareness (SSA)', v.

ones are Pennsylvania-based Analytical Graphics, Inc. (AGI), and California-based ExoAnalytic Solutions, Inc. and LeoLabs, Inc.[28]

It is clear that an efficient SSA system is a condition *sine qua non* of a prospective STM framework and that facilitating the development of SSA capabilities as well as promoting the sharing of high-quality SSA data at the global level are the most pressing issues to be solved for the safety and long-term sustainability of space. The core role of SSA, originally within the exclusive realm of the military, also highlights the importance of civil-military cooperation for the success of international STM.

3.1.1. Existing international SSA systems

Most advanced space countries and emerging ones have developed their own SSA systems, not for STM but for national security reasons. There is therefore a potential for interconnexion in order to develop a truly global STM system. This section reviews two major examples of such systems: the US Space Surveillance Network (SSN) and the EU Space Surveillance and Tracking Support Framework (EU SST).

The US Space Surveillance Network (SSN)

The SSN is the largest existing SSA system and the only capable of supporting a global STM system. Initiated and primarily equipped by the US DoD, it also comports SSA systems from partner countries such as Australia and the United Kingdom. The SSN is mostly composed of phased array radars, originally developed and primarily used as missile warning systems, and telescopes. It also comports a variety of other sensors including space-based tracking telescope systems.[29] In December 2019, Lockheed Martin and the Air Force's Space and Missile Systems Centre started the first trial of the future cornerstone of the SSN: the Space Fence. Qualified by a Lockheed Martin executive as the "world's largest and most advanced radar system", the Space Fence shall allow the US military to add to its catalogue hundreds of thousands of new debris in LEO smaller than 10 cm, in comparison with the roughly 25,000

[28] For more information on Analytical Graphics, Inc.'s Commercial Space Operations Centre (ComSpOC), see https://agi.com/comspoc; on ExoAnalytic Solutions' Space Operations Centre (ESpOC), see https://exoanalytic.com/space-situational-awareness/; and on LeoLabs' SSA solutions see https://www.leolabs.space/services.

[29] Weeden, 'Space Situational Awareness Fact Sheet (Updated May 2017)'.

objects it currently tracks.[30] Figure 2-2 shows the global network of sensors composing the SSN.

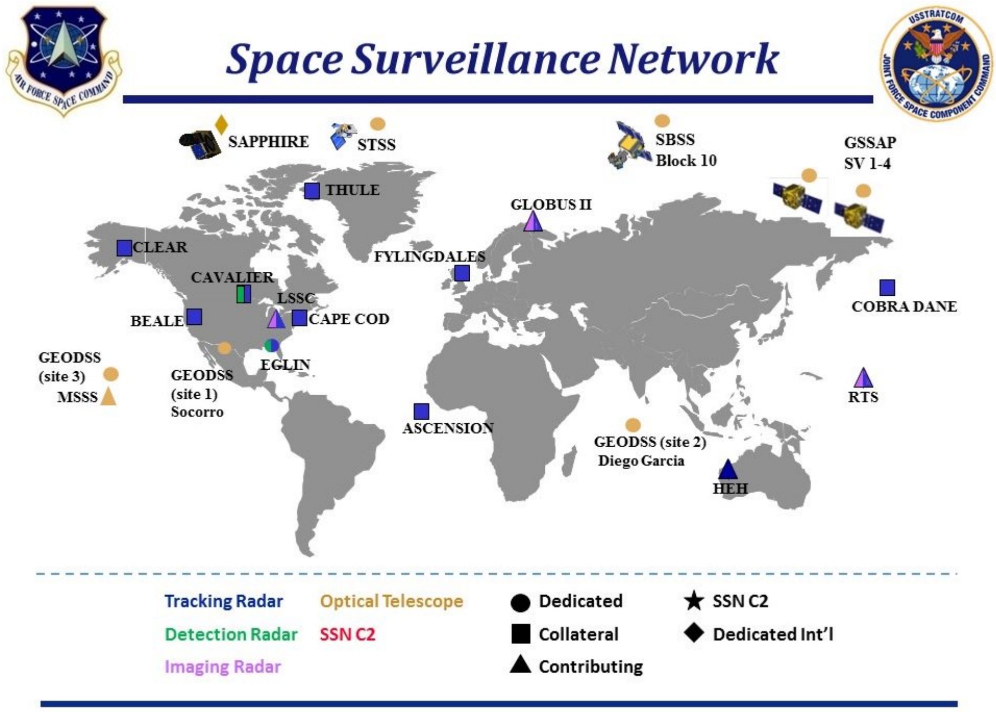

Figure 2-2. The US Space Surveillance Network[31]

The EU Space Surveillance and Tracking Support Framework (EU SST)

The EU SST is a regional initiative aiming to provide SSA services to ensure the "safety and security of the economies, societies and citizens in Europe."[32] Established following a decision of the European Parliament and the European Council in 2014,[33] it now comports eight members (France, Germany, Italy, Poland, Portugal, Romania, Spain and UK) and operates 11 radars, 19 telescopes and 4 laser stations.[34] Figure 2-3 shows the distribution of EU SST sensors as of November 2017.

[30] Nathan Strout, 'A New Radar to Track Space Objects Is Almost Ready', C4ISRNET, 11 December 2019, https://www.c4isrnet.com/battlefield-tech/space/2019/12/11/a-new-radar-to-track-space-objects-is-almost-ready/.
[31] Obtained from a tweet of the official Twitter account of the 18th Space Control Squadron of 14 February 2018. Available at https://twitter.com/18SPCS/status/963629809921351680 (accessed 17 January 2020).
[32] 'The Foundation: The SST Decision', EU SST, accessed 4 March 2020, https://www.eusst.eu/project/sst-decision/.
[33] 'Decision No 541/2014/EU of the European Parliament and of the Council of 16 April 2014 Establishing a Framework for Space Surveillance and Tracking Support' (European Union, 16 April 2014), https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32014D0541.
[34] 'Key Facts and Figures', EU SST, accessed 4 March 2020, https://www.eusst.eu/key-facts-and-figures/.

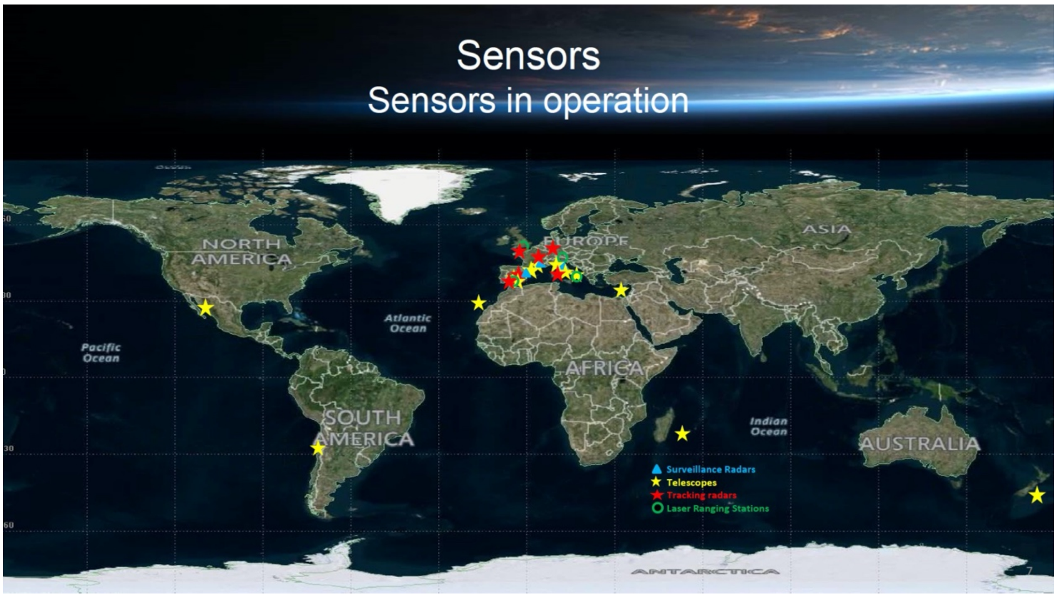

Figure 2-3. The EU Space Surveillance and Tracking Support Framework[35]

3.1.2. Semantic shift: space domain awareness

On 4 October 2019, Maj. Gen. John Shaw, Deputy Commander of the Air Force Space Command (AFSPC), announced a semantic shift at the DoD. Willing to insist on the warfighting nature of outer space, it was decided that the term SSA would be replaced by *space domain awareness* (SDA),[36] similarly to existing practices in other environments like *maritime domain awareness* (MDA).[37] Reacting to this change, space security analyst Brian Weeden of the Secure World Foundation provided some nuance about its actual impact, stating that "this shift from SSA to SDA is essentially the same thing they said about the shift from space surveillance to SSA about 12 years ago".[38] In fact, as further explained in Chapter 5, transition from space surveillance to SSA in the late 2000s was less a change of approach than a mere change of words.

Due to the widespread use of the term SSA in academia and by most governments, it is the wording chosen in this dissertation.

[35] Claudio Portelli, 'EU SST Consortium Governance, Initial Operation and Current Status' (Agenzia Spaziale Italiana, Rome, Italy, 21 November 2017).
[36] It should not be confused with the newly established Space Development Agency of the US DoD, sharing the same acronym.
[37] Sandra Erwin, 'Air Force: SSA Is No More; It's 'Space Domain Awareness'', SpaceNews.com, 14 November 2019, https://spacenews.com/air-force-ssa-is-no-more-its-space-domain-awareness/.
[38] Sandra Erwin, 'U.S. Space Command Eager to Hand over Space Traffic Duties to Commerce Department', SpaceNews.com, 17 November 2019, https://spacenews.com/u-s-space-command-eager-to-hand-over-space-traffic-duties-to-commerce-department/.

3.2. Space weather monitoring

Let us start with an analogy: a state has a naval fleet cruising in a given area of the world. For the safety and security of its fleet, it gathers information about the environment: islands, sandbars, enemy fleets, allied fleets, commercial vessels, etc. This data gathering and analysis approach, already mentioned above, is MDA, the maritime pendant of SSA/SDA. But what is the other key parameter to take into account at sea? The weather of course. Although there is no air nor cloud in outer space, there are similar physical phenomena having an important impact on space object, called *space weather*.

The core of the space weather field is the analysis and prediction of the physical interactions among various parameters such as solar wind, interplanetary magnetic fields, the Earth magnetic field, etc. A typical manifestation of space weather are the magnificent and colourful aurorae that can be observed on the Earth's poles. However, beyond touristic entertainment, space weather phenomena can have a huge impact on human activities, both on and above the surface of the Earth: disruption of communications, damaging of satellite parts, dangerous irradiation of human beings onboard planes or spacecraft, etc.

An important aspect with regards to STM and SSA is the impact of space weather on the orbits of satellites, due principally to the solar radiation pressure.[39] Being able to predict solar activity is therefore critical to the development of reliable orbital propagation algorithms, in other words to predict the future position of a space object after observing it with a radar or a telescope. The impact of solar activity can also be seen in terms of debris re-entry. In fact, during periods of intense solar activity, the atmosphere "heats up" and therefore slightly expands, dragging down debris higher than usual. This is perfectly visible on figure 2-5, showing the predicted evolution of space debris larger than 10 cm by the ESA, presented later in this chapter. The oscillations of the plots correspond to the cycles of solar activities (11 years), with an important decrease of debris during intense activity.

4. STM regime: regulatory aspects

While the understanding of the STM system is necessary for having a comprehensive view of the issue, the core of this dissertation is on the regulatory aspects of STM, namely the STM regime. This section starts by defining the concept of international regime in a general sense, before focussing on the existing elements of STM regime at both international and

[39] Photons emitted by the Sun exert some pressure on the irradiated surface of the satellite (solar wind), exactly like air molecules exert pressure on the sails of the ship (*usual* wind).

national levels. Finally, it explains the current limitations of the existing proto-regime and the need for further STM research.

4.1. What is an international regime?

There exist numerous definitions of the concept of international regime, each being closely associated with a specific approach to international regime theory.[40] As this dissertation focussed on domestic decision-making rather than regime building *per se*, the definition chosen here is the very general – consensual – one developed by Stephen Krasner. A regime is for him a "[set] of implicit or explicit principles, norms and rules, and decision-making procedures around which actors' expectations converge in a given area of international relations".[41]

The main reason of the usual consensus over this definition is that it reaches comprehensiveness by incorporating different elements, summarised in Figure 2-4 using Krasner's own words. Moreover, for him, principles and norms are the "defining characteristics of a regime" while rules and decision-making procedures further refine overarching principles and norms. Consequently, while a major change of norms and principles imply the change of the regime itself, changes of rules and decision-making procedures are adjustments within the regime.[42]

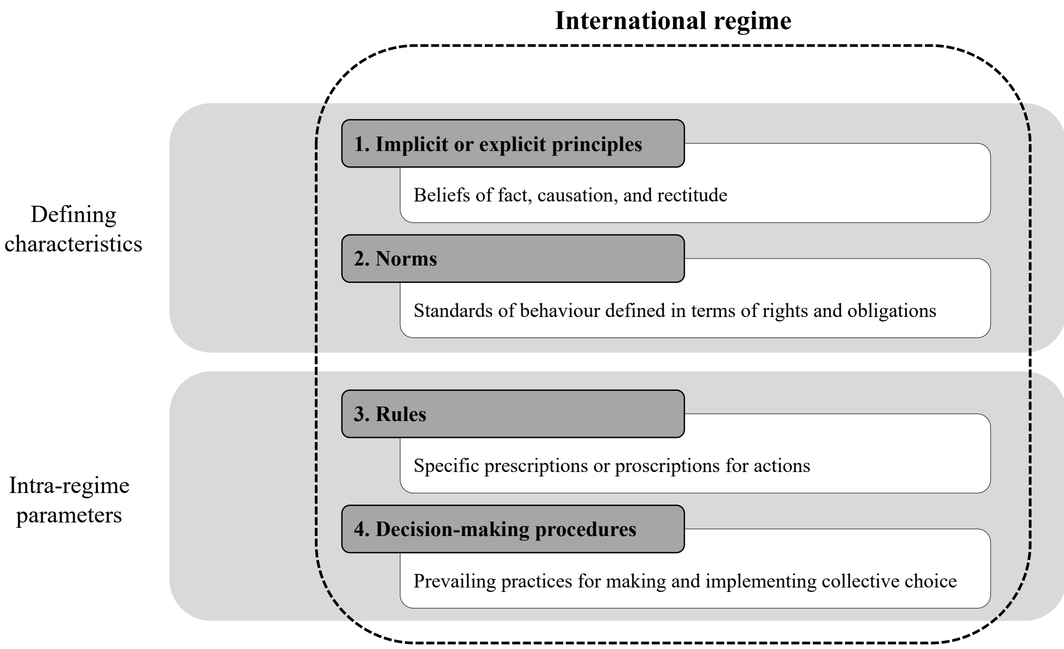

Figure 2-4. Structure of international regimes, according to Krasner

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[40] Andreas Hasenclever, Peter Mayer, and Volker Rittberger, *Theories of International Regimes* (Cambridge, UK: Cambridge University Press, 1997).
[41] Stephen Krasner, ed., *International Regimes* (Ithaca, New York: Cornell University Press, 1983), 2.
[42] Krasner, 2–3.

4.2. Existing international proto-regime for STM

While there is no comprehensive and overarching international regime on STM, numerous building blocks – standards, guidelines, etc. – can be found, constituting what the author of this dissertation chose to call a proto-regime. On the other hand, originating from the responsibility and liability of states, and states only, in international space law, there exists a rich body of national regulations established by spacefaring countries around the world, providing a basic level of STM. This section provides a review of existing pieces of STM-related legislation and introduces the lacks that need to be addressed.

4.2.1. UN rules and norms

Different bodies of the United Nations have worked on the development of norms and rules for the promotion of safe and sustainable space activities. They constitute truly global initiatives that have been and still are at the basis of the current STM proto-regime.

STM elements in international space law treaties

The five international space law treaties contain elements constitutive of an STM regime. The IAA's 2018 STM study differentiates *status, activity, object and traffic-related provisions*, as summarised in table 2-2 below.[43]

Table 2-2. STM-related provision in the five space law treaties (from IAA 2018)[44]

Type of provision	**Provisions in the five space law treaties**
Status-related	Non-appropriation principle (OST) Common heritage of mankind (MA)
Activity-related	Freedom of exploration of outer space (OST) Freedom of use of outer space (OST) Exclusively peaceful purposes (MA)
Object-related	Registration requirement (OST) Prohibition of weapons of mass destruction in outer space (OST)
Traffic-related	Responsibility and liability of States (OST) Consultations in case of harmful interference with activities of other state parties (OST) Information-sharing on the nature, conduct, locations and results of space activities (OST) Information-sharing on phenomena potentially dangerous for astronauts (OST) Assistance to astronauts (OST)

[43] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation', 61–64.
[44] OST: Outer Space Treaty, MA: Moon Agreement.

The role of the ITU in spectrum resource management

First of all, there exists an international regime to deal with half of the scope of STM, namely spectrum management, or as said in the definition, the avoidance of harmful "radio-frequency interference". [45] The International Telecommunication Union (ITU), oldest international organisation still active, founded in 1865, and boasting a membership of 196 states, is in charge of coordinating all communications, both on Earth and in outer space. Starting to investigate the use of satellites from 1958 in technical reports of its International Radio Consultative Committee, the ITU held in 1963 the first "extraordinary and specialised" Administrative Radio Conference on space radiocommunications.[46] Marking "the transition from regulatory provisions for research purposes to those applicable to the everyday reality of space telecommunications", it was followed by a space-centred World Administrative Radio Conference in 1971, and culminated with space radiocommunication issues being on the agenda of the 1973 Plenipotentiary Conference of the ITU.[47] After continuous developments, the current role of the ITU with regards to STM is to managed what is called the "satellite spectrum/orbit resource", in three ways:

1. By maintaining a register of the "international rights and obligations rights and obligations of satellites and associated earth stations to use this resource", called the *Master International Frequency Register*.
2. By ensuring the compatibility of new satellites with those of the *Register*.
3. By checking the conformity of new satellites with the ITU's *Radio Regulations*, aimed to "ensure an interference-controlled environment for satellite operation and [to] guarantee equitable access to use of the natural resources of the frequency spectrum and geostationary satellite orbit". [48]

As explained in the third point, one of ITU's most important responsibilities is to facilitate the attribution of slots along the geostationary orbit. Other orbital regimes however follow a "first come, first served" principle.[49]

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[45] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation'.
[46] RE Butler, 'The Role of the ITU in the Use of the Geostationary Orbit', *Acta Astronautica* 17, no. 6 (1988): 607–10.
[47] Butler.
[48] 'Sharing the Sky – ITU's Role in Managing Satellite and Orbit Spectrum Resources', ITU Backgrounders (Geneva, Switzerland: International Telecommunications Union, 2014).
[49] Chuen Chern Loo, 'Orbit/Spectrum International Regulatory Framework: Challenges in the 21st Century' (ITU Regional Radiocommunication Seminar for Asia 2014, Hanoi, Viet Nam, May 2014).

The development of guidelines at the UNCOPUOS

The United Nations Committee for the Peaceful Uses of Outer Space (UNCOPUOS) has been developing guidelines forming the backbone of the existing international STM proto-regime. The first set of guidelines concerns space debris. On 22 December 2007, the General Assembly endorsed the *Space Debris Mitigation Guidelines*[50] after years of work at the UNCOPUOS Scientific and Technical Subcommittee (STSC).[51] These seven qualitative guidelines – they do not contain any measurable criteria – were developed based on recommendations of the Inter-Agency Space Debris Coordination Committee (IADC), whose work is explained in sub-section 4.2.2.

These guidelines were later extended with the *21 Guidelines for the Long-Term Sustainability of Outer Space Activities* (in short *LTS Guidelines*), adopted by the UNCOPUOS on 21 June 2019 after eight years of work at working group level.[52] The LTS guidelines are the most advanced and comprehensive set of global norms on STM, qualified by the former head of the LTS working group, Peter Martinez, as "the most significant output of COPUOS in the last decade".[53] As guidelines, the LTS are by definition non-binding but they provide an excellent framework for any country willing to contribute to the preservation of the outer space environment. Therefore, after their adoption, a new working group was established by the UNCOPUOS STSC in order to monitor their implementation.[54] Another important outcome of the LTS working group was the establishment of a *Compendium of space debris mitigation standards adopted by States and international organizations*, very useful tool to track the progressive development of international regime for space debris mitigation, key element of a future STM regime.[55]

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[50] 'Resolution 62/217 of 22 December 2007 "International Cooperation in the Peaceful Uses of Outer Space"' (New York: United Nations General Assembly, 22 December 2007).
[51] 'Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space' (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 2010).
[52] 'Press Release: Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on Peaceful Uses of Outer Space Adopted' (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 22 June 2019).
[53] Jeff Foust, 'Long-Awaited Space Sustainability Guidelines Approved by UN Committee', SpaceNews.com, 28 June 2019, https://spacenews.com/long-awaited-space-sustainability-guidelines-approved-by-un-committee/.
[54] 'Report of the Committee on the Peaceful Uses of Outer Space, Sixty-Second Session (12-21 June 2019)', General Assembly Official Records Seventy-fourth Session Supplement No. 20 (New York: United Nations General Assembly, 3 July 2019).
[55] 'Compendium of Space Debris Mitigation Standards Adopted by States and International Organizations' (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 25 February 2019); Peter Martinez, 'Development of an International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities', *Space Policy* 43 (2018): 13–17.

Another important work of the UNCOPUOS, that has contributed to the development of the LTS guidelines is the Transparency and Confidence Building Measures (TCBMs), adopted by the General Assembly on 29 July 2013.[56] In particular, two categories of TCBMs fall under the scope of STM:

> "(d) Specific information-exchange measures aimed at expanding the availability of information on objects in outer space and their general function, particularly those objects in Earth orbits;
> (e) Measures related to establishing norms of behaviour for promoting spaceflight safety such as launch notifications and consultations that aim at avoiding potentially harmful interference, limiting orbital debris and minimizing the risk of collisions with other space objects"[57]

Finally, it is important to mention an ambitious but failed initiative of the EU to develop a major set of guidelines on space activities. In December 2008, the EU, after more than a year of internal coordination, released the *EU Draft Code of Conduct for Outer Space Activities* to the international community.[58] The purpose of the EU was to use the draft as the basis of an *International Code of Conduct for Outer Space Activities*. However, after discussions with international partners and the publication of the final draft on 31 March 2014,[59] the *Code of Conduct* progressively died out due to three reasons: procedural disagreements at the UN, the complexity to incorporate all recommendations of around a hundred parties and finally the opposition of China and Russia.[60]

4.2.2. Non-UN intergovernmental organisations' role in STM norm development

One of the oldest international organisations established for the promotion of spaceflight safety is the Consultative Committee for Space Data Systems (CCSDS). Created in 1982 by major space agencies, bringing along numerous industrial partners, it has been playing an

56 'Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities' (New York: United Nations General Assembly, 29 July 2013).
57 'Report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities'. para. 27.(d)-(e), p. 13.
58 Christopher Johnson, 'Draft International Code of Conduct for Outer Space Activities Fact Sheet' (Washington, DC: Secure World Foundation, 2014).
59 'EU Proposal for an International Space Code of Conduct, Draft' (Brussels, Belgium: European Union External Action Service, 31 March 2014), https://eeas.europa.eu/generic-warning-system-taxonomy/404_en/14715/EU%20proposal%20for%20an%20international%20Space%20Code%20of%20Conduct,%20Draft.
60 Michael J Listner, 'The International Code of Conduct: Comments on Changes in the Latest Draft and Post-Mortem Thoughts', The Space Review, accessed 4 March 2020, https://www.thespacereview.com/article/2851/1.

important role in developing recommendations for efficient data sharing among space operators, public and private.[61]

Currently, the main organisation driving the development of STM guidelines is the Inter-Agency Space Debris Coordination Committee (IADC), created in 1993 as international forum of discussion on the space debris issue. Its 13 members include all majors space agencies in the world.[62] The IADC's main outcome are the *IADC Space Debris Mitigation Guidelines* focussing on the limitation of debris released during normal operations, on the prevention on-orbit breakups, on post-mission disposal (with the famous 25-years rule) and on the prevention of on-orbit collisions.[63]

Building upon IADC and UNCOPUOS guidelines, an Orbital Debris Working Group (ISO/TC20/SC14/WG7) was established at the International Organisation for Standardisation (ISO), leading to the adoption in 2010 of standards ISO24113:2010 *Space systems - Space debris mitigation requirements*, revised a year later as ISO24113:2011 and in 2019 as ISO24113:2019.[64] Numerous members of the IADC and UNCOPUOS expert groups contributed to the development of ISO standards. Their content is therefore in line with existing international guidelines.

4.2.3. Industry- and NGO-driven initiatives

The third major category of norms and rules composing the existing STM proto-regime originate from industrial or NGO initiatives. Michael P. Gleason of the Aerospace Corporation published in 2019 an excellent study on existing STM standards, guidelines and best practices, of which such initiatives constitute an important part.[65] They are briefly reviewed below:

- The Space Data Association (SDA), industrial version of the CCSDS, is an international organisation created in 2009 by major satellite operators (e.g. Eutelsat, Inmarsat, Intelsat, etc.) in order to enhance the safety of space operations by sharing the data they have on their own satellites. For this purpose, it created the Space Data Centre, powered and administered by AGI, to centralise these shared orbital data.[66]

[61] 'About CCSDS', CCSDS.org, accessed 5 March 2020, https://public.ccsds.org/about/default.aspx.
[62] 'What's IADC?', iadc-home.org, accessed 5 March 2020, https://www.iadc-home.org/what_iadc.
[63] 'IADC Space Debris Mitigation Guidelines, IADC-02-01, Revision 1' (Inter-Agency Space Debris Coordination Committee, September 2007). p. 4.
[64] 'ISO 24113:2019, Space Systems - Space Debris Mitigation Requirements' (International Organisation for Standardisation), accessed 16 January 2020, https://www.iso.org/standard/72383.html.
[65] Michael P Gleason, 'Establishing Space Traffic Management Standards, Guidelines and Best Practices' (Center for Space Policy and Strategy, The Aerospace Corporation, September 2019).
[66] 'Space Data Association', space-data.org, accessed 5 March 2020, https://www.space-data.org/sda/.

- The Consortium for Execution of Rendezvous and Servicing Operations (CONFERS), initiated with seed funding from the Defense Advanced Research Projects Agency (DARPA), is an industry forum aiming "to leverage best practices from government and industry to research, develop, and publish non-binding, consensus-derived technical and operations standards for OOS [*On-Orbit Servicing*] and RPO [*Rendezvous and Proximity Operations*]".[67]
- Non-profit association of the global satellite communications industry, the Global VSAT Forum (GVS), created in 1997, contributes to the development and the promotion of best practices in order to mitigate collisions in outer space and the proliferation of space debris. GVS's motivation to contribute to such development is driven by the concerns raised by the numerous existing projects of large constellations.[68]
- ASTM International,[69] partnering with the Commercial Spaceflight Federation, established in 2016 the Committee F47 on Commercial Spaceflight.[70] According to Gleason, numerous standards have been developed by the Committee F47 in the theme of "operations and safety".[71]
- SSA leading company AGI also established in own research centre for the development of appropriate standards for orbital data exchange, the Centre for Space Standards and Innovation (CSSI).[72]
- The most recent industrial initiative, announced during the 20th Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference in September 2019, is the Space Safety Coalition (SSC). The SSC is an "ad hoc coalition of companies, organizations, and other government and industry stakeholders that actively promotes responsible space safety through the adoption of relevant international standards, guidelines and practices, and the development of more effective space safety guidelines and best practices."[73] The first outcome of the SSC was the publication of a set of

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67 'About: The Consortium for Execution of Rendezvous and Servicing Operations (CONFERS)', satelliteconfers.org, accessed 5 March 2020, https://www.satelliteconfers.org/about-us/.
68 Gleason, 'Establishing Space Traffic Management Standards, Guidelines and Best Practices', 8.
69 International standards development organisation formerly known the American Society for Testing and Materials.
70 'Committee F47 on Commercial Spaceflight', astm.org, accessed 5 March 2020, https://www.astm.org/COMMITTEE/F47.htm.
71 Gleason, 'Establishing Space Traffic Management Standards, Guidelines and Best Practices', 11.
72 'Welcome to Center for Space Standards & Innovation (CSSI)', centerforspace.com, accessed 5 March 2020, http://www.centerforspace.com/.
73 'Best Practices for the Sustainability of Space Operations' (Space Safety Coalition, 16 September 2019), https://spacesafety.org/wp-content/uploads/2019/11/Endorsement-of-Best-Practices-for-Sustainability_v28.pdf.

guidelines, counting among its 37 endorsees giants in the space field such as Airbus Group, Iridium, Intelsat, AGI, etc.[74]

- Lastly, the International Association for the Advancement of Space Safety (IAASS) is a non-profit organisation established in 2004. As previously listed organisations, its purpose it to "help shape and advance an international culture of space safety".[75] Members of the association have been publishing numerous books and articles on space safety and the association itself edits and publishes the *Journal of Space Safety Engineering*, one of the leading peer-reviewed journals in the field.

4.3. National regulations on space activities

While there are numerous international standards and guidelines presented in the previous section, most of existing STM-related regulations can be found in national governments' legislations. In fact, in accordance with international space law, spacefaring countries are both responsible "for national activities in outer space" and liable for the damage caused by an object launched by or from the country.[76] Most of them have therefore developed numerous national regulations for the licencing of such space operations. In order to show a large scope of possible national STM regulations, this section introduces the example of the United States, most complex framework to date.

First of all, to sum up roughly,[77] licensing space operations in the United States requires to go through two or three different agencies: the Federal Communications Commission (FCC) for communications, the Federal Aviation Administration (FAA) for launch and the National Oceanic and Atmospheric Administration (NOAA) if the spacecraft has remote sensing capabilities. But while these agencies provide licenses, there are what can be called transversal regulatory elements constituting a form of STM regime, the most important of these being the Orbital Debris Mitigation Standard Practices (ODMSP) of 2001, revised in November 2019.[78]

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[74] 'Endorsees', spacesafety.org, accessed 5 March 2020, https://spacesafety.org/endorsees/.
[75] 'Welcome to IAASS', iaass.space-safety.org, accessed 5 March 2020, http://iaass.space-safety.org/.
[76] 'Resolution 2222 (XXI) of 19 December 1966 "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," Also Known as Outer Space Treaty (OST)' (New York: United Nations General Assembly, 19 December 1966). Articles VI and VII.
[77] There exist numerous nuances depending on the exact capabilities of the spacecraft and whether it is the property of a federal or non-federal entity, which details are superfluous here.
[78] 'U.S. Government Orbital Debris Mitigation Standard Practices, November 2019 Update' (National Aeronautics and Space Administration, November 2019), https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf.

The ODMSP, that are the focus of Chapter 4 of this dissertation, are federal-level regulations applicable to all space activities under American responsibility.[79]

The second important STM-related US framework is the DoD's SSA sharing program, focus of Chapter 5 of this dissertation. Being the organisation with the most advanced and largest SSA capabilities in the world, the DoD is also the main global provider of SSA services, online on *space-track.org*, or through SSA sharing agreements with commercial and foreign entities.[80] Due to huge number of agreements – at least a hundred currently valid[81] – signed by the US Strategic Command (USSTRATCOM) with trusted partners, the DoD SSA sharing program can already be considered as a large-scale US-centred international SSA regime.

Finally, the United States is the only country with an actual national policy for STM, with the signing of SPD-3 "National Space Traffic Management Policy" by President Trump in June 2018. Apart from providing the definition introduced in section 2.1, SPD-3 contains the spirit of the American approach to STM as well as the respective roles of US Government agencies in its implementation. In particular, this policy promotes the Department of Commerce (DoC) as the lead agency for STM and instructs it to develop the *Open Architecture Data Repository*, database supposed to simplify and enhance access to reliable SSA data by merging governmental and commercial sources.[82]

4.4. Limitations of the current situation

The two previous sections have shown that there exist numerous elements constitutive of an STM proto-regime, at both international and national levels: do we need more? This section demonstrates that while the existing proto-regime provides certain benefits towards the preservation of the outer space environment, it has some limitations that need to be addressed to reach full efficiency.

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[79] ODMSP can be waived in specific cases, which is the main focus of Chapter 4.

[80] Quentin Verspieren, 'Military Influence on International Regime-Making for Space Traffic Management: Explaining the Evolution of SSA Data Transparency at the US Department of Defense' (70th International Astronautical Congress, Washington, DC, 2019).

[81] Karen Singer, '100th Space Sharing Agreement Signed, Romania Space Agency Joins', U.S. Strategic Command, 26 April 2019, http://www.stratcom.mil/Media/News/News-Article-View/Article/1825882/100th-space-sharing-agreement-signed-romania-space-agency-joins/. Note: other agreements were signed after this communiqué but their announcement did not contain any information about the total number of SSA agreement in place, hence the estimation provided here of at least a hundred.

[82] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.

4.4.1. Tremendous acceleration of space traffic and debris proliferation

Is the current STM proto-regime working? In other words, is outer space a safe and sustainable environment? Figure 2-5 shows the simulations made by the European Space Agency (ESA) on the effectiveness of existing space debris mitigation measures (IADC and UNCOPUOS).

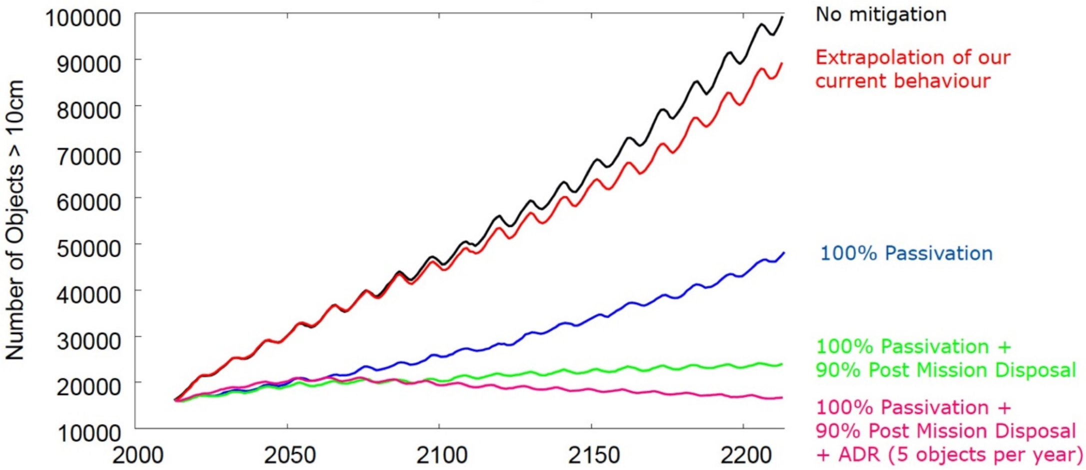

Figure 2-5. Effectiveness of space debris mitigation measures, source: ESA[83]

This figure says the following: while the guidelines are appropriate to deal with the space debris issue, the current level of implementation is inappropriate. The green curve in particular is quite encouraging, showing that a high level of implementation of existing guidelines would allow to stabilise the population of debris in outer space, only requiring a supplementary effort (pink curve) to reverse the tendency. However, the red curve clearly indicates that the current level of implication of space actors in solving the space debris issue is utterly insufficient.

It is important to specify that the *LTS Guidelines* were approved after the publication of this study. Nevertheless, while they could improve the situation by pushing more actors towards

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[83] Holger Krag, 'State of the Space Environment' (Space Sustainability Summit, Washington, DC, 25 June 2019). The meaning of the five projections is the following:

- *No mitigation*: debris mitigation guidelines are not implemented
- *Extrapolation of our current behaviour*: the level of implementation of guidelines stays similar to the current level
- *100% Passivation*: full implementation of existing passivation guidelines, that is to say the depletion of all energy sources in the satellites (batteries, chemical propulsion, etc.)
- *100% Passivation + 90% Post Mission Disposal*: in addition to above, 90% of spacecrafts are deorbited following guidelines (e.g. within 25 years in LEO)
- *100% Passivation + 90% Post Mission Disposal + ADR (5 objects per year)*: in addition to above, five specifically hazardous pieces of debris are removed from space (*active debris removal*)

compliance, they would not drastically change the tendency observed on this figure as they are mostly qualitative guidelines.

Moreover, the uncertainty of the impact of the planned large constellations of satellites (e.g. SpaceX's Starlink) on the space environment is source of numerous concerns, the IADC itself having initiated studies on their impact.[84] Overall, space traffic is expected to increase dramatically, driven by the aforementioned constellations but also by the simplification of access to outer space. Universities, start-ups, developing countries' governments are now able to benefit from space technologies using affordable small satellite technologies. Figure 2-6 shows the forecasted number of launches by 2023.

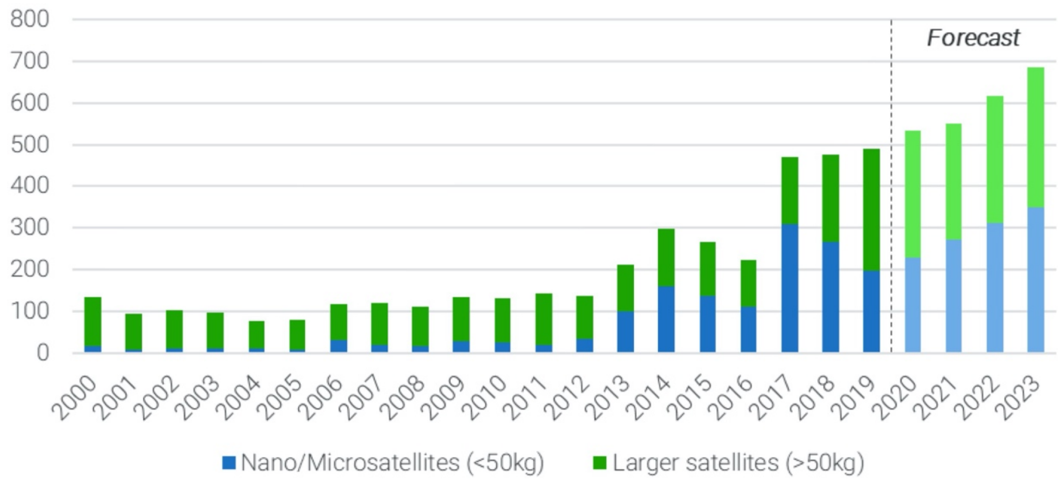

Figure 2-6. Satellites launched from 2000 and forecast for 2020-2023[85]

4.4.2. The need for improvements

As explained in the previous section, the main issue with existing guidelines for space debris mitigation is not their nature but their insufficient level of implementation. In terms of regime it means that while principles and norms are clearly defined, there is a lack of mechanism for the monitoring and/or enforcement of implementation.

Secondly, most elements of the existing proto-regime presented above concern space debris mitigation rather than STM. Beyond debris mitigation, STM should cover various aspect presented previously such as the provision of reliable SSA information, the development of

[84] 'IADC Statement on Large Constellations of Satellites in Low Earth Orbit. IADC-15-03, Revision 4' (Inter-Agency Space Debris Coordination Committee, November 2017).
[85] Moranta, Hrozensky, and Dvoracek, 'Towards a European Approach to Space Traffic Management', 14; Primary source: 'Satellites to Be Built and Launched by 2027' (Paris, France: Euroconsult, 2019).

standards for communication among satellite operators, the clarification of "rules of the road" in case of expected conjunction between two or more space objects, etc.

These two elements, that is to say the need for monitoring and/or control mechanisms and the importance to extend the existing proto-regime beyond space debris mitigation, are the core of STM research, presented in the next section.

5. Existing research on international regime-making for STM

Before starting this section, it is necessary to clarify that its focus is not on the components and functions of an STM regime, which are already subject to a certain consensus in the space law and policy community. On the other hand, this section focusses on literature on regime-making for STM. Importance is therefore given to processes rather than contents.

5.1. Drawing ideas from air and maritime law?

Historically, the first idea of space law scholars was to draw, not to say transpose, lessons and ideas from other traffic regimes. The main reason was that space law being a nascent field, these scholars were before all either maritime or air laws experts. They therefore had almost innate pre-conceptions on space law making. However, even now that the space law field is well developed and that the technical knowledge of the space environment is abundant, it is still a dominant idea in the community that air and maritime laws could be useful in drafting space law. The author therefore chose in this dissertation to follow Rolando Quadri's 1959 advice to his students: "il faut libérer la doctrine du droit international cosmique de la servitude envers la doctrine traditionnelle du droit aérien, servitude qui explique l'impasse très sérieuse où se trouve la plupart des auteurs".[86]

5.2. The endless and unnecessary debate over the limit between air and space

The question of the limit between airspace and outer space is a recurring debate of the space law and policy community. While the author of this dissertation considers this debate utterly futile, for reasons that are briefly presented below, its presence in the literature makes it unavoidable.

This debate originates from another recurring debate on the nature of space law, and specifically STM, on whether it should be *functionalist* or *spatialist*. The *functionalist approach*

[86] "International cosmic law doctrine should be liberated from its servitude towards the traditional air law doctrine, servitude that explains the very serious deadlock in which most authors are stuck", in Quadri, 'Droit International Cosmique', 1988.

claims that space law should cover space-related activities, be they happening on the ground (e.g. launch pad preparations), in the air (e.g. rocket launch) and in space (e.g. collision avoidance manoeuvres), whereas the *spatialist approach* considers that space law should cover what is happening in outer space while what happens in the airspace during the launch should be subjected to air law.[87] It therefore implies the need to define the limit between air and space.[88]

The 2010s have seen the re-emergence of the debate on whether this limit should be defined and where, particularly motivated by space law scholars of McGill University in Canada. In particular, in their book *ICAO for Space?* Ram Jakhu, Tommaso Sgobba and Paul S. Dempsey, apart from very interesting considerations on regime-making addressed in the next section, brought back to the table the debate over spatialism/functionalism and therefore the limit between the two regimes of air and space law.[89] Going even further, Dempsey later proposed the creation of an intermediary zone "near space" between air and space, in an analogy with maritime zones defined in the UN Convention on the Law of the Sea, that could serve to deal with hybrid "aerospace vehicles".[90] Some readers would surely notice the similarity of these proposals with the debate having occurred in the early 1950s in the space community. At this time, some space law scholars, mostly coming from an air law background, were pushing for the same approach, in particular John Cobb Cooper, also from McGill University.[91] Prestigious voices such as Charles Pépin raised their concerns and opposition, explaining that Cooper was already reviving a debate of the 1910s.[92] By the late 1950s, the debate was already considered obsolete.[93]

5.3. Existing proposals for a new international regime

In the last decade, the form that should be taken by an STM framework and the process for its establishment have been highly debated. The term of STM itself can lead to confusion as it implies the existence of an overarching authority controlling or managing the traffic in space while most proposals merely involve coordination. Adopting a cautious approach, a 2018

[87] Olavo de Oliveira Bittencourt Neto, 'The Elusive Frontier: Revisiting the Delimitation of Outer Space', in *Proceeding of the International Institute of Space Law 2012* (Eleven International Publishing, 2013).
[88] Quadri was even going further by saying the name of "space law" was in itself problematic as it implies a *spatialist* nature, In: Quadri, 'Droit International Cosmique', 1988, 553.
[89] Ram S Jakhu, Tommaso Sgobba, and Paul S Dempsey, *The Need for an Integrated Regulatory Regime for Aviation and Space: ICAO for Space?* (Vienna, Austria: Springer-Verlag, 2011).
[90] Paul S Dempsey, 'The Definition and Delimitation of Outer Space' (56th session of the Legal Subcommittee, United Nations Committee on the Peaceful Uses of Outer Space, Vienna, Austria, 30 March 2017).
[91] McDougal and Lipson, 'Perspectives for a Law of Outer Space', 424–25.
[92] Pépin, 'Legal Problems Created by the Sputnik', 69–71.
[93] Quadri, 'Droit International Cosmique', 1988, 568–69.

report of the IDA-STPI used the expression of "oversight, coordination and management". This phrasing encompasses all the facets of existing STM regime-making proposals presented in this section, from top-down international treaty-based regime to bottom-up standard-based coordination regime.

5.3.1. The incremental bottom-up approach

The "incremental bottom-up approach"[94] is the dominant approach in the space field, as it builds upon the existing proto-regime for STM presented above, aiming to further develop it and solidify it into a coherent comprehensive regime. It therefore relies on the existence of numerous specialised discussion fora, introduced in section 4.2 (e.g. IADC, ISO, GVF, CONFERS), for the progressive development of building blocks, that is to say mostly standards and norms of behaviour. The US national STM policy (SPD-3) clearly mentions the importance of "promot[ing] space safety standards and best practices across the international community".[95] Based on these considerations, voices were raised in the space community to oppose the idea of *managing* – or *controlling* as some Europeans prefer to say – space traffic, favouring the concept of space traffic *coordination*.[96]

But how to cement these building blocks into a coherent regime? There is also a debate about the process to follow. IAA experts, whose usual publications, in particular their 2018 STM study, demonstrate an inclination for UN-led initiatives, and seeing STM at the interface of telecommunication, air and space law, believe in the establishment of a "triangular coordination" scheme among the UNCOPUOS, the ITU and the ICAO.[97] Another proposed path, favoured by most government representatives interviewed by the IDA-STPI experts is to maintain the light form of the existing regime, with standards and best practices, and to focus on their promotion, in order to harmonise national space laws.[98] Finally, the space industry and satellite operators tend to favour self-regulation, that they see as more efficient and pragmatic than waiting for the creation of international – in the sense of intergovernmental - tools for oversight, coordination or management of the space traffic.[99] The sense of responsibility of

[94] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation'. p. 128.
[95] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[96] Bhavya Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', IDA Document (Washington, DC: Institute for Defence Analyses, Science and Technology Policy Institute, 2018), 61–62.
[97] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation', 128–31.
[98] Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', 74–75.
[99] Lal et al., 75–76.

large satellite operators can be seen in the numerous initiatives presented in subsection 4.2.3., especially the latest *Space Safety Coalition*.

5.3.2. The comprehensive top-down approach

The second most commonly discussed item in the literature is the comprehensive top-down approach, in other words, the establishment of an international treaty-based STM regime, under the auspices of the UNCOPUOS. Before looking at the most complete example of this approach, proposed by the IAA in its 2018 STM study, it is important to specify that the huge majority of SSA and STM experts – met by the author or having contributed to the existing literature – does not believe in its likelihood and even, for some of them, in its desirability. The UN operating on a consensus basis, the drafting of an international treaty for STM seems very unlikely, as shown by the concerns raised by some emerging space countries, seeing STM as a US government strategy to maintain the *status quo* of American domination in outer space.[100] Moreover, the government-centric nature of the UNCOPUOS could prove unproper to deal with the valuable inputs of the industrial and academic communities.[101]

In its 2018 study, the IAA proposes a comprehensive and ambitious top-down roadmap for the creation of international STM regime.[102] It relies on the differentiation between 1) "fundamental and unalterable legal principles," inscribed in international space law in the form of an "Outer Space Convention (OSC)", 2) a set binding "operative rules" that could be frequently evaluated and revised to cope with the change of the outer space environment, called "Outer Space Traffic Rules (OSTR)" and 3) the promotion of non-binding standards, resembling the existing proto-regime, under the name of "Outer Space Traffic Technical Standards (OSTTS)".[103] Figure 2-7 displays the pyramidal structure of this proposal.

[100] Lal et al., 76, further discussed in subsection 5.3.4.
[101] Lal et al., 77.
[102] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation', 133–42.
[103] Schrogl et al., 133.

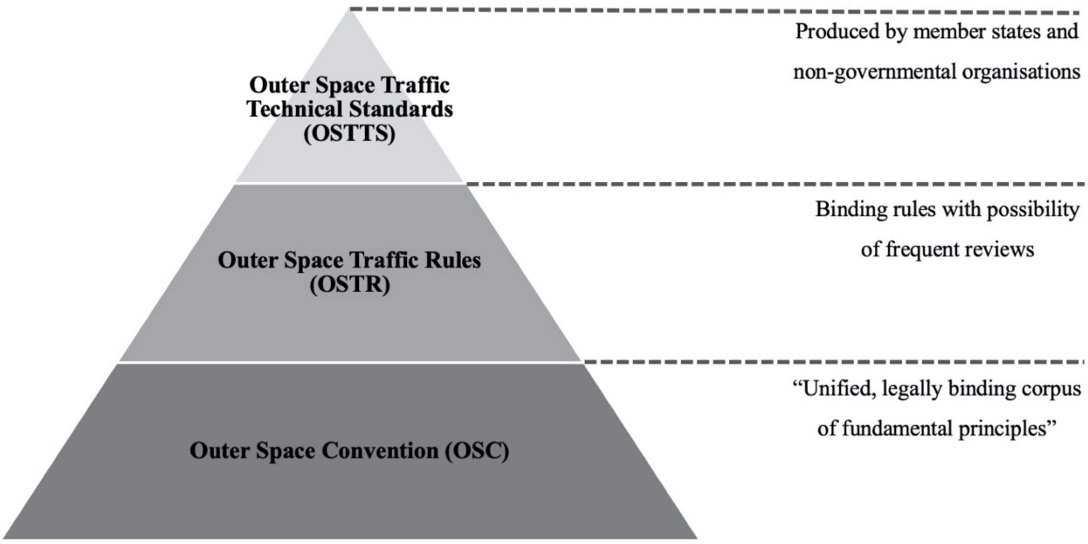

Figure 2-7. The IAA's top-down STM regime proposal

The core of this three-layered structure, the OSC, is proposed to be modelled on the UN Convention on the Law of the Sea (UNCLOS) and the ITU Constitution, and to include the establishment of an International Space Organisation, outer space equivalent of the International Maritime Organisation (IMO), the ITU and the International Civil Aviation Organisation (ICAO). According to the IAA experts' group, the OSC could enter into force after a minimum of 15 years of work, including a plenipotentiary conference, as shown on figure 2-8.

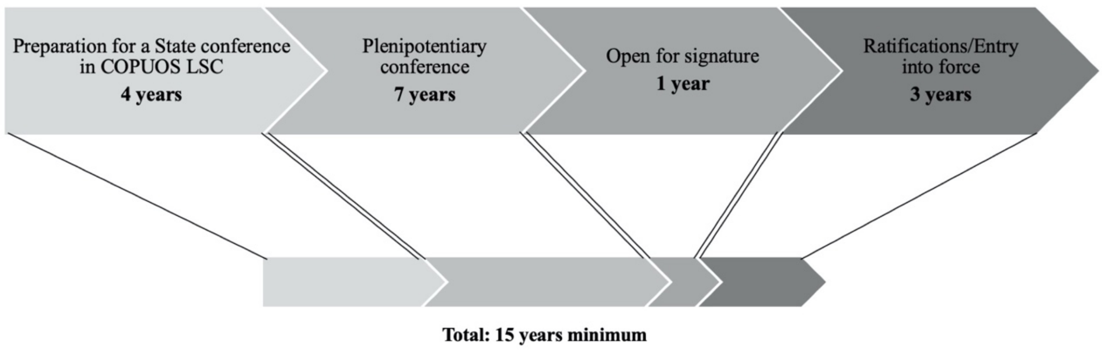

Figure 2-8. Expected timeline for the adoption of an Outer Space Convention

Beyond the legitimate concerns presented at the beginning of this section, the author of this dissertation does not believe this approach to be desirable. Even if imagining that such an unrealistic proposal succeeds, its long timeframe is totally inappropriate to cope with the fast-changing outer space environment.

5.3.3. The middle way: restricted multilateralism

A fourth approach is what can be labelled *US-led restricted multilateralism*. It consists in the creation of a regime under US leadership – as hinted in SPD-3 – with a group of trusted allies – most likely Mike Pence's "like-minded, freedom-loving nations"[104] – that could later be promoted and extended globally. While it is believed likely by most experts, it is not necessarily seen positively. In a 2018 report, the Institute for Defense Analyses' Science and Technology Policy Institute (IDA-STPI) explained the perception of numerous interviewees, in particular those from emerging nations, of STM as a "mechanism for restricting access to space and space activities", for the benefit of the current leading space power, the US.[105] As shown in the latest ESPI report trying to identify a "European approach to STM", an excessive US leadership in international STM regime-making could raise concerns in the European space community, not regarding potential restrictions on the use of outer space like in emerging countries but on the "risk of competitive disadvantage" generated by global adoption of US-led standards.[106] Therefore, while "shar[ing] U.S. willingness to promote a safe and responsible behaviour in space", the ESPI recommends Europe to take an active role in the "development of a set of common safety standards and best practices [that] could form a second backbone for transatlantic cooperation".[107]

5.3.4. Extending the ICAO's jurisdiction

The extension of the ICAO's jurisdiction can have two meanings. This first, a longstanding idea in international space law, consists in proposing an amendment of the Chicago Convention of 1944[108] in order to change its regulatory area from "aircraft" to "aerospace vehicles", therefore giving the ICAO automatic responsibility over the regulation of activities in outer space. The primary motivation for such a reform is the impact that space activities – in particular suborbital flights – can have on airspace safety. However, as explained

[104] 'Remarks by Vice President Pence at the 2019 International Astronautical Congress Opening Ceremony'.
[105] Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', 62.
[106] Moranta, Hrozensky, and Dvoracek, 'Towards a European Approach to Space Traffic Management', 40.
[107] Moranta, Hrozensky, and Dvoracek, 40.
[108] The Convention on International Civil Aviation of 1944, usually called the Chicago Convention, defines the main regulatory framework of international air travel and established the International Civil Aviation Organisation (ICAO). 'Convention on International Civil Aviation of 1944 "Chicago Convention"', ICAO Document 7300 (International Civil Aviation Organisation, 7 December 1944), https://www.icao.int/publications/Documents/7300_orig.pdf.

by Jakhu, there is no need to go through the complex – and very likely unsuccessful – procedure to amend the Chicago Convention as a solution lies in its Article 37.[109]

Before explaining what is this second, simpler and more realistic way to extend ICAO's jurisdiction over space activities, and core of Jakhu's book *ICAO for Space?*, it is necessary to define a very important ICAO instrument: the Standards and Recommended Practices (SARPs). The role of SARPs, as defined by Article 37, is to facilitate contracting states' "collaborat[ion] in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organisation in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation".[110] SARPs are included in the Annexes of the convention and are therefore easily amendable. However, according to the definition, they cover issues related to air navigation, not to space. What can then be done? Jakhu's whole argument relies in the last sentence of Article 37, saying that SARPs can be adopted on "such other matters concerned with the safety, regularity, and efficiency of air navigation as may from time to time appear appropriate",[111] therefore including space activities. To further support his claim, he indicates that "under this provision (…) ICAO has promulgated Annexes addressing environmental issues and aviation security, areas not contemplated when the Chicago Convention was originally drafted in 1944".[112]

5.3.5. Russia's 2017 proposal of information sharing mechanism

Aligned with the idea that STM should be focussing on coordination rather than management, the Russian Federation made an official proposal at the UNCOPUOS in 2017 to establish an STM-related international information sharing mechanism. The working paper submitted to the STSC during the LTS discussions stressed the "urgency of reinforcing the role and responsibilities of the Committee [*note: the COPUOS*] and its subsidiary bodies with regard to normative regulation of space security".[113]

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[109] Jakhu, Sgobba, and Dempsey, *The Need for an Integrated Regulatory Regime for Aviation and Space: ICAO for Space?*, 42.
[110] 'Convention on International Civil Aviation of 1944 "Chicago Convention"', Article 37.
[111] 'Convention on International Civil Aviation of 1944 "Chicago Convention"', Article 37.
[112] Jakhu, Sgobba, and Dempsey, *The Need for an Integrated Regulatory Regime for Aviation and Space: ICAO for Space?*, 42.
[113] 'Further Ideas on a Set of Goals for Achieving the Vienna Consensus on Space Security and the Need for Thorough Reflection on the Modalities of Addressing the Complex Issues Associated with Space Traffic Management and the Justifiability of the High Expectations of Early Decisions in This Area', Working paper submitted by the Russian Federation (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 2017).

While the creation of such mechanism for SSA data sharing is being taken into consideration by numerous governments around the world, as seen with the US OADR project or its existing SSA sharing program, and the EU SST, the Russian proposal was defeated at the UNCOPUOS.[114]

6. Rationale of the study: space policy inside-out

It can seem surprising to see that while the core of the dissertation is on domestic decision-making, most of this scene-setting chapter focusses on international regime for STM. The reason is that the only way to understand the influence of the militaries of advanced space power on space safety and sustainability regime-making is to investigate their role in domestic decision-making. Firstly, it is widely agreed in international relations that regime formation has domestic roots. Secondly, the military is by definition very discreet on the international negotiation stage, leaving the way to official diplomats. Based on this, keeping a macroscopic perspective would fail to reveal the true influence of the military, hence the need to investigate domestic processes.

6.1. International regime-making for space safety and sustainability: a two-level game

The interface between domestic politics and international negotiations has been at the centre of international relations literature for decades. In particular, Robert Putnam's two-level game brought a new understanding to the "reciprocal causation" between the two spheres, going beyond the unidirectional analysis that characterised previous attempts.[115] As a matter of fact, in his main paper on the topic, Putnam mentions Allison's "promising attack on the problem of domestic-international interaction", while regretting the fact that the bureaucratic politics literature generally stayed within the boundaries of domestic affairs with limited incursions in international negotiations.[116] To use Putnam's framework in order to explain the need to investigate domestic processes, any result of bargaining among negotiators (level I) requires "ratification" – used in a general sense by Putnam – by each negotiator's "group of constituents" (level II). Specifically, this dissertation investigates the actual impact of the militaries of the US, France and Japan on their respective domestic "win-sets" on international regime-making for space safety and sustainability, "the 'win-set' for a given Level II constituency [being] the

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[114] Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', 61.
[115] Putnam, 'Diplomacy and Domestic Politics: The Logic of Two-Level Games', 433.
[116] Putnam, 431.

set of all possible Level I agreements that would 'win' when simply voted up or down".[117] In terms of conceptual framework, choice was made in this study to analyse military influence in domestic decision-making on space safety and sustainability based on decision-making, public choice theories, and civil-military relations as explained in the following chapter.

6.1.2. Example of past studies on space policy inside-out

There are examples in the literature of 'inside-out' space policy studies but none combine both the military and STM. In fact, most of them focus on presidential decision-making, in particular about space exploration. The closest existing study to this one is Brian Weeden's in which he used decision-making theories to analyse the structure of presidential decision-making on dual-use technology (e.g. GPS) and STM.[118] However, while Weeden focusses on the US government, this dissertation aims to enlarge the view to two like-minded allied countries (France and Japan), in order identify common patterns of military influence.

On the military side, there has been some attempts to study the influence of the US military on the development of early international law. One particularly noticeable is USAF Colonel Delbert Terrill Jr.'s comprehensive analysis of the role of the USAF in the development of the first three international space law treaties (Outer Space Treaty, Rescue Agreement and the Liability Convention).[119] It demonstrates the complexity of the USAF position over the years, from strong opposition to the Outer Space Treaty to constructive amendments taken into account in the Liability Convention's negotiations at the UNCOPUOS, very different from the usual cliché conveyed about the US military.

6.2. Revealing the role of the military in STM

An attentive reader would surely have noticed that key actors are mostly absent from the literature summarised above: the military forces of advanced space powers. What is being done to take into account military interest in and influence over international regime-making for STM? The answer, motivating this whole dissertation, is that not much work has been done in public academic circles to understand military interests in STM, beyond mere SSA

[117] Putnam, 437.
[118] Weeden, 'Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology: The Global Positioning System and Space Traffic Management'.
[119] Delbert Jr. Terrill, *The Air Force Role in Developing International Outer Space Law* (Maxwell Air Force Base, Alabama: Air University Press, 1999), https://www.airuniversity.af.edu/Portals/10/AUPress/Books/B_0069_TERRILL_OUTER_SPACE_LAW.pdf.

considerations. As shown in the proposed models, most efforts are based either on international organisations dealing with civilian activities (e.g. ICAO) or at least the peaceful uses of outer space (UNCOPUOS), or on the progressive creation of norms by commercial and non-governmental entities. In fact, military considerations are usually purposely excluded from existing studies. For example, the IAA's 2006 study on STM, while acknowledging the importance of the military as actor in outer space and the necessity to take the military uses of space into account in a future STM framework, also adopts the contradictory stance of "deliberately exclud[ing] military space operation rules from its scope".[120] Its revision in 2018 follow the same principle by leaving the regulation of military activities to the discretion of states: "a fundamental aspect [*of STM*] is the difference in civil and military uses of outer space. States will have to find adequate answers how to approach this".[121] Finally, what is even more concerning is the view that most reports adopt of military forces being slowing down or opposing the creation of a regime due to their grip over SSA,[122] or simply for ideological reasons.[123] As demonstrated in the following chapters of this dissertation, the reality is far more complex. Although there are a few studies claiming to tackle the issue of military participation in STM or civil-military relations in STM, those providing interesting practical and conceptual insights are too rare,[124] the majority usually being inaccurate and short-sighted reviews of governmental documents.[125] After acknowledging the lack, it is the time to understand the reasons behind it and evaluate their legitimacy.

The main argument usually raised by experts overlooking military influence in STM is that the space sector is becoming increasingly commercial and that the relative role of the military is dwindling. Such argument suffers from serious flaws. First of all, the militaries of advanced space powers are still and will stay among the largest operators in space. According the Union of Concerned Scientists (UCS), as of 30 September 2019, the US government was operating 189 military satellites, which corresponds to 19% of all American satellites in orbit (commercial included) and 8.5% of all satellites in Earth orbit.[126] Therefore, although the

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[120] Contant-Jorgenson, Lala, and Schrogl, 'Cosmic Study on Space Traffic Management', 53.
[121] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation', 132.
[122] Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', 79.
[123] Contant-Jorgenson, Lala, and Schrogl, 'Cosmic Study on Space Traffic Management', 53.
[124] Theresa Hitchens, 'Space Traffic Management: U.S. Military Considerations for the Future', *Journal of Space Safety Engineering* 6 (2019): 108–12, https://doi.org/10.1016/j.jsse.2019.04.003.
[125] Ntorina Antoni, Christina Giannopapa, and Kai-Uwe Schrogl, 'Legal and Policy Perspectives on Civil–Military Cooperation for the Establishment of Space Traffic Management', *Space Policy*, 1 June 2020, 101373, https://doi.org/10.1016/j.spacepol.2020.101373.
[126] The UCS operates the largest satellite database based on public sources, available at: 'Union of Concerned Scientists Satellite Database', ucsusa.org, accessed 22 January 2020,

generalisation is slightly farfetched, one could consider the US military to be the second largest satellite operator in the world, passed in early 2020 by SpaceX with its Starlink constellation. Not far behind is the Chinese government with its extensive fleet of remote-sensing, PNT and communications satellites (more than 120) with important national security applications.[127] This leads to the second flaw of the argument. While there is undoubtedly an increase of commercial activities in space, it is mirrored by a strong military build-up among major space countries, specifically to strengthen their ability to protect these numerous new governmental and commercial assets.[128] As a matter of fact, military build-up in space has appeared more robust than overvalued New Space starts who collapsed as quickly as they appeared.[129] The third major flaw of the argument consists in a confusion between those making the rules and those having to comply with the rules. Even in the case of clear domination of commercial activities in space, regulations are and will be made by states – with inputs from their respective militaries, as only states are recognised in international space law treaties. The final flaw concerns the necessary role played by the military in a prospective STM framework. Currently and most likely for the years to come, the backbone of the STM system, SSA, will remain under military supervision, owing to its intrinsically dual nature.[130]

The second argument is one of intellectual inertia. For many scholars, the military is nothing else than an agent of conservatism, opposing ideologically any form of rulemaking, as epitomised by this extremely simplistic comment of the 2006 STM study: "There are interfering factors, in particular national military and security policies and practices, which might hinder the establishment and operational effectiveness of a space traffic management regime".[131] Such argument is a typical example of the perpetuation of a baseless *cliché* over the years, or *availability cascade* in cognitive biases' terms. The main purpose of this dissertation is to scientifically demonstrate the contrary.

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https://www.ucsusa.org/resources/satellite-database. The number of military satellites indicated here is therefore a minimum value.

[127] Frank A Rose, 'Managing China's Rise in Outer Space', Global China: Assessing China's Growing Role in the World (Washington, DC: Brookings Institution, April 2020), 7, https://www.brookings.edu/research/managing-chinas-rise-in-outer-space/.

[128] In fact, the United States' Defense Space Strategy of June 2020 identifies as an objective to "Deter adversary aggression against the space capabilities of the United States and its allies, partners, and commercial interests": 'Defense Space Strategy: Summary' (Arlington, Virginia: Department of Defense, June 2020), 8.

[129] Tim Bradshaw et al., 'OneWeb Collapses after SoftBank Funding Talks Fall Through', Financial Times, 28 March 2020, https://www.ft.com/content/8695c459-effd-4b54-8d96-69d8e614f6b4.

[130] Lal et al., 'Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)', 80.

[131] Contant-Jorgenson, Lala, and Schrogl, 'Cosmic Study on Space Traffic Management', 12.

Chapter 3. Conceptual framework, methodology and data

On ne peut se passer d'une méthode pour se mettre en quête de la vérité des choses

René Descartes, Discours de la méthode (1637)[1]

This chapter introduces the conceptual and methodological concepts forming the backbone of the study. It goes beyond methodological considerations presented in the introduction, by presenting with utmost details the theories and models used in this dissertation. At first, it explicates the main theoretical bodies used to understand and hypothesise the behaviour of the American, Japanese and French armed forces with regards to the definition of domestic policy on space traffic management (STM): civil-military relations (in particular Janowitz's constabulary force concept) and public choice theory (mostly Dunleavy's bureau-shaping model). This chapter then introduces the approach followed to analyse domestic decision-making processes and validate the hypotheses in the form of Graham Allison's three-model framework, originally developed for the Cuban Missile Crisis. Finally, the last section presents the data collected as part of the case studies and justifies its collection process, relevance, representativity, etc.

1. Conceptual framework

Although the main features of the conceptual framework were already introduced in Chapter 1, this section goes further in its clarification. It first defines what has been loosely called 'the military' in previous chapters before emphasising specific elements of civil-military relations and public choice theory.

1.1. What is 'the military'?

This dissertation often uses the expression 'the military' in a very general sense such as in "military influence on", "military expectations" or "the militaries of advanced space

[1] "One cannot do without method in one's quest for the truth of things", Discourse on the Method (1637)

powers". Although one can understand the concept embodied in 'the military', this section clarifies its meaning and scope in this dissertation.

In line with the analytical framework laid out by Allison and presented in the next section, the military is considered in this dissertation to be both a complex institution with defining features and an ensemble of individuals. Generally, when mentioning the military, it should be understood as all organisations and personnel under the responsibility of the Department of Defense (DoD) for the United States, the Ministry of Armed Forces (MINARM) for France and the Ministry of Defense (MOD) for Japan. If looking at the most comprehensive example, the DoD, it includes military services (Army, Navy, Air Force, Marine Corps, Space Force) and their associated military departments (Army, Navy and Air Force) whose aim is to organise, train and equip forces; joint components such as the 11 combatant commands for exercising command and control over forces, in short the actual use of force; the office of the Secretary of Defense for all overarching administrative issues such as policy development, planning, acquisition, programming, etc; defence agencies such as the famous Defense Advanced Research Projects Agency (DARPA) and National Security Agency (NSA); and a variety of other structures contributing to US national security. Within all these organisations forming the US, French and Japanese militaries are both civilian and military (uniformed) personnel with varying equities and points of view, as well as different career patterns (e.g. career civil servant or officer, political appointee, mid-career recruit). Figure 3-1 shows the DoD's organisational chart as of early 2019.

In some cases, the boundary of what can be considered part of the military is unclear. Again, in the case of the US, the National Reconnaissance Office is both a defence agency under the responsibility of the Secretary of Defense and an intelligence agency, then part of the Intelligence Community under the responsibility of the Director of National Intelligence. Similarly, the US Coast Guard is a branch of the US Armed Forces but under the supervision of the Department of Homeland Security in peacetime. For these reasons, the term of 'national security actors' is sometimes used in this dissertation in lieu of 'the military'.

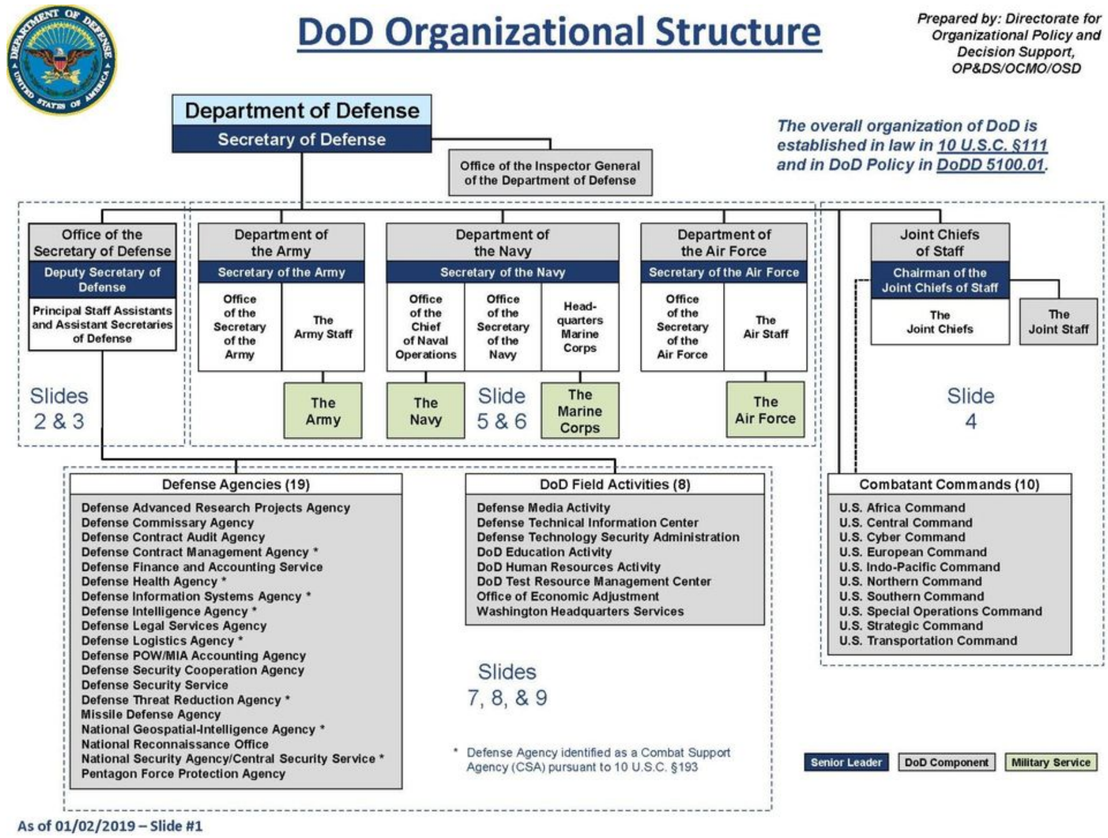

Figure 3-1. United States Department of Defense organisation chart, as of 1 February 2019.

1.2. Civil-military relations

While the main testing framework of this study consists of decision-making theories, the underlying theoretical framework used to conceptualise and hypothesise the behaviour of the military in interagency discussion processes is borrowed from CMR, with a focus on Morris Janowitz's interrelated concepts of civilianisation of the military and constabulary force. This body of literature provides useful tools for the understanding of the complex interactions between two very different organisational cultures. The space field, one of the most complex areas of military activities, with infinite technicalities and close interconnectedness with other fields, requires the tight collaboration of military and civilian experts, both from a technical and policy standpoint. It appears therefore legitimate, in order to ensure the effectiveness of military activities in outer space, to foster bi-directional inputs, consisting in a growing civilianisation of the military establishment and a more active participation of the military in space policymaking, both by proposing and rejecting specific policy directions.

1.2.1. Skill structure of the military establishment

The first element mentioned in the previous paragraph, the need for civilianisation of the military, is at the core of Morris Janowitz's concept of *constabulary force*, already explained in the introduction of this dissertation. By differentiating "military technologists" and "military managers", Janowitz envisions a modification of the skill structure of the military establishment with, respectively, high-level technical experts with close civilian ties focussing on the technical evolution of the military – epitomised by space technology – and generalist managers with a foot in the political arena. It was then chosen by the author to build the hypotheses under this framework rather than Samuel Huntington's desire for an apolitical military. Again, it is important here to understand that Janowitz mentions the apparition of a body of military technologists as informal or formal structure made of individuals clearly identifiable by their technical expertise. Analysing the apparition of structures defined by identifiable sociological features is related but not equivalent to studying the development of the much more diffuse concept of military culture[2] and its declinations: operational culture, service identity, etc.[3] Although not formally included in the hypotheses, cultural considerations are present in this dissertation, following the *differentiation* approach to the cultural analysis of the military, "depict[ing] subcultures and larger informal cultures within the organization", in opposition to the macroscopic *integration* and microscopic *fragmentation* approaches.[4] In line with the spirit of hypothesis 3, Joseph L. Soeters insists on the importance of the multiplicity of organisational sub-cultures in the adaptability of the military establishment:

> "empirical arguments lead us to believe that differentiation or heterogeneity within an organizational culture is more the rule than exception. (…) As most armed forces nowadays really do have to face up changing and turbulent environments, this is an important issue".[5]

Within the topic of this dissertation, the creation around the world – in particular by the three countries studied – of space forces and units is an important element towards the development

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[2] Joseph L Soeters, Donna J Winslow, and Alise Weibull, 'Chapter 14. Military Culture', in *Handbook of the Sociology of the Military*, ed. Giuseppe Caforio, Handbooks of Sociology and Social Research (New York: Springer, 2006), 237.
[3] Builder, *The Masks of War: American Military Styles in Strategy and Analysis*.
[4] Interestingly, the three existing perspectives to the cultural analysis of the military mirror Allison's framework: the integration approach focusses on identifying general patterns giving its coherence to the military establishment, the differentiation approach concerns large sub-cultures - potentially overlapping - within the military (e.g. Air Force, Navy, Commissioned Officers) and the fragmentation approach goes down to analyse the coexistence of a multitude of micro-cultures. Full definitions in: Soeters, Winslow, and Weibull, 'Chapter 14. Military Culture', 239–40.
[5] Soeters, Winslow, and Weibull, 240.

of space-related formal or informal structures and on the apparition of a distinctive space – operational – culture in theses armed forces.

1.2.2. CMR and military effectiveness

Regretting what they considered to be an excessive domination of Huntington's concept of objective civilian control of the military in CMR literature, some scholars have called for the study of other "potentially significant ramifications of civil-military relationships", such as its impact on military effectiveness,[6] issue of utmost importance in the space field. By reviewing existing literature, Suzanne C. Nielsen demonstrates the growing interest for this dimension of CMR, and the consensus on the importance of "relatively cooperative relationships between senior military and political leaders".[7] She provides a list beneficial outcomes of such a relationship, that are relevant to the study of space security policy: the strengthening of the use of high technologies in military applications (here SSA, active debris removal or on-orbit servicing),[8] the development of a doctrine aligning with political priorities (here preserving the long-term sustainability of the outer space environment)[9] and the ability to quickly adapt to a changing environment.[10] Nielsen's views are perfectly in line with Janowitz's idea – at the core of his *constabulary force* concept – that "military managers" should receive a "political-military education" in order to provide meaningful input in governmental policy discussions, as "political agents".[11] Himself a soldier-scholar as called for by Janowitz, Sam C. Sarkesian encouraged military leaders to actively engage in policymaking by confronting their views with those of their civilian controllers:

> "It seems clear that the American military belongs to the American people, and military professionals have the duty and obligation to insure that the people and its political leaders are

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[6] Suzanne C Nielsen, 'Civil-Military Relations Theory and Military Effectiveness', *Public Administration and Management* 10, no. 2 (2005): 62; For an overview of CMR studies on military effectiveness after Nielsen's initial efforts, see: Thomas C Bruneau, '1. Civil-Military Relations: Why Control Is Not Enough', in *Civil-Military Relations: Control and Effectiveness Across Regimes*, ed. Thomas C Bruneau and Aurel Croissant (Boulder, Colorado: Lynne Rienner Publishers, 2019).
[7] Nielsen, 'Civil-Military Relations Theory and Military Effectiveness', 75.
[8] Nielsen, 'Civil-Military Relations Theory and Military Effectiveness' quotes: Stephen Biddle and Robert Zirkle, 'Technology, Civil-military Relations, and Warfare in the Developing World', *Journal of Strategic Studies* 19, no. 2 (1 June 1996): 171–212, https://doi.org/10.1080/01402399608437634.
[9] Nielsen, 'Civil-Military Relations Theory and Military Effectiveness'; Nielsen quotes: Deborah D Avant, *Political Institutions and Military Changes* (Ithaca, New York: Cornell University Press, 1994); Jack Snyder, *The Ideology of the Offensive: Military Decision Making and the Disasters of 1914* (Ithaca, New York: Cornell University Press, 1984); Barry R Posen, *The Sources of Military Doctrine* (Ithaca, New York: Cornell University Press, 1984).
[10] Nielsen, 'Civil-Military Relations Theory and Military Effectiveness'; Nielsen quotes: Elizabeth Kier, *Imagining War* (Ithaca, New York: Cornell University Press, 1997).
[11] Janowitz, *The Professional Soldier*, 426.

> counseled and alerted to the needs and necessities of military life. This cannot be done by adhering to a notion of the military profession as a silent order of monks isolated from the political realm".[12]

Similarly, Major General William E. Rapp regretted that senior military leaders in the US, deeply infused with Huntington's principles, have imposed restrictions on themselves and have therefore provided poor inputs for national security decision-making. For him, "they worry that diving into the murky waters of national security decision-making causes them to become 'political,' which is seen as antithetical to military culture and ethics."[13] Instead Rapp promotes the idea of "equal dialogue with unequal authority."[14]

Conversely, instead of promoting its views to its civilian supervisors, the military leadership can rely on its extensive bureaucracy to ward them off and maintain a preferred course of action. Barry Posen sees in traditional military secrecy, a requirement of the job, a "handy rationale for fending off meddlers at home."[15] He therefore insists on the importance of clear military doctrines in the management of "the risk of direct civilian intervention in military affairs".[16]

1.3. Public choice theory: Dunleavy's bureau-shaping model

Public choice theory, in this dissertation present through the case of Patrick Dunleavy's bureau-shaping model[17], has served to derive Hypothesis 1, by proposing a non-imperialist interpretation of the military bureaucracy with regards to space safety and sustainability responsibilities. This section provides more details on this model and explains how it constitutes a major evolution from the traditional imperialist views of governmental bureaucracy. It has been a common conception of bureaucratic analysis in the 1970s and 1980s – and persistent until now, that a bureaucrat's primary goal was the maximisation of the size of his agency, as summarised by Gordon Tullock in 1976:

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[12] Sam C. Sarkesian, 'The U.S. Military Must Find Its Voice', *Orbis* 42, no. 3 (1 June 1998): 426, https://doi.org/10.1016/S0030-4387(98)90030-8; Cited in: John Allen Williams, '4. Political Science Perspectives on the Military and Civil–Military Relations', in *Social Sciences and the Military: An Interdisciplinary Overview*, ed. Giuseppe Caforio, Cass Military Studies (New York: Routledge, 2007), 93.
[13] William E Rapp, 'Civil-Military Relations: The Role of Military Leaders in Strategy Making', *Parameters* 45, no. 3 (2015): 13–26.
[14] Rapp, 18; Rapp attributes the concept to Richard Betts, *American Force* (New York: Columbia University Press, 2012), 225–31.
[15] Barry R Posen, 'Foreword: Military Doctrine and the Management of Uncertainty', *Journal of Strategic Studies* 39, no. 2 (2016): 168.
[16] Posen, 168.
[17] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*.

> "As a general rule, a bureaucrat will find that his possibilities for promotion increase, his power, influence and public respect improve, and even the physical conditions of his office improve, if the bureaucracy in which he works expands. This proposition is fairly general. Almost any bureaucrat gains at least something if the *whole* bureaucracy expands".[18]

The meaning of 'expanding the bureaucracy' has been a topic of debate, primarily between those focussing on workforce expansion and those focussing on budget increase.[19] Some scholars have however tried to counter this vision by proposing alternative interpretation of bureaucratic behaviour. In particular, one of the most interesting critique of Tullock's and Niskanen's imperialist views of bureaucracy can be found in Patrick Dunleavy's *bureau shaping model*.[20] Although it oversimplifies a complex model, one can summarise Dunleavy's core argument as relying on the differentiation of bureaucrats' intentions by their rank, leading to the understanding that senior bureaucrats, those actually having the power and influence to pursue budget-maximisation strategies, have little incentive in doing so. He writes:

> "Instead, higher-ranked bureaucrats place more emphasis upon non-pecuniary utilities: such as status, prestige, patronage and influence, and most especially the interests and importance of their work tasks".[21]

More precisely, among the different elements constituting Dunleavy's bureau-shaping model, two are of particular importance here. The first, concerning "competition with other bureaus", indicates that although there is a natural tendency for interagency rivalry, "bureaus may want to export troublesome and costly low-grade tasks to rivals, especially when doing so carries no major implication for a reduced program budget".[22] The offloading of space safety responsibilities by the military clearly falls under this category: their transfer to a civilian agency is unlikely to cause budget cuts, as existing spending are devoted in their huge majority to data collection and processing, mission that will be maintained in its pure military form (called space domain awareness in the US, in opposition to SSA). Getting rid of space safety services is basically getting rid of a barely budgeted supplementary – non-military – mission. The second applicable element of the bureau-shaping model is what Dunleavy labelled "load-

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[18] Tullock, *The Vote Motive*, 29.
[19] Respectively in: Fiorina and Noll, 'Voters, Bureaucrats and Legislators'; and Niskanen, *Bureaucracy: Servant or Master?*, 8; Both cited in: Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*, 154.
[20] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*.
[21] Dunleavy, 200; Dunleavy cites: Halperin, *Bureaucratic Politics and Foreign Policy*; and Kingdon, *Agendas, Alternatives, and Public Policies*.
[22] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*, 204.

shedding, hiving-off and contracting out". It is described as "by far the most radical possibilities for top-tier agencies to reshape their functions" and consists in "export[ing] responsibility for functions inconsistent with senior officials' agency-type ideal".

Concluding on the bureau-shaping model however requires a note of caution: Dunleavy insists on the differences of appreciation and motivation among bureaucrats depending on their rank. The author of this dissertation having primarily interviewed senior officials on this issue, the clear applicability of the bureau-shaping model is served by this bias. Interviews with low-ranking bureaucrats with moderate career perspective – by definition unlikely as they do not consider themselves legitimate to talk with outsiders – may have provided empirical data pointing towards a slightly different direction.

2. Testing the hypothesis: Allison's three-model framework

The core of this study consists in understanding the potential involvement of a secretive organisation – the military – in the policymaking responsibilities of an obscure one – the government. Dealing with more or less interdependent actors, having their own capabilities, power and equities, it is necessary to lay out a basic framework in order to give some clarity to the huge quantities of information collected. In particular, knowing that issues related to international regimes are usually dealt with at the highest level of the executive government, the main challenge here is to understand *decision-making processes* within the said government. Specifically, in the case of this study, the key is to model efficiently how the military can influence interagency processes leading to the definition of an official domestic position on the creation of an international regime for STM. The choice made in this dissertation is to adopt the decision-making theory framework developed by Graham Allison in *Essence of Decision* in 1971 to explain the Cuban Missile Crisis,[23] with additions from CMR and public choice theories presented in the previous section.

2.1. Underlying framework: Graham Allison's three decision-making models

This section introduces the main approach followed in this study, borrowed from Allison's *Essence*, and the details of its application to the three case studies.

[23] Allison, *Essence of Decision: Explaining the Cuban Missile Crisis*; It is based on an earlier paper: Graham T Allison, 'Conceptual Models and the Cuban Missile Crisis', *The American Political Science Review* 63, no. 3 (1969): 689–718; It was later refined and augmented with Philip Zelikow in: Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis.*

2.1.1. Graham Allison's approach

In *Essence*, Allison and Zelikow provide a detailed historical analysis of the events having unfolded during the Cuban Missile Crisis of 1962. In particular, they focus on explaining the rationale behind specific decisions made by both the American and Soviet sides. On a methodological standpoint, Allison's original purpose was to show the limits of the realist vision of government decision-making as the rational thinking process of a unitary state actor (*Model I: Rational Actor Model*). He therefore introduced two new models to highlight the role played by subnational actors in state decision-making: the *Organisational Behaviour Model (Model II)* and the *Governmental Politics Model (Model III)*.[24] The three models are defined below, following Allison's own explanations. The evolution of Model III is described in a following section.

Model I: Rational Actor Model

The main feature of Model I is to consider the organisation studied as a unitary rational actor. It is the core of the realist understanding of international relations, that has long been the dominant approach to explain state decision making. To go even further, it has been deeply interiorised in mainstream – or journalistic – international affairs narratives. When looking at the headlines of main newspapers, it is common to hear about "the American reaction to the rise of Iran", "Japan decides to install Aegis Ashore" or their synecdochic equivalents "Brussels reacts to the results of the Brexit referendum" and "Paris tries to save the Iran nuclear deal". In *Essence*, Allison sets up a clear framework for the Rational Actor Model, reproduced in figure 3-2.

[24] Model III is called the "Bureaucratic Politics Model" in Allison, 'Conceptual Models and the Cuban Missile Crisis'. This is the name kept in later literature.

MODEL I – THE RATIONAL ACTOR MODEL

I. Basic Unit of Analysis: Governmental Action as Choice. Nations or national governments choose actions maximising their strategic goals and objectives.

II. Organising Concepts

- **A.** *Unified National Actor*. The agent is a nation or government seen as rational unitary decision makers.
- **B.** *The Problem*. Strategic situation to which the agent chooses to react.
- **C.** *Action as Rational Choice:*
  1. Objectives
  2. Options
  3. Consequences
  4. Choice

III. Dominant Inference Pattern. *If a nation or its representatives performed a particular action, that action must have been selected as the value-maximising means for achieving the actor's objectives*.

IV. General Propositions. Propositions explicitly outlining the rationale behind the choice, in other words the logic of the value-maximising behaviour.

- **A.** The decrease of an alternative's perceived costs reduces its likelihood to be chosen.
- **B.** The increase of an alternative's perceived costs increases its likelihood to be chosen.

V. Evidence. The key aspect of analysing a governmental decision with the Rational Actor Model is to arrange evidence into a coherent picture.

Figure 3-2. Framework of the Rational Actor Model, reproduced from Allison and Zelikow (1999)[25]

Model II: Organisational Behaviour Model

The assumption at the base of Model II is that the government is a "vast conglomerate of loosely allied organisations",[26] where the problems it faces are identified, evaluated and solved through coordination among these organisations. More precisely, governmental decision-making is seen as the result of an equilibrium of a complex system in which each building block follows "standard patterns of behaviour",[27] often referred to as *standard operating procedures* (SOPs). The key in using this model to explain governmental choice is to identify the routinised outputs of departments and agencies, based on their official responsibilities, technical capabilities, organisational culture, etc. As summarised by James G. March and Herbert A.

[25] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 24–25.
[26] Allison and Zelikow, 143.
[27] Allison and Zelikow, 143.

Simon, instead of a "logic of consequences" epitomised by the Rational Actor Model, the Organisation Behaviour Model follows a "logic of appropriateness".[28] Allison's framework is reproduced in figure 3-3.

MODEL II – THE ORGANISATIONAL BEHAVIOUR MODEL

I. Basic Unit of Analysis: Governmental Action as Organisational Output

II. Organising Concepts

- **A.** *Organisational Actors*
- **B.** *Factored Problems and Fractionated Power*
- **C.** *Organisational Missions*
- **D.** *Operational Objectives, Special Capacities, and Culture*
- **E.** *Action as Organisational Output:*
    1. Objectives: Compliance Defining Acceptable Performance
    2. Sequential Attention to Objectives
    3. Standard Operating Procedures
    4. Programs and Repertoires
    5. Uncertainty Avoidance
    6. Problem-directed Search
    7. Organisational Learning and Change
- **F.** Central Coordination and Control
- **G.** Decisions of Government Leaders

III. Dominant Inference Pattern. *If a nation performs an action of certain type today, its organisational components must yesterday have been performing (or have had established routines for performing) an action only marginally different from today's action.*

IV. General Propositions

- **A.** Existing Organised Capabilities Influence Government Choice
- **B.** Organisational Priorities Shape Organisation Implementation
- **C.** Implementation Reflects Previously Established Routines
- **D.** Leaders Neglect Calculations of Administrative Feasibility at their Peril
- **E.** Limited Flexibility and Incremental Change
- **F.** Long-range Planning
- **G.** Imperialism
- **H.** Directed Change

V. Evidence. Information on the organisations involved in the governmental decision analysed.

Figure 3-3. Framework of the Organisational Behaviour Model, adapted from Allison and Zelikow (1999)[29]

[28] James G March and Herbert A Simon, *Organizations*, 2nd ed. (Cambridge, UK: Blackwell Publishers, 1993), 8.

[29] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 164–85. The category "Specific Proposition" was removed due to its specific focus on the Cuban Missile Crisis, not bringing any value for generalisation.

Model III: Governmental Politics Model

The third and most influential model presented by Allison in *Essence* is the Governmental Politics Model. While Model II attributes a limited role to leaders in the outputs of their organisations, Model III puts them on the front stage. Top government decision-makers, presidents, prime ministers or kings often sit at the centre of a limited circle of powerful individuals, in charge of different areas of governmental responsibility, but also representing major external stakeholders (e.g. industrial lobbies, NGOs). Being the main interface between the top government leader and hundreds of direct and indirect stakeholders, these individuals play a major role in governmental choice. Although they are influenced by the organisations they represent in high-level meetings and therefore they contribute to the promotion their output (Model II), these powerful actors engage in bargaining to pursue specific goals affected by a myriad of causes: personal ethics, historical grudge with another actor/organisation, self-promotion, corruption, etc. Like for the two previous models, Allison proposes a conceptual framework adapted in figure 3-4.

MODEL III – THE GOVERNMENTAL POLITICS MODEL

I. Basic Unit of Analysis: Governmental Action as Political Resultant

II. Organising Concepts

- **A.** *Who plays?*
- **B.** *What factors shape players' perceptions, preferences, and stands on the issue at hand?*
    1. Parochial Priorities and Perceptions
    2. Goals and Interests
    3. Stakes and Stands
    4. Deadlines and Faces of Issues
- **C.** *What determines each player's impact on results?*
- **D.** *What is the game?*
    1. Action-channels
    2. Rules of the Came
    3. Action as Political Resultant

III. Dominant Inference Pattern. *If a nation performed an action, that action was the resultant of bargaining among individuals and groups within the government.*

IV. General Propositions, categories:

- **A.** Political Resultants
- **B.** Actions and Intention
- **C.** Problems and Solutions
- **D.** Where you Stand Depends on Where You Sit

E. Chiefs and Indians
F. The 51-49 Principle
G. International and Intranational Relations
H. The Face of the Issue Differs from Seat to Seat
I. Misexpectations
J. Miscommunication
K. Reticence
L. Styles of Play

V. Evidence. Information on the differences of perceptions and priorities within the government and the bargaining processes having led to the resultant decision.

Figure 3-4. Framework of the Governmental Politics Model, adapted from Allison and Zelikow (1999)[30]

The most important aspect in Allison's approach is the analysis of the same series of events with three different lenses, each highlighting specific explanatory features. It teaches us that in complex decision-making processes like those involved in dealing with the Cuban Missile Crisis, there is no single explanation but a multitude of more or less interdependent ones. All three families of explanations introduced by Allison are part of a multifaceted truth, and it is only by overlaying numerous models that a fine understanding of the situation can emerge from the depths of history. Allison summarises this philosophy with this homemade maxim: "because simplifications are necessary, competing simplifications are essential".[31]

2.1.2. Comments on the bureaucratic politics paradigm

Considering the methodology presented thereafter and the opportunity for the author to interview people directly involved in STM policy making, emphasis is put in this dissertation on the role of individuals, and consequently on Model III, governmental politics, that came to be known as the *bureaucratic politics paradigm*. Its history and evolution are introduced below.

The base of the bureaucratic politics model can be traced back to Richard E. Neustadt's famous description of the US government, not as constituted of the three traditional, separated powers (legislative, executive and judicial) but as made of "separated institutions sharing

[30] Allison and Zelikow, 294–313. The category "Specific Proposition" was removed due to its specific focus on the Cuban Missile Crisis, not bringing any value for generalisation.
[31] Allison and Zelikow, 8.

power",[32] later described by Warner R. Schilling as "quasi-sovereign powers".[33] Based on these views, policy decisions are bargains among leaders having control over these "quasi-sovereign powers", following similar political processes as international diplomacy among allies. After these founding fathers, to which can be added Samuel P. Huntington and Roger Hilsman, came a "second wave" of bureaucratic politics theorists, such as Allison.[34] *Essence* is undoubtedly the most influential work in the field and still constitutes the basis of most bureaucratic politics approaches. It was later further refined, not only in its second edition with Philip Zelikow (from which is taken the framework above) but also in collaboration with Morton H. Halperin.[35] Moreover, the latter is the co-author of the other *bible* of bureaucratic politics, *Bureaucratic Politics and Foreign Policy*, in which an additional focus is put on the role of the Congress, beyond the executive branch's administration.[36]

2.1.3. How and where the models are applied here

The models are applied in this study at three different levels of decision-making, which does not have any methodological implication but changes the type of actors involved in the decision-making process. The first, state-level, concerns interagency decision-making where the various actors involved in a decision are either government agencies or large subsets of government agencies (e.g. for mastodons like the US DoD, considering it as one bloc in governmental decision-making may be oversimplifying). The second is agency-level where the elements considered in the decision are bureaus, offices or any possible subdivision of an agency, department or ministry. The third level concerns informal structures within agencies. The most representative examples of such structures, playing a core role in this dissertation, are the different categories of space-related officers within the US Air Force. In fact, this study will demonstrate that there are important differences of appreciation on space safety and sustainability between 'pure space officers' (officers either trained primarily for space operations or having had a career primarily composed of space-related positions) and more versatile space officers oscillating between a missileer's and a space operator's careers. Each

[32] Richard E Neustadt, *Presidential Power: The Politics of Leadership* (New York: John Wiley, 1960), 33.
[33] Warner R Schilling, 'The Politics of National Defense: Fiscal 1950', in *Strategy, Politics and Defense Budgets*, ed. Warner R Schilling, Paul T Hammond, and Glenn H Snyder (New York: Columbia University Press, 1962), 22.
[34] Robert J Art, 'Bureaucratic Politics and American Foreign Policy: A Critique', *Policy Sciences* 4 (1973): 467–90.
[35] Graham T Allison and Morton H Halperin, 'Bureaucratic Politics: A Paradigm and Some Policy Implications', *World Politics* 24, Supplement: Theory and Policy in International Relations (1972): 40–79.
[36] Halperin and Clapp, *Bureaucratic Politics and Foreign Policy*; Halperin, *Bureaucratic Politics and Foreign Policy*.

of these three levels implies different actors considered in each of the three models, as shown on table 3-1.

Table 3-1. Actors involved in decision-making processes, based on models and levels

	Level 1 - State	Level 2 - Agency	Level 3 – Informal structures
Model I – Rational Actor	State as unitary actor	Agency as unitary actor	N/A
Model II – Organisational Behaviour	State subsets: agencies, and if relevant large subsets of agencies	Agency subsets: bureaus, offices, secretariats, etc.	Thematic groups (e.g. 'pure space officers', missileers)
Model III – Governmental Politics	Heads of government agencies, and other influential personalities in direct contact with the head of state or government	Heads of agency subsets: undersecretaries, assistant secretaries, directors, etc. in direct contact with the head of agency	Representatives (official or unofficial) of thematic groups (e.g. General Hyten as prominent 'pure space officer')

It is however important to specify that the three models are used not as a strict recipe but as an underlying weft. In other words, Allison's frameworks are not always followed point by point when analysing the root causes of governmental decisions but they help highlighting elements that would not be visible in a merely journalistic exposé. In fact, thanks to its size and to the extent of its activities, the models can be straightforwardly applied to the US case, as shown in Chapter 5 in particular. Some aspects of France's military reorganisation are also identified by applying the models. Japan however, owing to its unique approach to space policymaking, does not allow a direct application of the framework, which is used more loosely. Table 3-2 shows, for each model and level of analysis, in which chapter they are formally applied.

Table 3-2. Actors involved in decision-making processes, based on models and levels

	Level 1 - State	Level 2 - Agency	Level 3 – Informal structures
Model I – Rational Actor	Chapter 5	Chapter 5, 7	N/A
Model II – Organisational Behaviour	Chapter 5	Chapter 5, 7	Chapter 5
Model III – Governmental Politics	Chapter 5	Chapter 5	Chapter 5

2.2. Applicability of Allison's models to STM

Allison developed his analytical framework based the specific context of the Cuban Missile Crisis. The keyword here is *crisis*. The decisions analysed in *Essence* are marked by a context of heightened tensions between two clearly defined powerful blocs and in a context of high urgency. Can it be used beyond times of crisis? Can it be applied to STM policymaking which, while a topic of great importance, does not pertain to thermonuclear war?

2.2.1. A framework designed for broader purposes

Although he decided to apply it to the Cuban Missile Crisis, Allison himself insists on the "broader implications" of his framework in "arenas beyond foreign affairs", in particular to the "domestic policy of national governments", focus of this study.[37] A cautious analysis of the models shows that they were not developed with an idea of crisis in mind but more generally to have a finer understanding of governmental decision-making. In particular, none of the "general propositions" of models II and III presented in figures 3-3 and 3-4 contain elements of urgency, with the exception of "organisational learning and change" for model II,[38] and "problems and solutions" and "the 51-49 principle" for model III. In fact, elements of urgency and gravity (hence of crisis) specific to the situation of the Cuban Missile Crisis are included by Allison under the category "Specific Proposition", not reproduced in the figures above because irrelevant to the general purpose of this section. They concern "deterrence" and "force posture" for model II,[39] and "use of force in crises" and "military action" for model III.[40]

In fact, Allison's framework has been used extensively for studies of decisions made in 'non-crisis' context. An excellent account of the use of the bureaucratic politics paradigm was written by J. Garry Clifford, who believes that "whether one studies nuclear strategy, the rise of the military-industrial complex, or the United States alliance with Britain, bureaucratic history provides pertinent pieces to the jigsaw puzzle".[41] There is even in the literature a past example of Allison's decision-making framework being applied to space-related issues and to STM. In 2017, in his PhD dissertation on presidential decision-making, space policy expert

[37] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 7.
[38] Allison and Zelikow, 171–72.
[39] Allison and Zelikow, 182–85.
[40] Allison and Zelikow, 311–12.
[41] Clifford, 'Bureaucratic Politics'.

Brian Weeden[42] used Allison's framework to analyse successive administrations' decisions on the Global Positioning System (GPS) and on STM, about what he called "the Obama Administration's pre-decisional process on STM".[43]

2.2.2. Existing specific points applicable to the current situation in outer space

Some similarities can be found between the Cuban Missile Crisis context and the current situation in outer space, such as the existence of a military standoff and a sense of urgency due to the fast pace of the space field.

First of all, space is an increasingly warfighting domain as shown by the focus on a warlike rhetoric adopted by senior military leaders in the US in the last few years.[44] In fact, recent reports of independent think-tanks (e.g. Secure World Foundation, Center for Strategic and International Studies and Brookings Institution) have demonstrated from open-source materials the worldwide development of counterspace capabilities,[45] with a focus on the rise of the Chinese People's Liberation Army,[46] centre of the attention of the US military. The Global Times, press outlet affiliated to the Communist Party of China reacted to the presentation of the US Space Force's flag by President Trump on 15 May 2020 by blaming the US – and to a lesser extent Japan – for the current arms race in space.[47] Similarly, the Russian government has issued a very critical statement in reaction to the publication of the US Defense Space Strategy of June

[42] Dr Brian Weeden, Director of Program Planning at the Secure World Foundation, in Washington, DC, welcomed and supported the author during his data gathering stay in the United States for Part I. Both Dr Weeden and his former PhD advisor Dr Scott Pace advised the author to use Allison's methodology.
[43] Weeden, 'Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology: The Global Positioning System and Space Traffic Management', 358.
[44] At an event of the Center for Strategic and International Studies in Washington, DC on 18 November 2019, soon after he was sworn in as the first Commander of the re-established US Space Command, General Jay Raymond declared: "And I think the thing that's driving it [note: the re-establishment of the US Space Command] is one simple sentence. I think there's eleven words in the sentence: *Space is a warfighting domain, just like air, land and sea*. You know, it used to be you couldn't say that in public – space and warfighting in the same sentence. The U.S. wants to keep the space domain safe. And that's still our goal, is to deter any conflict from beginning or extending into space. But we didn't say that publicly. Now, every speech I give I say that, and usually right up front." The full transcript of the event is available at 'A Conversation with General Raymond'.
[45] Brian Weeden and Victoria Samson, 'Global Counterspace Capabilities: An Open Source Assessment 2020' (Washington, DC: Secure World Foundation, April 2020), https://swfound.org/media/206955/swf_global_counterspace_april2020.pdf; Todd Harrison et al., 'Space Threat Assessment 2020' (Washington, DC: Center for Strategic and International Studies, March 2020), https://csis-prod.s3.amazonaws.com/s3fs-public/publication/200330_SpaceThreatAssessment20_WEB_FINAL1.pdf?6sNra8FsZ1LbdVj3xY867tUVu0RNHw9V.
[46] Rose, 'Managing China's Rise in Outer Space'.
[47] Xuanzun Liu, 'US Space Force Devt Risks New Arms Race in Outer Space', Global Times, 20 May 2020, https://www.globaltimes.cn/content/1188977.shtml.

2020,[48] demonstrating for them "Washington's aggressive endeavours".[49] Such strategic standoff among three of the world's leading powers is quite reminiscent of the Cuban Missile Crisis's context.

Secondly, while the timescale is different, there is an urgency to deal with space debris and space traffic management for the long-term sustainability of space. As explained in Chapter 2, space traffic is growing at an unprecedented rate driven by SpaceX's Starlink constellation, and the population of debris in outer space never stops to grow.

2.2.3. Need for update and adaptation of the framework

The arguments used above to justify the applicability of Allison's framework to the topic of this study also reveal its shortcomings: it is a very general framework that can highlight relevant patterns of organisational behaviour and bureaucratic politics, but requires the addition of tailored "Specific Propositions" to reach full efficiency – like Allison did for the Cuban Missile Crisis. The question is then to identify distinctive features of military involvement in space safety and sustainability, that cannot be fully covered by the framework.

The first aspect concerns the focus on the military. In Allison's original work, the military is only one organisation among many others influencing presidential decision-making, such as the Central Intelligence Agency. Hence it is necessary to look at the latest developments of the field of CMR, that has greatly evolved since the publication of Allison's work, as shown in section 1.2.

Secondly, a major difference between the current issue and the Cuban Missile Crisis is the drastic technological evolution of the military. The extreme level of technicality involved in space safety and sustainability policymaking reinforces the central role of what Morris Janowitz calls the "military technologists" and their link with civilian experts, be they inside or outside the military establishment, as shown in section 1.2.1.

Thirdly, it goes without saying after reading Chapter 2 that the space domain brings with itself numerous unique physical and legal characteristics (hence the need for technologists) that restrict the possibilities offered to decision-makers. In particular, the level of uncertainty inherent to space activities combined with the heavy asymmetry of information on the space environment (including among domestic agencies) have a direct impact on decision-making.

[48] 'Defense Space Strategy: Summary'.
[49] 'Comment by the Information and Press Department on the Release of the US "Defence Space Strategy"', Ministry of Foreign Affairs of the Russian Federation, 19 June 2020, https://www.mid.ru/foreign_policy/news/-/asset_publisher/UdAzvXr89FbD/content/id/4170086.

Finally, contrary to Allison's case study focussing on a stand-off between two countries, domestic decision-making on space safety and sustainability is seen as the first step towards to development of an international regime. Building on the explanations provided in Chapter 2 about Robert Putnam's two-level game, such interagency discussions are aiming to define the domestic win-set in prevision of negotiations with other countries.

2.3. Proposed specific propositions to Allison's models II and III

This section proposes possible additions or amendments to Allison's models II and III in the form of *Specific Propositions* adapted to the study of military involvement in space safety and sustainability. These propositions, derived from the CMR and public choice theories presented above as well as the specific – and undebated – characteristics of the space environment, shall be evaluated via the three cases studies of this dissertation, along with the hypotheses. If they prove robust, they could be reutilised in future studies of this kind.

1. Skill Structure of the Military Establishment. This proposition goes beyond Model III's *Styles of Play* and *Where You Stand Depends on Where You Sit*. Instead of considering respectively the career type of the individual (career civil servant, lateral entry or political appointee) as well as its current position, this proposition focusses on the overall career coherence and technical expertise of the individual. As such, individuals having had a coherent career in space operations would share a certain understanding of space activities independently from their mode of appointment or currently held position. Hence, what matters here is to belong to an informal or formal structure of space – military – technologists.
<u>Applicable to:</u> Model II as structures (e.g. space military technologists) and Model III as specialised individuals (e.g. leading space officers, like Generals Hyten and Raymond).

2. International Finality of Domestic Decision-Making. This proposition is somewhat close to Model III's *International and Intranational Relations* but does not emphasise direct influence on other states' intranational affairs. Instead, focus here is on the image of respectability projected internationally as well as on the understanding of domestic decision-making as the definition of the national win-set for international negotiations, rather than a mere domestic matter.

- **a.** Actions and decision are reflected in a country's international respectability (e.g. here responsible behaviour in outer space).
- **b.** Domestic decisions are to be defended on the international stage

Applicable to: Models II and III

3. Methodology: case studies

The three case studies presented in this dissertation focus on the impact of the military on domestic policy decisions on STM and SSA, and by extension on the creation and nature of an international regime for STM. They therefore concern three of the world's most advanced space powers: the United States, France and Japan. These countries have both complex enough domestic policymaking processes – worthy of investigation – and their approval of a prospective STM regime is the condition *sine qua non* for its establishment.

The choice of the case-study methodology is based on the fact that there are only a very limited number of countries in the world that would fit the description above, and that other methods usually employed to develop or validate theories – experimentation or large-*n* observation[50] – are not applicable here. Moreover, the bureaucratic politics paradigm and the organisational behaviour model are heavily data-driven and require going deeply into the details of specific governmental decisions.

3.1. The great absentees: China and Russia

Among the major contemporary space powers, two are noticeably absent from this study: Russia and China. While they undoubtedly play a prominent role in international space politics and that the creation of an overarching international STM regime could not happen without their active participation, it is virtually impossible to conduct a comprehensive case study on their domestic STM policy making processes, *a fortiori* when the study's focus on military influence is very sensitive even in liberal democracies. The choice of the author not to conduct case studies on China and Russia was motivated by two main reasons.

First of all, as further developed in section 3, there is very little information available about any country's STM policies, even for very active and transparent governments like the US. Data-gathering fieldwork is therefore unavoidable. While the policy decision-making processes of the Russian and, in particular, Chinese governments are obscure even to experts – and do not fit most existing theories which tend to focus on liberal democracies, one can imagine the insurmountable task of digging into domestic space security issues. Even identifying suitable agencies and, more complicated, individuals that could answer questions

[50] Stephen Van Evera, *Guide to Methods for Students of Political Science* (Ithaca, New York: Cornell University Press, 1997), 27.

on Russian and Chinese STM policy is close to impossible. Probably paraphrasing Henry Kissinger's famous "Who do I call if I want to call Europe?", a representative of the 18th Space Control Squadron[51] explained during a conference attended by the author that for many years, US military satellite operators did not know where to call if they notice a possible collision between one of their satellites and a Chinese object.

The second reason is about the personal safety of the author, in particular in China. In the last decade, there were numerous cases of researchers arbitrarily detained by Chinese authorities after trying to dig into the complexities of the government. Therefore, in the already unrealistic case that the author could secure meetings in Beijing, it is obvious that a French student living in Japan spending days going around the city to ask questions at the Ministry of National Defense, the Ministry of Foreign Affairs, the China National Space Administration or the Central Military Commission – like was done in the three case countries – would have triggered some red-light somewhere at Ministry of State Security. Finally, the COVID-19 outbreak did not help either.

3.2. The three chosen cases: the United States, France and Japan

This section briefly presents the three case studies at the core of this dissertation. It introduces the basic characteristics of each of these countries with regards to STM and the rationale behind the choice to include them in the studies.

3.2.1. The United States

Studying international – space – affairs without looking at the US would be a gross mistake, to say the least. Clear space superpower since the fall of the Soviet Union, the US is the only country having extensive-enough SSA capabilities to support an international STM framework. It is also the only country with an actual STM policy, since Space Policy Directive-3 signed by President Trump in 2018. As already mentioned in Chapter 2, it is also very likely that a future STM framework would be centred on the US, both politically and technically. It

[51] The 18th Space Control Squadron, located at the Vandenberg Air Force Base, California, "is tasked with providing 24/7 support to the space sensor network (SSN), maintaining the space catalog and managing United States Strategic Command's (USSTRATCOM) space situational awareness (SSA) sharing program to United States, foreign government, and commercial entities. The squadron also conducts advanced analysis, sensor optimization, conjunction assessment, human spaceflight support, reentry/break-up assessment, and launch analysis". Description from '18th Space Control Squadron', Peterson Air Force Base, 6 August 2018, http://www.peterson.af.mil/About/Fact-Sheets/Display/Article/1060346/18th-space-control-squadron/.

is not the purpose of this section to delve into details, so these are left for the extensive case study presented in Part I of this dissertation.

3.2.2. France

The choice of France as case study, beyond the facility of information gathering granted by the author's nationality, is justified by numerous reasons. First of all, France is a historical space power. After the USSR and the US, France was the third country to launch a satellite with its own domestic rocket system: *Astérix*, onboard the *Diamant A* rocket on 26 November 1965.[52] Secondly, with this same *Diamant* class of rockets, France is at the origin of the European launch system programs, culminating with the current Ariane rockets.[53] Thirdly, France always had a very porous barrier between the civil and military uses of space. For example, contrary to the US case, the French Space Agency CNES has both military and civilian components,[54] therefore providing an interesting perspective on civil-military relations in domestic space policy making. Fourthly, France is the most advanced European country in terms of SSA capabilities with its Air Force's GRAVES system.[55] Finally, through the case of France, information can be gathered on the EU approach to SSA/STM on which France plays the leading role.

3.2.3. Japan

Studying at The University of Tokyo and having interacted for many years with almost all high-level actors of the Japanese space sector, the author could not think one second of avoiding the case of Japan. Beyond these superficial considerations, Japan has a very unique history of military involvement in space affairs. Following the typical Japanese – voluntary – misinterpretation of peaceful as non-military, the Diet passed in 1969 a resolution banning the military from using space technology,[56] resolution that kept being applied until 2008 and the

[52] British satellite Ariel 1, Canadian satellite Alouette 1 and Italian satellite San Marco 1 were all launched on American rockets, respectively onboard a Thor-Delta on 26 April 1962, a Thor-Agena on 29 September 1962 and a Scout X-4 on 15 December 1964.

[53] Michaël Pierrot, 'Les premiers pas : fusées Véronique et Diamant', Futura Sciences, 2015, https://www.futura-sciences.com/sciences/dossiers/astronautique-aventure-fusee-europeenne-ariane-197/page/2/.

[54] 'About CNES', Centre National d'Études Spatiales, accessed 5 March 2020, https://cnes.fr/en/web/CNES-en/3773-about-cnes.php.

[55] The *Grand Réseau Adapté la VEille Spatiale* (GRAVES, in English *Large Space Surveillance Network*) is France's major SSA system, owned by the French Air Force. Further details are provided in the chapter devoted to France.

[56] Setsuko Aoki, 'Introduction to the Basic Space Law of 2008', *German Journal of Air and Space Law* 57, no. 4 (2008): 585–89. p. 586.

enactment of the Basic Space Law.[57] Having been out of the space game for forty years, it is very interesting to witness the progressive development of a space culture in the Japanese Self-Defense Forces and the impact it has on the Japanese government approach to SSA and STM. This is the primary motivation of this case study, as Japan is the only great space power with no substantial military application, even though it evolves in a very tense geopolitical context.

3.3. Why comparing these three?

The previous section introduced the individual benefits of all three case studies, but how do they relate to each other? What is the point of comparing them? During a presentation of my research at The University of Tokyo, a very valid point was raised by a professor member of my thesis committee: these three countries are part of the same "bloc" of liberal democracies and existing cooperation programs both in the space and military arenas would strongly limit the possibility to identify meaningful differences of approach in STM policymaking. This point, absolutely true, instead of being a hurdle is actually the main rationale of the comparison. The previous chapter presented different approaches to international regime-making for STM. An attentive reader would remember that what was labelled "restricted multilateralism" was considered by some experts as a likely one on the short term. Why is it likely? Specifically because it builds upon existing political alliances and technical cooperation among "like-minded, freedom-loving nations".[58]

Therefore, if it wishes to "lead the world in creating the conditions for a safe, stable, and operationally sustainable space environment",[59] the US needs to act at two levels: dealing with China and Russia in a pragmatic three-player game and maintaining trust within its bloc of allies, some of them – in Europe mostly – fearing a hidden American agenda. The second level is equally complex as it requires coordination with countries having different historical approaches to military affairs and space government structures. Apart from being respectively the fourth and fifth largest countries in terms of satellite registration and space security budgets, Japan and France also display some of the most contrasted behaviours with regards to the aforementioned elements. Acknowledging the numerous hurdles facing the US, France and Japan in their quest for a common vision on the preservation of military interests in STM, when

[57] Aoki. pp. 587-8.
[58] 'Remarks by Vice President Pence at the 2019 International Astronautical Congress Opening Ceremony'.
[59] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy', sec. 3.

a common point is identified, it bears a certain weight in what could be a comprehensive view of the 'US-and-allies bloc'.

4. Case-study data

A downside of case-study methodology is the need for huge quantities of data, in order to extract meaningful conclusions. However, dealing with a confidential topic – in both senses, there is very little primary source of information, let alone secondary. A natural consequence is the necessity to get information directly through interview-based research. Mentioning bureaucratic analysis, Clifford wrote, quoting an undisclosed scholar:

> "There is also the problem of evidence. Given the pitfalls in getting access to recent government documents, analysts of bureaucratic politics have relied heavily on personal interviews. Indeed, one scholar as stated that if 'forced to choose between the documents on the one hand, and late, limited, partial interviews on the other, I would be forced to discard the documents'"[60]

This section introduces the main data and information sources used in the study.

4.1. Open source documents

There are very little primary and secondary open sources on any country's approach to STM and even less considering the involvement of their military in domestic space policy making processes. Why is that so? First of all, the issue of STM and military involvement in STM is not fashionable, or at least has not been until very recently. Secondly, it concerns mostly internal government dealings, by nature not available to the public, though not necessarily classified. Thirdly, most decisions on SSA and STM are being made during the redaction of this dissertation, meaning that the information is scarce both because nothing has been automatically released yet (like for ancient space programs such as Mercury or Gemini) and because the research community did not have time to build a sufficient body of literature. Therefore, apart from official government strategies, communiqués and policies, the sources used in this study are the following:

- Newspapers with a focus on space and/or defence, in particular *Space News* and *Breaking Defense*;
- Academic journals on space policy and technology, in particular *Space Policy*, *Acta Astronautica, the Journal of Space Safety Engineering* and *The Space Review*;

[60] Clifford, 'Bureaucratic Politics', 164.

- Reports of major space and /or defence research bodies such as the International Academy of Astronautics, the US Institute for Defense Analyses' Science and Technology Policy Institute, or the European Space Policy Institute.

4.2. Interviews of stakeholders

The main source of data and information for this study is interviews, mostly anonymous, with direct stakeholders, be they from national governments (civilian or military), international organisations, private sector, NGOs or research institutions. The scope of the study being of a sensitive nature, preserving the anonymity of the interviewees is key. It is however important to specify that while most of the information presented in this dissertation concerns what happened *behind the scenes* and was not therefore not public, it does not cover any secret or classified elements. Most of the information was undisclosed, not based on specific security reasons but merely because no one took the time to ask, analyse and publish.

Most interviews were recorded by the author, with the approval of the interviewee, in order to generate an anonymised transcript. It was then merged with the manuscript notes taken by the author to add contextual elements not grasped by a simple audio recording.

The statistical details of relevant interviewees are provided in each chapter, while their full list can be found in Appendix A. It contains only an identifying number and a vague affiliation, in order to give a minimum of background while preserving the anonymity of the interviewee.

4.2.1. Process

The main challenge of interview-based research, *a fortiori* when the topic is sensitive, is to find and convince interviewees to grant the author a meeting. All interviewees were contacted by email, with a precise description of the research topic. While some contacts originated from the author's professional and academic networks, most of the interviewees were reached thanks to the support of key individuals at the Japan Space Forum, namely Mr. Susumu Yoshitomi and Mr. Yoshinori Yoshimura, and at the Secure World Foundation, namely Ms. Victoria Samson, Dr Brian Weeden, Mr. Josh Wolny and Mr. Christopher Johnson.

The large majority of the interviews were conducted face-to-face at the office of the interviewee. Some were done in public places (restaurants, cafés or parks) and a few on the phone. The typical interview lasted an hour, was recorded and composed of a mix of prepared (80%) and improvised questions (20%). A list of sample interview questions is provided in Appendix B.

The recordings were processed right after the interviews, in order to add to the automatically generated transcripts non-verbal elements written down by the author during the interview. This is the primary reason why the author favoured face-to-face discussions, irony, irritation or doubts being difficult to identify on the phone. The production of the transcripts was also motivated by the desire to do possible textual analysis and to have ready-to-use quotes.

4.2.2. Representativity of sources

In order to precisely understand the interagency processes involved in space policy making, it is important to gather the perspective of all or most actors involved. As shown with the cases of the US and France, the author was able to interview staffs from all major agencies involved in space policy making, as shown in respectively figures 3-5 and 3-6, as well as table 3-3.

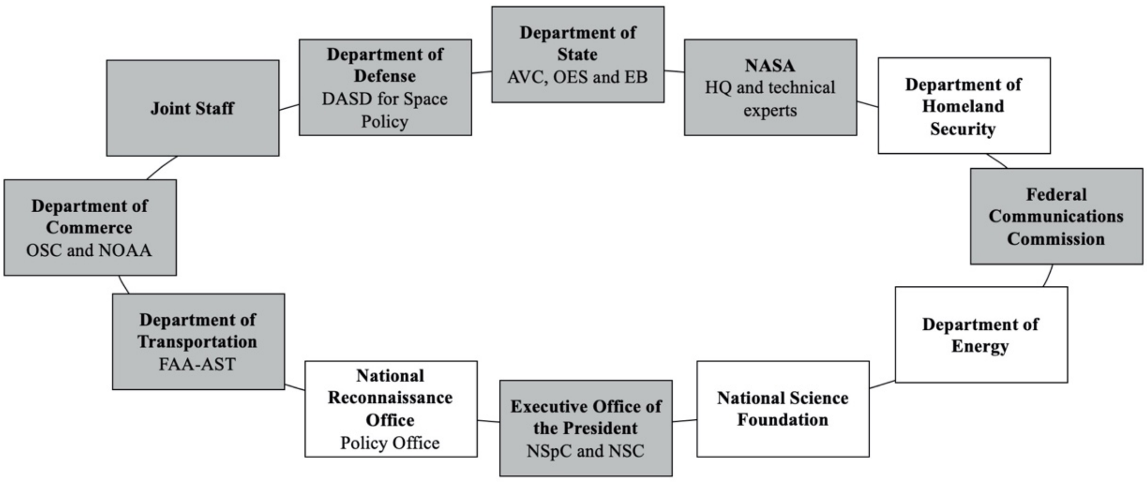

Figure 3-5. Participants in the USG interagency working group on space sustainability[61]

While it seems more restrained in France, it covers most agencies involved, as shown on figure 3-6.

[61] According to Interviewee US-21 (Department of State). In grey are the organisations whose staffs were interviewed for the study. Abbreviations: AVC: Bureau of Arms Control, Verification and Compliance; EB: Bureau of Economic and Business Affairs; OES: Bureau of Oceans and International Environmental and Scientific Affairs; NSpC: National Space Council; NSC: National Security Council; FAA-AST: Office of Space Transportation, Federal Aviation Administration; NOAA: National Oceanic and Atmospheric Administration; OSC: Office of Space Commerce (technically part of NOAA); DASD: Deputy Assistant Secretary of Defense.

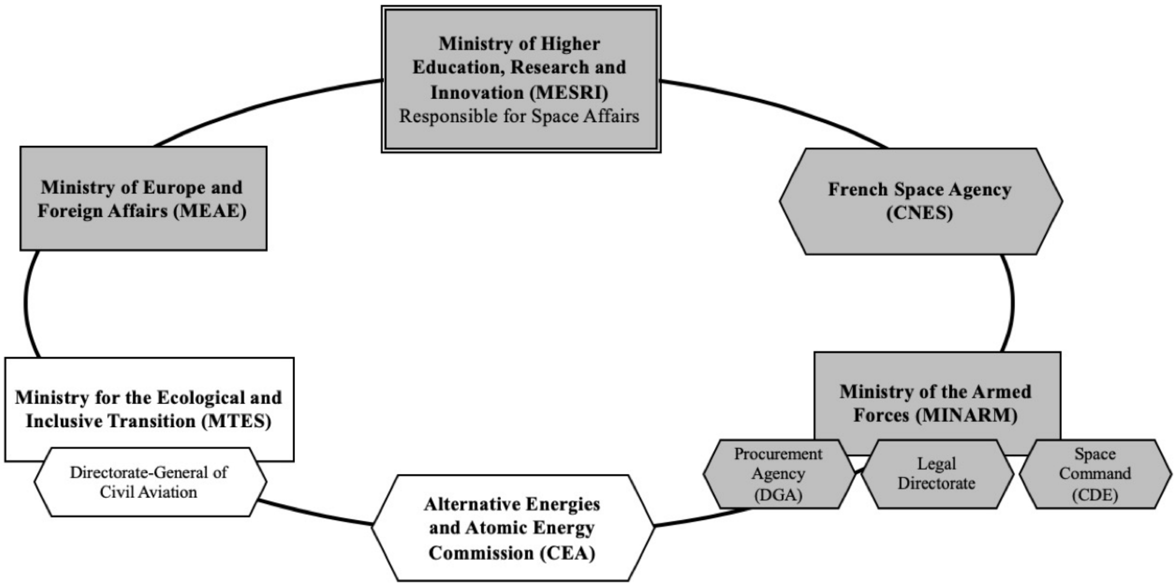

Figure 3-6. Participants in French inter-ministerial discussions for the revision of the national space activities law[62]

Table 3-3. Number of interviewees with affiliations

Country	Affiliation	Number (former)
France	Ministry of Armed Forces	3
	Space Agency (CNES)	2
	Ministry of Higher Education, Research and Innovation	1
	Ministry of Europe and Foreign Affairs	1
	Space Policy Analyst[63]	1
	Subtotal	8
Japan	Liberal Democratic Party	1
	National Space Policy Committee	1
	Advisory Panel on Security and Defense Capabilities	0 (1)
	Japan Aerospace Exploration Agency	2
	Ministry of Defence (civilian)	1
	Ministry of Defence (military)	0 (1)
	Subtotal	7

[62] In grey are the organisations whose staffs were interviewed for the study. In this case, those not interviewed played a really minor role in the working group.
[63] This category concerns interviewees that did not chose to be associated with any specific affiliation. They could therefore be academics, government officers or employees of private entities.

United States	National Space Council	2
	Department of Defense (civilian)	4 (2)
	Department of Defense (military)	1 (3)
	Department of State	3
	Federal Aviation Administration (Department of Transportation)	2
	Department of Commerce	3
	Senate	2
	House of Representatives	0 (1)
	Federal Communications Commission	1
	National Aeronautics and Space Administration	1
	Commercial entity	3
	Academia/Think-tank	5
	Space Policy Analyst	5
	Subtotal	38
TOTAL		**53**

The case of Japan is more complex as the information provided in the dissertation was collected by the author in a less organised way, during countless discussions with Japanese government officials met throughout the author's life in Tokyo. The Japanese interviewees listed in table 3-3 are only those that the author formally interviewed as part of his doctoral research.

4.2.3. Anonymity of sources

In order to limit the risk of involuntary disclosure of the interviewees' identities, the author adopted simple measures:

1. As the interviews were recorded, the author was never addressing the interviewees by name directly and tried as much as possible to avoid mentioning elements that would make the identification of the source easy. In case the interviewee mentions his own name during the interview, the name was removed from the transcript.
2. Both on written notes and digital files, all interviewees are mentioned by an alphanumeric code indicating their country and a random order number (e.g. US-5, FR-3 or JP-1).
3. The actual gender of the interviewees is never mentioned in the dissertation, by always using the neutral masculine form *he/him/his*.

4. The description of the interviewees' positions and affiliations in the list of Appendix A remains vague.

The author understands the limits of these measures, that would obviously not prevent a serious malicious attempt to identify the sources. It is not a problem however as, while all interviewees preferred not to be publicly mentioned for both personal and professional reasons, they did not disclose any classified or restricted information on their country's activities, but only what happened *behind the scenes.*

4.2.4. Validity concerns

A usual concern raised by interview-based research concerns the validity of the cited information, concern that can be divided into two levels.

The first one relates to the authenticity of the anonymous quotes. To put it simply, how to know if a quote is genuine? The answer is simple: there is no way to prove that, as the only person that can confirm its authenticity is by definition anonymous.

The second concern, more interesting methodologically, regards the veracity of information provided by interviewees. How to ensure that the interviewee did remember properly a specific event? Even worse, how to ensure that the interviewee did not lie, whatever good or bad reason may have motivated him? The author identified two approaches to deal with this:

1. Supposing that the authenticity of the quotes is granted, a way to verify an information is to cross-reference it with multiple interviewees. This was particularly efficient for the US case-study as the author was able to interview a very large number of experts.
2. The most efficient way to confirm an information is to find a public source corroborating it. One can however argue that the information concerning something by definition confidential, the public source may either be difficult to find or even not existing. In the former case, knowing what to find facilitates the identification of the source and in the latter, more advanced methods – legal of course – have to be adopted, such as *Freedom of Information Act Requests* in the US case, as explained in the following section.

It is however necessary to bring some nuance to the idea of veracity of the information, in particular in historical studies. In his famous essay *What is History?,* E.H. Carr addresses the concept of truth in historical studies, and warns the reader of the great responsibility of the historian on the facts' variability of interpretations but also on their nature itself:

> [The facts] are like fish swimming about in a vast and sometimes inaccessible ocean; and what the historian catches will depend, partly on chance, but mainly on what part of the ocean he chooses to fish in and what tackle he chooses to use – these two factors being, of course, determined by the kind of fish he wants to catch. By and large, the historian will get the kind of facts he wants. History means interpretation.[64]

One lesson that will become apparent while reading this dissertation is that dissonances among interviewees is often not attributable to a faulty memory or a malicious intention but to a difference of perspective, similar to the effect produced by Troika's famous 'Squaring the Circle' artwork.[65]

4.3. [For the US] The Freedom of Information Act of 1966

An important tool to obtain data for the United States case-study is the *Freedom of Information Act* (FOIA) *of 1966*,[66] amended by the *FOIA Improvement Act of 2016*.[67] The rationale behind the enactment of the FOIA was the definition of "a statutory right of public access to Executive Branch information in the federal government".[68] In other words, anyone – including non-US citizens – can request an agency of the US government to disclose a piece of information it withholds, unless it falls under at least one of nine exemptions. These exemptions were established by Congress "to protect against certain harms, such as an invasion of personal privacy, or harm to law enforcement investigations".[69] Exemption 1 in particular concerns "information that is classified to protect national security"[70] which is not accessible unless its declassification is decided by a responsible authority. As the author does not hold a US security clearance, all information obtained through FOIA requests for this dissertation were, although not publicly released in the past, not classified information.

The methodology of this study being reliant on anonymous interviews from direct stakeholders, FOIA requests can prove extremely useful to check the veracity of a statement. Chapter 4 provides an excellent example of such use of FOIA-obtained information. When

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[64] Edward Hallett Carr, *What Is History?* (New York: Random House - Vintage Books, 1961), 26.
[65] Troika is a contemporary art group having gained world fame for their perspective sculptures, including Squaring the Circle' (2013), 'Dark Matter' (2014), 'Polar Spectrum' (2015) and 'Everything is and isn't at the same time' (2015). Information available at https://troika.uk.com/work/troika-squaring-the-circle/ (accessed 23 January 2020).
[66] 'The Freedom of Information Act of 1966', 5 US Code § 552 (1966).
[67] 'FOIA Improvement Act of 2016', Pub. L. No. 114–185 (2016).
[68] 'Department of Justice Guide to the Freedom of Information Act' (Department of Justice, 2019), 1, https://www.justice.gov/oip/foia-guide/introduction/.
[69] 'FAQ: What Are FOIA Exemptions?', FOIA.gov, accessed 5 March 2020, https://www.foia.gov/faq.html.
[70] 'FAQ: What Are FOIA Exemptions?'

studying the approach of the US military with regards to the preservation of the outer space environment, the author was assured by numerous interviewees that the DoD was deeply committed to mitigating space debris and that important work has been done to bring “national security space launches”[71] into compliance with the US Government Orbital Debris Mitigation Standard Practices (ODMSP), space debris mitigation rules applicable to any US government agency. While the alignment of the statements of different independent stakeholders strengthened their credibility, proof was provided by a successful FOIA request to the US Air Force, showing the exact number of “national security space launches” from 2011 to 2018, including those compliant with the ODMSP and those having been granted a waiver – from compliance – by the Secretary of Defense.

FOIA requests however have a very important limitation for research: their processing time. While an official – interim – answer shall be provided within 15 days, the actual processing of the whole request can take months, and most likely years. In the case of the aforementioned request, which was a very simple one, it was submitted 30 November 2018 and the final response only came on 16 October 2019. Some requests made for this study will therefore likely be received after the submission of the dissertation.

[71] Expression used by the US Air Force in a successful FOIA request.

Part I

The United States Military and Space Traffic Management

Chapter 4. The US military and space debris generation: a responsible actor in outer space?

As the combatant commander responsible for space today, I don't want more debris

Gen. John Hyten, then-Commander, US Strategic Command (2019)[1]

Is the US military a responsible actor in outer space, following the best international standards on space debris mitigation? A way to answer this complex question with clear objective data is to look at the compliance of DoD space activities with the US Government Orbital Debris Mitigation Standard Practices (ODMSP). The ODMSP are a set of technical guidelines established to provide guidance on the mitigation of debris generation and serving as the principal debris-related requirements of space activities subjected to the supervision and control of the US government as explicitly required in the National Space Policy of 28 June 2010. These guidelines, developed in 2001, have been the basis of all international initiatives on space debris mitigation and have been mostly transcribed in what became the guidelines of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) and of the Inter-Agency Debris Coordination Committee (IADC). Therefore, evaluating the compliance of a USG agency's activities with the ODMSP equates to evaluating their compliance with the best international norms cited above.

Main actor of space utilisation in the US government, the Department of Defense (DoD), composed of all the military departments as well as the National Reconnaissance Office (NRO), is, as any other operator in the US, subjected to the ODMSP. The 2010 Space Policy however authorises the approval of "exceptions" to the ODMSP by the head of the agency sponsoring the space activities. In the case of the US military, waivers should be requested to the Secretary of Defense. By delegation, the Deputy Secretary of Defense then evaluates the proposal and decides whether to grant the waiver or not. Any approval should be notified to the Secretary of

[1] Amanda Macias, 'Top US Military Officer Responsible for Space Warns of an Urgent Danger: Junk', CNBC, 11 April 2019, https://www.cnbc.com/2019/04/11/top-us-military-officer-responsible-for-space-warns-junk-is-urgent-danger.html.

State. Building upon the great work initiated by Stephen Garber,[2] this chapter investigates the posture of the US military on space debris mitigation with a focus on the attribution of waivers to the US Air Force (USAF) during the last decade.

To do so, the analysis draws from two sources of data. Firstly, a clear objective response is provided by a successful Freedom of Information Act (FOIA) request on the number of "national security space launches" realised by the Air Force from 2011 to 2018 and their compliance with the ODMSP. Secondly, to understand the hidden dynamics of the evolution of the Air Force's compliance with the ODMSP, the author interviewed numerous experts familiar to the matter, mostly current officials at the Department of Defense and the Department of State. They helped providing an explanatory framework behind the FOIA's dry answer, in particular regarding project development cycles at the Department of Defense and the personal influence of key decision-makers.

The chapter is organized as follows. After presenting the methodology and data used for the study, this chapter provides the historical background of the ODMSP and the National Space Policy of 2010 and reviews the implementation of these requirements into the DoD's and the Air Force's own directives and instructions. Then, it presents the recent drive of the Air Force towards compliance with the ODMSP. It analyses various reasons having led to the improvement of the Air Force's behaviour in outer space with a specific focus on the actual evolution of its launch capabilities and the personal push of key decision-makers for increased compliance. Finally, it also comments on the interagency discussions for the revision of the ODMSP, which conclusions were announced in December 2019, and that were subject to intense speculation regarding the respective inputs of the main participants, before concluding with a brief comparison with NASA's activities compliance with the ODMSP.

1. Methodology

The methodology of this study is quite simple and centred on the analysis of the intersections among three areas, as shown of figure 4-1:

1. ***Regulations***, corresponding to the body of rules applicable to the DoD with regards to space debris mitigation, and their implementation in the DoD's own internal requirements.

[2] Stephen J. Garber, 'Incentives for Keeping Space Clean: Orbital Debris and Mitigation Waivers', *Journal of Space Law* 41, no. 2 (2017): 179–201.

2. ***Perception***, meaning the understanding or awareness of the DoD personnel on the importance of debris mitigation and their commitment to enhancing DoD practices.
3. ***Implementation***, that is to say analysing the actual implementation of debris mitigation regulations to DoD activities in outer space, in other words the level of compliance of DoD activities with the ODMSP.

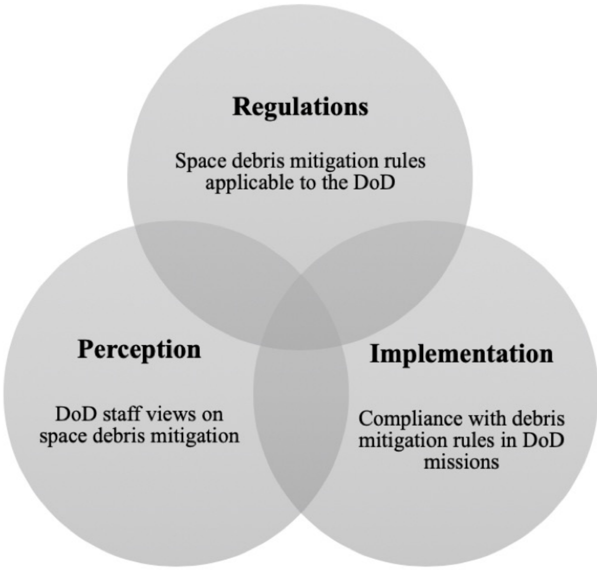

Figure 4-1. Three areas of investigation and intersections

2. Data

This chapter draws from two sources of data: interviews, to understand the hidden dynamics at stake in the DoD with regards to space debris mitigation and a successful FOIA request to provide an objective measurement of the Air Force's compliance with the ODMSP.

2.1. Anonymous interviews

As explained in Chapter 3, most of the information related to military behaviour in space and approach to space sustainability is confidential. It is therefore necessary to rely primarily on anonymous interviews with direct stakeholders. They help to understand the views of DoD personnel on the mitigation of space debris, the potentially conflicting organisational approaches within the DoD (e.g. between the OSD, the USAF and the NRO), and the role played by influential decision-makers.

2.2. Freedom of Information Act requests

In this chapter, FOIA requests were made with the goal of providing clear objective data to confirm or infirm the information obtained during anonymous interviews. Three requests were made for this study, as summarised in table 4-1:

- ***Request 2019-00979-F***, the only successfully completed one, focussed on the number of waivers granted by the Secretary of Defense to USAF launches from 2011 to 2018.
- ***Request 19-F-1762***, still processing, went a step further than the previous one by requesting a copy of the actual waiver signed by the Deputy Secretary of Defense and of all supported documents submitted to him to support his decision.
- ***Request F-2019-00117***, still processing, is the same as the previous one but focussing specifically on waivers granted to the NRO.

Table 4-1. FOIA requests submitted for this chapter

FOIA reference	Submitted to	Submission date	Status (date)
2019-00979-F	Air Force Headquarters	30 November 2018	Completed (final response: 16 October 2019)
19-F-1762	Office of the Secretary of Defense/Joint Staff FOIA Requester Service Center	28 August 2019	Processing (interim response: 6 September 2019)
F-2019-00117	Information Review and Release Group, National Reconnaissance Office	9 September 2019	Processing (interim response: 12 September 2019)

Appendix A presents the full texts of all requests made by the authors and of all responses provided by the USAF, the OSD and the NRO.

3. Orbital debris mitigation rules applicable to the US military

The US military, as any other agency of the federal government, is subjected to specific rules with regards to space debris mitigation. This section introduces applicable regulations and their implementation into the DoD's and the USAF's own sets of internal requirements.

3.1. The US Government Orbital Debris Mitigation Standard Practices

The US Government Orbital Debris Mitigation Standard Practices (ODMSP) are a set of technical guidelines established to provide guidance on the mitigation of debris generation, adopted in 2001 on the model of previous NASA guidelines. At the time of their adoption, they comported eight requirements divided into four categories:[3]

1. "Control of debris released during normal operations". It concerns design measures to limit the emission of debris from spacecraft and rocket bodies, and in particular of those larger than 5 mm and susceptible to stay in orbit more than 25 years (1-1).
2. "Minimizing debris generated by accidental explosions". It concerns design measures to limit accidental explosions that could threaten other spacecraft both during the mission (2-1) and after mission completion (2-2).
3. "Selection of safe flight profile and operational configuration". It covers the design of a trajectory limiting the risks of collision with large objects during the spacecraft orbital lifetime (3-1), the minimization by design of the risk of loss of control for post-mission disposal due to collisions with debris smaller than 1 cm (3-2) and the requirement of detailed analyses of tether systems (3-3).
4. "Post-mission disposal of space structures". It defines different methods for post-mission disposal including atmospheric re-entry,[4] storage orbits and direct retrieval (4-1) and reaffirms the need for special analysis when tether systems are involved (4-2).

A revised version of the ODMSP was announced in November 2019 at the first International Conference on Orbital Debris by J-C Liou, NASA Chief Scientist for Orbital Debris and Program Manager for the NASA Orbital Debris Program Office. Apart from slight modifications on the previously mentioned elements, this revision includes the addition of a preamble and of a fifth part titled "Clarification and additional standard practices for certain classes of space operations". It covers large constellations (5-1), small satellites (5-2), rendezvous, proximity operation and on-orbit servicing (5-3), active debris removal (5-4) and tether systems[5] (5-5).[6] Further details on the revision process are presented in section 4.6, in particular regarding the choice to keep the 25-year rule instead of a shorter re-entry deadline.

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[3] 'U.S. Government Orbital Debris Mitigation Standard Practices' (National Aeronautics and Space Administration, 2001), https://www.orbitaldebris.jsc.nasa.gov/library/usg_od_standard_practices.pdf.

[4] This includes the so-called "25-year rule" requiring the re-entry of an object within 25 years of the completion of its mission.

[5] In the November 2019 revision, mentions of tether systems were removed from parts 3 and 4 and combined in point 5-5.

[6] 'U.S. Government Orbital Debris Mitigation Standard Practices, November 2019 Update'.

The ODMSP serve as the principal debris-related requirements of space activities subjected to the supervision and control of the US government as explicitly required in the National Space Policy of 28 June 2010.

3.2. The National Space Policy of 2010

On 28 June 2010, US President Barack Obama announced the *National Space Policy of the United States of America*. This *2010 National Space Policy* expresses the “President’s commitment to reinvigorating U.S. leadership in space for the purposes of maintaining space as a stable and productive environment for the peaceful use of all nations”.[7] With a strong focus on space sustainability, this policy reaffirmed the importance for the United States to “lead” the development of international standards for debris mitigation and to “continue to follow the United States Government Orbital Debris Mitigation Standard Practices”. It however added a provision on the granting of exceptions to the ODMSP, stating:

> “[The United States shall] require the head of the sponsoring department or agency to approve exceptions to the United States Government Orbital Debris Mitigation Standard Practices and notify the Secretary of State”[8]

The inclusion of this provision is extremely useful from a research standpoint as it provides an indicator for the compliance of DoD activities with the ODMSP. Knowing the procedure by which the Secretary of Defense can provide exemptions, internally called *waivers*, appropriate FOIA requests allow to have a clear overview of the DoD’s approach to space debris mitigation. Section 4 presents the details of the request made and all associated results.

In the case of the US Air Force, waivers should be requested by the Secretary of the Air Force to the Secretary of Defense. By delegation, the Deputy Secretary of Defense then evaluates the proposal and decides whether to grant the waiver or not. Any approval is then notified to the Secretary of State, either through the Bureau of Oceans and International Environmental and Scientific Affairs’ Office of Space and Advanced Technology, or through the Bureau of Arms Control, Verification and Compliance (there is no official single channel) [US-5].

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[7] ‘Fact Sheet: The National Space Policy’ (Office of the Press Secretary, The White House, 28 June 2010), President Barack Obama Archives, https://obamawhitehouse.archives.gov/the-press-office/fact-sheet-national-space-policy.

[8] ‘National Space Policy of the United States of America’ (Office of the President, 28 June 2010), 8, https://aerospace.org/sites/default/files/policy_archives/National%20Space%20Policy%2028Jun10.pdf.

3.3. Implementation by the DoD and USAF

After the enactment of the 2010 National Space Policy, the DoD implemented measures related to the preservation of the outer space environment by issuing DoD Directive 3100.10,[9] later streamlined in the Department of the Air Force's (DAF) activities through AF Policy Directive 13-6,[10] AF Policy Directive 91-2,[11] AF Instruction 91-202[12] and AF Instruction 91-217.[13] This list is not exhaustive but presents the issuances having a direct implication with this chapter's focus. At the time of publication of this dissertation, the other military departments have not yet implemented their own directives or instructions. Figure 4-2 summarises the structure of the implementation of debris-related measures at the DoD.

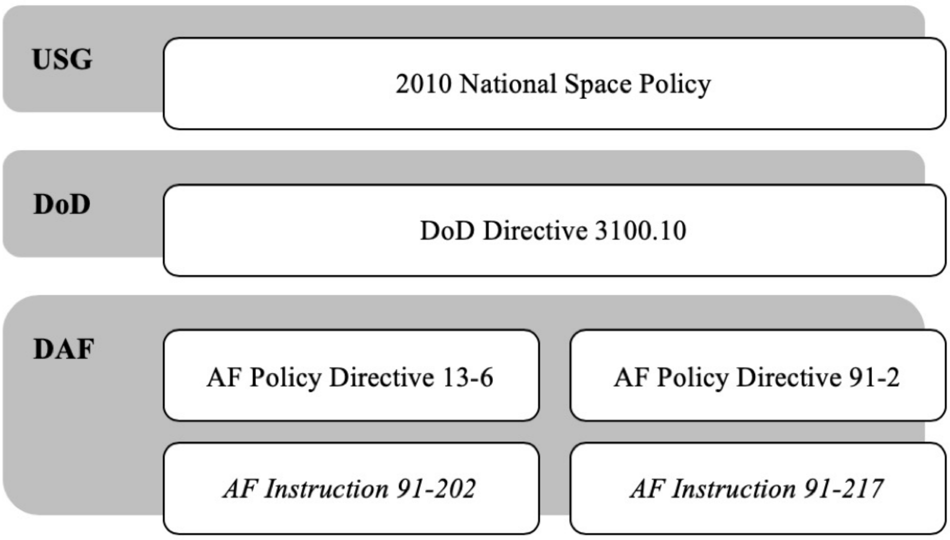

Figure 4-2. Implementation of debris-related measures at the DoD and USAF (non-exhaustive)

According to the DoD's Washington Headquarter Services, DoD Directives are documents issued to "establish policy, assign responsibilities, and delegate authority to DoD Components" and "contain no procedures", while DoD Instructions provide procedural details for the concrete implementation of the policy by responsible authorities defined in DoD

[9] 'DoD Directive 3100.10: Space Policy' (Department of Defense, 18 October 2012), https://www.esd.whs.mil/Portals/54/Documents/DD/ issuances/dodd/310010.pdf?ver=2019-02-04-130744-620.

[10] 'AF Policy Directive 13-6: Space Policy' (US Air Force, 13 August 2013), https://static.e-publishing.af.mil/production/1/saf_sp/publication/afpd13-6/afpd13-6.pdf.

[11] 'AF Policy Directive 91-2: Safety Programs' (US Air Force, 3 September 2019), https://static.e-publishing.af.mil/production/1/af_se/ publication/afpd91-2/afpd91-2.pdf.

[12] 'AF Instruction 91-202: The US Air Force Mishap Prevention Program' (US Air Force, 24 June 2015), https://static.e-publishing.af.mil/ production/1/af_se/publication/afi91-202/afi91-202.pdf.

[13] 'AF Instruction 91-217: Space Safety and Mishap Prevention Program' (US Air Force, 11 April 2014), https://static.e-publishing.af.mil/production/1/af_se/publication/afi91-217/afi91-217.pdf.

Directives.[14] AF Policy Directives are similar to DoD Directives and AF Instructions to DoD Instructions, at DAF-level. The next subsections introduce the main contributions of some of the aforementioned issuances.

3.3.1. DoD Directive 3100.10: Space Policy

The current DoD Directive 3100.10, enacted on 18 October 2012 by Deputy Secretary of Defense Ashton B. Carter and updated on 4 November 2016, replaced its 1999 version to define the space policy of the DoD in accordance with established space policies of the US government such as the 2010 National Policy and the National Security Space Strategy of 2011.[15] The directive contains numerous references to "the sustainability and stability of the space environment" (4.b), stating that the DoD, *inter alia*, "will promote the responsible, peaceful, and safe use of space, including following the U.S. Government Orbital Debris Mitigation Standard Practices" (4.d) and "will cooperate with interagency, international, and commercial partners to define and promote safe and responsible space operations" (4.e).

3.3.2. AF Policy Directive 13-6: Space Policy

AF Policy Directive 13-6 is the USAF equivalent of DoD Directive 3100.10 in the sense that it defines the USAF space policy. For what concerns the preservation of the space environment, it roughly mirrors Directive 3100.10 by stating that the USAF "will contribute to the continued sustainable use of space by maintaining knowledge of on-orbit space objects, (…) and complying with US Government Orbital Debris Mitigation Standard Practices" (2.1.2.1) and "will collaborate with interagency, international, and commercial entities to promote safe and responsible space activities" (2.1.2.2).

3.3.3. AF Instruction 91-217: Space Safety and Mishap Prevention Program

AF Instruction 91-217 is a long technical document implementing the previously mentioned DoD and AF directives. One point is particularly relevant for the analysis of section 4.2, the explanation of the ODMSP waiver request process for USAF launches:

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[14] 'Overview of Department of Defense Issuances' (Department of Defense, Washington Headquarter Services), accessed 5 December 2019, https://www.esd.whs.mil/Portals/54/Documents/DD/iss_process/DoD_Issuances.pdf.

[15] 'National Security Space Strategy: Unclassified Summary' (Department of Defense and Office of the Director of National Intelligence, January 2011), https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/2011_nationalsecurityspacestrat egy.pdf.

> "5.4.3.1. The SDARs [*note: Space Debris Assessment Reports*] shall include an assessment of debris generation risk during launch, on-orbit operations, and EOL disposal, and shall assess compliance with the US Government Orbital Debris Mitigation Standard Practices (ODMSP). All non-compliances with the ODMSP require an approved exception to National Space Policy before launch, as soon as possible following identification. Air Force exception to National Space Policy shall staff through Headquarters Air Force, Space Operations (Air Force/A3S) for Secretary of Defense approval."

This is exactly the process described in the FOIA answer obtained by the author on 16 October 2019 from the Headquarters Air Force (cf. appendix A.3).

3.4. Before the National Space Policy of 2010

Prior to the enactment of the 2010 Space Policy, the DoD and NASA already had their own rules on space debris mitigation. In fact, the main change of the 2010 Space Policy was to change the ODMSP waivers' attribution process, as explained in the successful FOIA answer (cf. appendix A.3):

> "The 28 June 2010 National Space Policy required that ODMSP waivers be granted by the applicable department head, which for National Security Space meant the Secretary of Defense (who delegated this authority to the Deputy Secretary of Defense). Previously, ODMSP waivers that were needed for National Reconnaissance Office missions were approved by the Director of the National Reconnaissance Office, and ODMSP waivers that were needed for Air Force Space Command missions were approved by the Space and Missile Systems Center commander"

4. The DoD's approach to space debris mitigation

This section investigates the approach of DoD components and personnel with regards to the mitigation of space debris, through quantitative data on the Air Force's compliance with the ODMSP and interview-based qualitative information.

4.1. Factual data on the Air Force's compliance with the ODMSP

Part of this dissertation's methodology relies on the use of anonymous sources in various government. However, as discussed in Chapter 3, only relying on such sources raises issues of validity. It is therefore important to couple the information from interviews with actual verifiable data: in this case, the successful result of a FOIA request.[16]

[16] All details on the requesting process are presented in appendix A.

With this request, the author asked to know the use of ODMSP waivers by the USAF since the enactment of the 2010 National Space Policy. Figure 4-3 presents the results of the FOIA request, provided by the Air Staff's Office of Operations, Plans and Requirements (AF/A3).

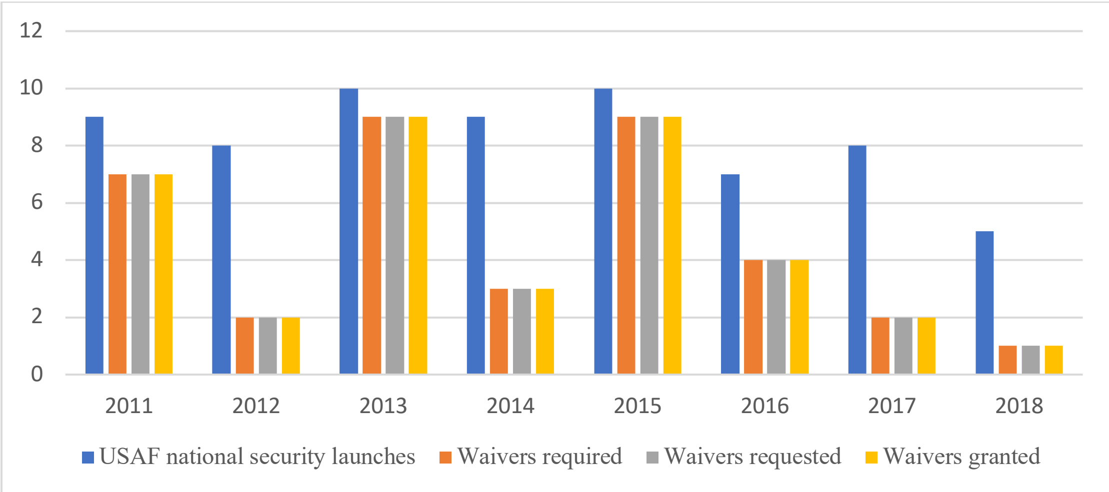

Figure 4-3. National security launches carried out by the US Air Force and associated ODMSP waivers (2011-2018)

An interesting aspect of this FOIA is that its results do not correspond to what has been published by Garber in his 2017 paper. He explained that "calendar year 2017 appears to be the first year in which the Air Force did not request any waivers from the Secretary of Defense". However, when interviewed by the author, an OSD official confirmed the veracity of the initial FOIA results (2016-2018, cf. appendix A.3) [US-1]. As for post-2018 data, another OSD interviewee assured the author that the USAF had become fully compliant in late 2018 [US-16].

At the time of redaction of his paper in early 2017, the information available to Garber was clearly indicating that the USAF reached compliance. In fact, in a memo of 6 February 2017 to the Secretary of the Air Force, then-Deputy Secretary of Defense, Robert O. Work declares:

> "I am pleased to learn that the Air Force will achieve full compliance with the U.S. National Space Policy's requirement to meet the U.S. Orbital Debris Mitigation Standard Practices (ODMSP) for new launches in Calendar Year 2017"[17]

[17] Robert O Work, 'Memorandum for Secretary of the Air Force Regarding Compliance with U.S. Orbital Debris Mitigation Standard Practices (ODMSP)', 6 February 2017, On File with Author.

An explanation for this discrepancy could be that the waivers approved for the two Air Force launches made in 2017 were granted *a posteriori*. The lack of information on the exact timeframe of each of the waivers approved by the Deputy Secretary of Defense (date of request, processing time, date of approval, etc.) is the primary motivation for the second FOIA made by the author (19-F-1762, cf. appendix B).

4.2. Conditions on granting the waivers

While indicating the exact number of waivers granted, the data obtained in the above-mentioned FOIA request does not provide any information on the rationale behind the granting of waivers to the USAF by the Deputy Secretary of Defense. As described in section 2.2, another FOIA request (19-F-1762) was submitted to obtain the full justification of each of the waivers granted from 2011 to 2018 but according to people familiar with the matter, its processing is likely to take years. In the meantime, however, based on interviews of current and past DoD officials, the author was able to identify some of the most frequent conditions of waiver attribution.

Technical issues leading to a violation of the ODMSP but being too expensive to solve in the short-term can lead to the granting of a waiver. For example, without providing the author with precise details, some interviewees explained that the main launcher used by the USAF, the Delta IV rocket, was releasing parts (debris) during specific portions of its flight that were in direct violation with ODMSP requirements [US-38]. As another interviewee puts it, Delta IV launches were typical examples of the “old school legacy space operations (…) with explosive bolts and all this kind of crap”, with very limited environmental concerns [US-15]. Internal DoD studies having shown that fixing the issue would cost in the range of USD 300-500 million, choice was made to provide waivers in the short-term, before transitioning towards cleaner launches [US-16].

Some waivers are provided based on what US-1 called “resilience features”. For example, mission imperatives can require the satellite to be inserted directly into geo-synchronous orbit, therefore leaving upper stages at a very high altitude [US-16], in direct violation of the ODMSP. In this case, a waiver has to be requested and is normally granted [US-1].

Waivers can be also granted *a posteriori* in case of launch malfunction. A recent Navy launch (details undisclosed) suffered issues during its launch, leading to an excessive use of satellite fuel, making compliance with ODMSP’s post-mission disposal requirement impossible. Therefore, while obtaining a waiver, the Navy was instructed to study the possibility of contracting on-orbit servicing to get compliant with the ODMSP [US-1].

4.3. Explaining the 5-year delay in compliance

First of all, it is important to acknowledge that the data set being relatively limited – only eight years, any trend analysis should be taken with caution. What seems to appear is a decreasing trend started in 2016 and comforted in 2017 and 2018, in line with the explanation of the DoD officials interviewed by the author. One question however remains: why is the decrease starting around 2015-2016?

4.3.1. Military programming and acquisition processes

Military programming and acquisition processes were mentioned by interviewees as the primary – organisational – factor explaining the 5-year delay of the USAF to reach quasi-compliance with the ODMSP. In fact, most USAF satellite projects are developed over five to ten years [US-16]. Even beyond satellite projects, "every time you make a new requirement on defence acquisition people, it takes basically five years to work through, it takes five years because it is what the budget cycle is" [US-13]. It therefore seems logical that projects approved up to 2010 (then launched by 2015) and that did not satisfy ODMSP requirements established by the 2010 National Space Policy, received waivers. Following projects however, developed with the policy in mind, were less likely to require a waiver. Garber also mentioned these considerations:

> "By the time a spacecraft is almost ready for launch, however, it is by definition much too late to change its construction or reconfigure it for an alternate launch vehicle that might produce less debris. Such factors need to be considered when spacecraft are being designed, not prepared for launch. It would be rather expensive to redesign a spacecraft or even potentially to provide it with additional fuel to maneuver for post-mission disposal. Thus in many cases, the Secretary of Defense and NASA Administrator effectively have had little choice but to approve exceptions to the rules, especially when critical national security spacecraft are involved (which includes virtually all DoD missions)"[18]

Moreover, as explained in section 4.2, it was extremely complicated and costly for the USAF to go against a legacy of non-compliant Delta IV launchers developed a decade before the enactment of the ODMSP, and for which a full supply chain was developed by the United Launch Alliance (ULA) [US-5]. From 2015 however, SpaceX's Falcon 9 was certified for national security space launches and took over most of GPS launches previously done using

[18] Garber, 'Incentives for Keeping Space Clean: Orbital Debris and Mitigation Waivers', 188.

Delta IV. Moreover, from 2018 the USAF simply stopped launching GPS satellites using Delta IV, contracting only Falcon 9 and one of ULA's other launchers, the Atlas V. This change of launch procurement may explain the decrease of waiver requests from 2016 onwards, that was primarily driven by Delta IV.[19]

4.3.2. Personal insistence of senior civilian leaders

Another reason for the acceleration of the USAF's move towards compliance with the ODMSP in the second half of the 2010s is the personal weight put by the Secretary of Defense and/or the Deputy Secretary of Defense (versions differ from one interview to another).

All interviewees agreed on the fact that one of the two highest civilian leaders of the DoD had grown tired of granting similar waivers over the years, without seeing a clear willingness of the USAF to improve its practices. He therefore announced that he would stop attributing similar waivers unless significant progress would be made, in particular regarding the improvement of its launch vehicles by budgeting technical modification for the following year [US-1]. In fact, in the signed waiver document provided by the Deputy Secretary of Defense, the Office of the Deputy Assistant Secretary of Defense (DASD) for Space Policy (OSD/SP) recommended to insert a sentence requiring compliance in the following years [US-16]. To support this vision, Garber quoted the same memorandum of then-Deputy Secretary of Defense Robert O. Work, published in February 2017, in which he instructs the Air Force, "to reach compliance by including the USG ODMSP requirements into future space launch acquisitions strategies and contracts."[20] This is probably what also led experts from the Aerospace Corporation to claim in 2017, without any information on the source, that "such waivers are increasingly difficult to obtain."[21] The increased difficulty to get a waiver was confirmed by inside sources interviewed by the author [US-1,15,16,17].

4.4. Cultural evolution in the DoD with regards to debris mitigation

Apart from the direct influence of some civilian leaders on ODMSP waivers, the overall culture of the DoD with regards to space debris mitigation has seen a sharp evolution in the last few decades.

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[19] Stephen Clark, 'U.S. Air Force Divides New Launch Contracts between SpaceX, ULA', Spaceflight Now, 20 March 2018, https://spaceflightnow.com/2018/03/20/u-s-air-force-divides-new-launch-contracts-between-spacex-ula/.
[20] Garber, 'Incentives for Keeping Space Clean: Orbital Debris and Mitigation Waivers'.
[21] Eleni M Sims and Barbara M Braun, 'Navigating the Policy Compliance Roadmap for Small Satellites' (The Aerospace Corporation, November 2017).

Specific military leaders have been really vocal in support to better practices in outer space, for the preservation of a safe and sustainable environment. Names coming up often during interviews are General John E. Hyten during his tenure as Commander of the USSTRATCOM, now 11th Vice Chairman of the Joint Chiefs of Staff (VCJCS) [US-16], or earlier General James E. Cartwright, himself former USSTRATCOM Commander and 8th VCJCS, who showed during his whole career a keen interest for transparency of space activities and space sustainability, including by handling the 2008 American anti-satellite operation to shoot down faulty NRO spacecraft USA-193 with extreme care for debris generation [US-25].[22] This event is further commented in the next chapter.

Moreover, the DoD has progressively increased its presence and influence in international discussions for the preservation of the outer space environment. For example, it played an important role in the Long-Term Sustainability (LTS) guidelines negotiations at the UNCOPUOS. Although all relevant US government agencies participated in the initial expert group, specific DoD staffs stayed for the whole duration of the discussions (several years) and took the *de facto* technical lead for the US government both for the expert group and the following working group [US-16,17], while DoS representatives continue to officially head the delegation, as for all UN-related fora [US-21]. The next chapters go further in the DoD's push for international norms.

4.5. Countervailing pressures?

Although DoD components have moved towards greater compliance with the ODMSP, the increasingly contested nature of the space domain has led some actors to raise their voices against an excessive focus on space debris with respect to more pressing issues. In particular, the NRO was often cited as an agency putting a strong emphasis on missions, at the expense of the preservation of the outer space environment [US-15]. Whether these opinions expressed about the NRO are based on actual facts or not is the reason why the author submitted FOIA request F-2019-00117 (cf. appendix C).

4.6. Debate over the DoD's position on the 2019 revision of the ODMSP

The disappointment of the space community over the recent revision of the ODMSP, presented in December 2019 by NASA's Liou during the first International Orbital Debris

[22] USA-193 was an NRO military reconnaissance satellite having suffered a launch failure and purposely destroyed by the US military to avoid reentry hazards.

Conference, led to speculations over the respective positions of the main agencies involved in the working group. In particular, space analyst Theresa Hitchens unveiled an apparent fight between NASA and DoD delegates over the 25-year rules.[23] According to her, DoD experts were pushing for a shorter deadline while NASA wanted to maintain the *status quo*. Liou, leading the interagency working group, later wrote that according to NASA's analysis, "reducing the 25-year rule to, for example, a 5-year rule, only leads to another 10% debris reduction over 200 years, which is not a statistically significant benefit".[24] In a publication in early 2020, Secure World Foundation expert Brian Weeden emitted doubts about this supposed NASA-DoD opposition, writing that while some at DoD may have been in favour of tighter regulations, it was not, based on discussions he had with DoD officials, a shared position in the department.[25]

An anonymous source consulted by the author and familiar with the matter has the following view: the DoD and NASA agreed on the benefit of maintaining the status quo over the 25-year rule while both the DoC and the Federal Aviation Authority (Department of Transportation) favoured a five-year deadline. This source however explained that there were debates within the DoD between the OSD/SP in favour of tighter rules and military operators willing to protect their best interests with laxer rules. The source added that leaks having led to Hitchens's article may have been aimed at supporting the DoD's image as an institution deeply concerned with the long-term sustainability of outer space [US-30].

5. Brief comparison with NASA's compliance with the ODMSP

This section provides a brief comparison of DoD's and NASA's compliance with the ODMSP. All the data on NASA's compliance and reasons for the cases of non-compliance originate from an official briefing of NASA's Liou at the White House's Office of Science and Technology Policy.[26]

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[23] Theresa Hitchens, 'New Space Debris Rules Stalled by Year-Long Interagency Spat', Breaking Defense, 24 September 2019, https://breakingdefense.com/2019/09/new-space-debris-rules-stalled-by-year-long-interagency-spat/.
[24] J-C Liou et al., 'Project Review: The 2019 U.S. Government Orbital Debris Mitigation Standard Practices', *Orbital Debris Quarterly News* 24, no. 1 (February 2020): 5.
[25] Brian Weeden, 'The United States Is Losing Its Leadership Role in the Fight against Orbital Debris', The Space Review, 24 February 2020, https://www.thespacereview.com/article/3889/1.
[26] J-C Liou, 'Orbital Debris Briefing' (EOP/OSTP Briefing, Washington, DC, December 2017), https://ntrs.nasa.gov/search.jsp?R=20170011662.

Contrary to the FOIA data concerning solely USAF rocket launches, NASA provides two types of data: the compliance with the ODMSP of their spacecraft launched in Earth orbit (figure 4-4) and the compliance of the launch vehicles they used (figure 4-5).

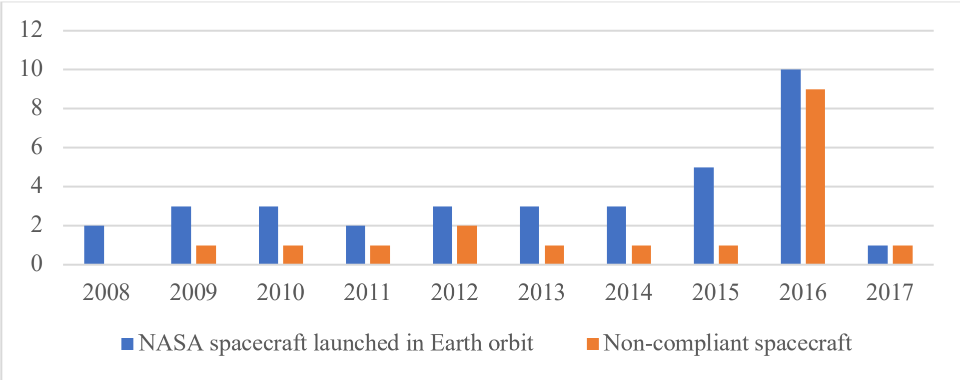

Figure 4-4. NASA spacecrafts launched in Earth orbit and compliance with the ODMSP (2011-2017)[27]

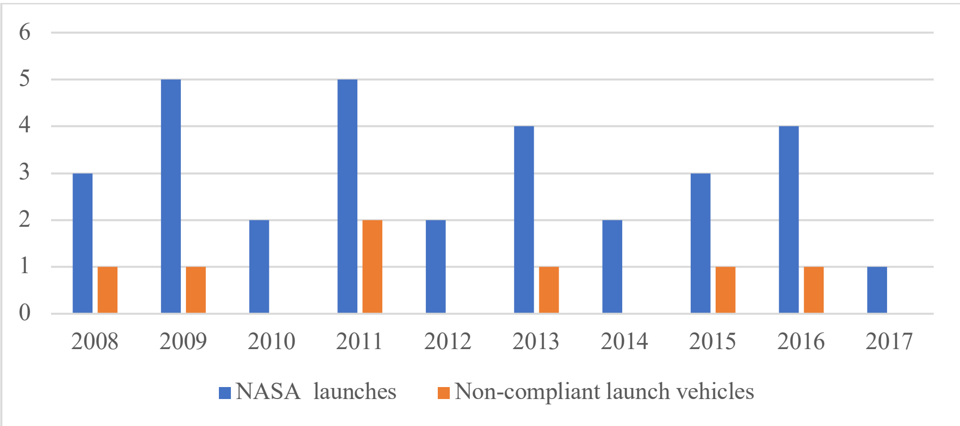

Figure 4-5. NASA launches and compliance with the ODMSP (2011-2017) [28]

In first analysis, it appears that NASA is usually compliant with the ODMSP, with the noticeable exception of 2016 when most of the spacecraft launched required a waiver. It was primarily due to the launch of a set of non-compliant Cyclone Global Navigation Satellite System (CYGNSS) spacecraft, accounting for eight of the nine waivers granted to NASA spacecrafts this year (out of ten launched), due to the impossibility to disconnect solar panels from batteries at the end of life of the satellites, hence violating the ODMSP's passivation rules.[29] Apart from this exceptional bump in NASA's compliance, what can explain such a

[27] Liou, 19.
[28] Liou, 19.
[29] Liou, 20.

successful track record, and why is there no visible impact of the 2010 Space Policy, even after a certain delay like in the USAF case?

The answer to these questions is twofold. It relates to the origins of the ODMSP as well as to NASA internal practices with regards to orbital debris mitigation. As explained in section 4.1., the USG ODMSP originate from NASA Safety Standard (NSS) 1740.14, *Guidelines and Assessment Procedures of Limiting Orbital Debris*, adopted internally in 1995.[30] Moreover, even after the enactment of the ODMSP, NASA continued to further strengthen its internal regulations. Contrary to the DoD that mostly limited itself to endorsing the ODMSP, NASA introduced the NASA Technical Standard NASA-STD-8719.14A, *Process for Limiting Orbital Debris* in 2007 (updated as NASA-STD-8719.14B in April 2019[31]) and the NASA Procedural Requirements for Limiting Orbital Debris, NPR 8715.6B in 2017.[32] NASA spacecraft and launches having to comply with these technical standards and requirements, are therefore expected to pass the ODMSP requirements without problem, explaining the good compliance record shown on figures 4-4 and 4-5. As for the absence of impact of the 2010 Space Policy, it is simply a consequence of the fact that NASA has been working on its compliance with ODMSP-like rules since 1995 and even on stricter ones since 2007.

Finally, although it is quite rare, what are the mission or design factors usually responsible for NASA spacecraft's non-compliance with the ODMSP? Liou provides three main reasons for the non-compliance of spacecraft launched from 2008 to 2017: issues with end-of-mission passivation (e.g. remaining pressure in tanks, impossible disconnection of batteries and solar panels), violation of the 25-year rule (e.g. NOAA 19 will remain 500 years in orbit) and a re-entry human casualty risk above the limit (e.g. 1 in 600 for MMS Atlas 5, below above the 1 in 10,000 threshold).[33]

6. Conclusions

The recent evolution of the USAF towards compliance with the ODMSP shows a clear awareness of the DoD on the importance to improve its practices to preserve a safe and sustainable operational environment. Moreover, the role played by the DoD in the creation of the UNCOPUOS LTS guidelines demonstrates of its willingness to be seen as a responsible

[30] Garber, 'Incentives for Keeping Space Clean: Orbital Debris and Mitigation Waivers', 185.
[31] Charity Weeden, 'Moving the Space Sustainability Needle? Assessing the New NASA Orbital Debris Mitigation Standard Practices', Astroscale, 28 January 2020, https://astroscale.com/moving-the-space-sustainability-needle/.
[32] Liou, 'Orbital Debris Briefing', B7.
[33] Liou, 20.

actor in outer space and to contribute to the 2010 Space Policy's requirement to all departments and agencies to "lead in the enhancement of security, stability, and responsible behaviour in space".[34] This leads to another issue, not fully explored in this dissertation: if the DoD is willing to be seen as a responsible actor, why not publicising the positive data about its compliance with the ODMSP? As Garber wrote:

> "sharing this domestic compliance data internationally would bolster the U.S. Government's deserved reputation as an international leader in debris mitigation and encourage other nations such as China and Russia to collect such data and report them internationally"[35]

When the topic was brought up by the author, most interviewees agreed on the benefits of such approach while pointing out two issues: one is how to ensure reciprocity from other major space powers, and the second is that having no administrative requirement to publicise the data, neither the DoD nor the DoS would assign already overworked staff to the task [US-5].

Appendix A – FOIA Request 2019-00979-F

A.1. Initial request (30 November 2018)

FOIA Request 2019-00979-F was initially submitted on 30 November 2018 on the USAF FOIA website (https://www.foia.af.mil/). The author selected the "HAF – Air Force Headquarters, DC" to treat the request. Text of the Request:

> DoD Directive 3100.10 and DoD Instruction 3100.12, implemented in the United States Department of the Air Force through AF Instruction 91-202 and AF Instruction 91-217 require "USAF launch vehicles" as well as "USAF space vehicles" to follow a set of orbital debris mitigation rules, including the U.S. Government Orbital Debris Mitigation Standard Practices (ODMSP). These directive and instructions also state that a waiver can be given by the Secretary of the Air Force or the Secretary of Defense, allowing the asset to be launched even if not respecting the ODMSP. With this FOIA request, I would like to have access to all releasable information on these waivers, with in particular: (1) The number of waivers requested by the USAF and the ratio between the waivers requested and those accepted by the Secretary of the Air Force. (2) The number and ratio of USAF assets having received an ODMSP waiver.

[34] 'National Space Policy of the United States of America', 6.
[35] Garber, 'Incentives for Keeping Space Clean: Orbital Debris and Mitigation Waivers', 189.

A.2. First answer from the USAF (28 August 2019)

The first answer received from the Headquarters Air Force Information Office (SAF/AAII) is reproduced below with redaction:

> Mr. Verspieren,
>
> This is in response to your 30 November 2018, Freedom of Information Act (FOIA) request for "DoD Directive 3100.10 and DoD Instruction 3100.12, implemented in the United States Department of the Air Force through AF Instruction 91-202 and AF Instruction 91-217 require "USAF launch vehicles" as well as "USAF space vehicles" to follow a set of orbital debris mitigation rules, including the U.S. Government Orbital Debris Mitigation Standard Practices (ODMSP). These directive and instructions also state that a waiver can be given by the Secretary of the Air Force or the Secretary of Defense, allowing the asset to be launched even if not respecting the ODMSP.
>
> AF/A3 was tasked to search for records responsive to your request. AF/A3 provides the following:
>
> Data for the last three years:
>
> Waivers are requested by the Secretary of the Air Force and granted by the Deputy Secretary of Defense, acting on authority delegated by the Secretary of Defense. 9 National Security Space launches were conducted in 2016, and 4 of them required a waiver. 7 National Security Space launches were conducted in 2017, and 1 of them required a waiver. 5 National Security Space launches were conducted in 2018, and 1 of them required a waiver. All required waivers were requested, and all requested waivers were granted.

A.3. Second answer from the USAF (16 October 2019)

Due to the provision of only three years of data, the author appealed to the action officer in order to get the maximum amount of information possible. The second and final answer from the SAF/AAII) was received by email on 16 October 2019:

> Sir
>
> Received the following from AF/A3:
>
> The 28 June 2010 National Space Policy required that ODMSP waivers be granted by the applicable department head, which for National Security Space meant the Secretary of Defense (who delegated this authority to the Deputy Secretary of Defense). Previously, ODMSP waivers

that were needed for National Reconnaissance Office missions were approved by the Director of the National Reconnaissance Office, and ODMSP waivers that were needed for Air Force Space Command missions were approved by the Space and Missile Systems Center commander. Any waiver requests that were granted at the lower level before 28 June 2010 were considered "grandfathered in," and were therefore not elevated to the Office of the Secretary of Defense. The responding office does not readily have access to records of those older waivers, so the information below only reflects waivers requested at the Department level after 28 June 2010. Since the policy changed in the middle of 2010, the data for 2011 launches is incomplete, so the figures listed below start with launches in calendar year 2012, and some numbers are updated from the previous response. These waivers are requested by the Secretary of the Air Force and granted by the Deputy Secretary of Defense, acting on authority delegated by the Secretary of Defense.

9 National Security Space launches were conducted in 2011, and 7 of them required a waiver.
8 National Security Space launches were conducted in 2012, and 2 of them required a waiver.
10 National Security Space launches were conducted in 2013, and 9 of them required a waiver.
9 National Security Space launches were conducted in 2014, and 3 of them required a waiver.
10 National Security Space launches were conducted in 2015, and 9 of them required a waiver.
7 National Security Space launches were conducted in 2016, and 4 of them required a waiver.
8 National Security Space launches were conducted in 2017, and 2 of them required a waiver.
5 National Security Space launches were conducted in 2018, and 1 of them required a waiver.

All required waivers were requested, and all requested waivers were granted.

Appendix B – FOIA Request 19-F-1762

After showing the initial response of FOIA Request 2019-00979-F to an official of the Office of the Secretary of Defense [US-1], the author was advised to submit a most comprehensive FOIA request about waivers granted to the entire DoD, not only to the USAF. Moreover, the author was advised to request the copy of the waiver granted by the Secretary of Defense as well as all supportive documents.

B.1. Initial request (28 August 2019)

The request was therefore submitted to the OSD/JS FOIA Requester Service Center. The request letter is reproduced below:

OSD/JS FOIA Requester Service Center
Freedom of Information Division
1155 Defense Pentagon

Washington, DC 20301-1155
Fax (571) 372-0500

Dear [redacted]

This is a request under the Freedom of Information Act (5 U.S.C. § 552).

I request that a copy of the following document(s) be provided to me: the waivers granted by the Secretary of Defense or the Deputy Secretary of Defense since 2010 regarding the adherence of Department of Defense launches to the US Government Orbital Debris Mitigation Standard Practices. I also request of copy of all supportive documents provided to the Secretary of Defense or the Deputy Secretary of Defense to inform their decision.

In order to help you determine my status for the purpose of assessing fees, you should know that I am affiliated with an educational or noncommercial scientific institution and this request is made for a scholarly or scientific purpose and not for a commercial use. To be precise, I am a French student of The University of Tokyo currently pursuing a PhD in international public policy, with no research funding. I therefore kindly request an exemption of fee.

I am willing to pay fees for this request up to a maximum of $25. If you estimate that the fees will exceed this limit, please inform me first.

I also include an email at which I can be contacted if necessary to discuss any aspect of my request: [redacted]

Sincerely,

Quentin VERSPIEREN

B.2. Interim response (6 September 2019)

The only response received by author to date is an interim mail response sent by the OSD/JS FOIA Requester Service Center, which partial scan is reproduced below, with redaction:

DEPARTMENT OF DEFENSE
FREEDOM OF INFORMATION DIVISION
1155 DEFENSE PENTAGON
WASHINGTON, DC 20301-1155

Ref: 19-F-1762

SEP 6 2019

Mr. Quentin Verspieren
[redacted]

Dear Mr. Verspieren:

This is an interim response to your August 28, 2019 Freedom of Information Act (FOIA)/ Privacy Act request, a copy of which is enclosed for your convenience. We received your request on the same day it was submitted and assigned it case number 19-F-1762. We ask that you use this number when referring to your request.

Although we have already begun processing your request, we will not be able to respond within the FOIA's 20-day statutory time period as there are unusual circumstances which impact our ability to quickly process your request. The FOIA defines unusual circumstances as (a) the need to search for and collect records from a facility geographically separated from this office; (b) the potential volume of records responsive to your request; and (c) the need for consultation with one or more other agencies or DoD components having a substantial interest in either the determination or the subject matter of the records. At least one, if not more of these scenarios applies or would likely apply to your request. While this office handles FOIA requests for the Office of the Secretary of Defense (OSD), the Joint Staff (JS) and other component offices, we do not actually hold their records and our office is not geographically located with these organizations. As we do not hold the records, until the required records searches are complete, we are unable to estimate the potential volume of records or the number of consultations that will be required to make a release determination.

Your request has been placed in our complex processing queue and is being worked based on the order in which the request was received. Our current administrative workload is approximately 2,999 open requests.

In some instances, we have found that requesters who narrow the scope of their requests experience a reduction in the time needed to process their requests.

The OSD/JS FOIA Public Liaison, [redacted] or by email at OSD.FOIALiaison@mail.mil to answer any concerns about the foregoing.

Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services they offer. The contact information for OGIS is as follows:

Appendix C – FOIA Request F-2019-00117

In addition to FOIA Requests 2019-00979-F and 19-F-1762, the author submitted a request directly to the National Reconnaissance Office.

C.1. Initial request (9 September 2019)

The initial request was submitted to the NRO on 9 September 2019 through the centralised USG FOIA website (https://www.foia.gov/). Text of the request:

> I request that a copy of the following document(s) be provided to me: the waivers granted by the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director since 2010 regarding the adherence of NRO rocket/satellite launches to the US Government Orbital Debris Mitigation Standard Practices. I also request of copy of all supportive documents provided to the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director to inform their decision. I would also like to know: (1) The number of waivers requested by the NRO and the ratio between the waivers requested and those accepted by the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director since 2010. (2) The number and ratio of NRO assets having received an ODMSP waiver, since 2010.

C.2. Interim response (12 September 2019)

The only response received by author to date is an interim email response sent by the NRO's Information Review and Release Group, reproduced below. Interestingly, it is the only FOIA request without any action officer identified by name.

> Mr. Verspieren,
>
> We received your recent FOIA request dated 9 September 2019 for:
>
> 'The waivers granted by the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director since 2010 regarding the adherence of NRO rocket/satellite launches to the US Government Orbital Debris Mitigation Standard Practices. I also request of copy of all supportive documents provided to the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director to inform their decision. I would also like to know: (1) The number of waivers requested by the NRO and the ratio between the waivers requested and those accepted by the Secretary of Defense, the Deputy Secretary of Defense or the NRO Director since 2010. (2) The number and ratio of NRO assets having received an ODMSP waiver, since 2010.
>
> We have assigned case number F-2019-00117 to your request.
>
> Since we may be unable to provide a response within the 20 working days stipulated by the Act, you have the right to consider this a denial and may appeal on this basis to the NRO Appellate Authority, 14675 Lee Road, Chantilly, VA 20151-1715 after the initial 20 working day period has elapsed; doing so, however, would exhaust your administrative appeal rights. To preserve these rights, we recommend that you allow us sufficient time to continue processing your request

and respond as soon as we can. You will then have the right to appeal any denial of information after you receive a final response from us. Unless we hear otherwise from you, we will assume that you agree and will continue processing your FOIA request on this basis.

In your request, you asked for a waiver of fees. Fee waivers are or reductions are granted when there is a public interest in disclosure of information, which will contribute significantly to the public's understanding of the operations or activities of the NRO. After reviewing your request, and in the context of the NRO's mission and functions, we have determined that NRO records responsive to your request, if they exist, would meet this criterion. Your request for a waiver of all fees is granted.

If you have any questions, please email FOIA@NRO.gov or call the Requester Service Center at 703-227-9326.

Sincerely,

Information Review and Release Group
National Reconnaissance Office

Chapter 5. A reluctant space safety services provider: the DoD's SSA Sharing Program

In many cases in the department, we're just so overclassified
it's ridiculous, just unbelievably ridiculous
General John E. Hyten, 11th Vice Chairman of the Joint Chiefs of Staff (January 2020)[1]

Thanks to its exceptional space surveillance capabilities, unrivalled around the world, the US Department of Defense plays a key role in space safety. Through its 18th Space Control Squadron (SCS), the US military provides space surveillance data to numerous trusted partners (foreign countries and private companies) having signed an agreement with the US Strategic Command (USSTRATCOM). However, the situation was not always like this: before the early 2000, NASA was responsible for the provision of space safety services with "commercial and foreign entities". What led the DoD to take over these services from NASA, even though space safety is clearly out of the responsibilities usually attributed to the armed forces? But what is even more interesting is that the requirement formulated in Space Policy Directive-3 (SPD-3), signed by President Trump in June 2018, to progressively hand over space safety services responsibilities to the Department of Commerce (DoC) by 2024 happened without any apparent opposition from the DoD, on the contrary. This chapter investigates this mystery: why request to take over space safety services from NASA to hand them over willingly to the DoC around 20 years later? Answering this key interrogation contributes to the evaluation of Hypothesis 1.

In addition to the study of the birth in the early 2000s and currently happening progressive disappearance of the DoD SSA Sharing Program, this chapter investigates what Theresa Hitchens calls the "safety versus secrecy security dilemma" of the DoD,[2] stuck between its unavoidable role in space safety and its inherent reliance on secrecy. It extends the work done

[1] Aaron Mehta, '"Unbelievably Ridiculous": Four-Star General Seeks to Clean up Pentagon's Classification Process', Defense News, 29 January 2020, https://www.defensenews.com/pentagon/2020/01/29/unbelievably-ridiculous-four-star-general-seeks-to-clean-up-pentagons-classification-process/.
[2] Hitchens, 'Space Traffic Management: U.S. Military Considerations for the Future'.

by Rick Sturdevant up to 2007,[3] and looks at the evolution of the Program to understand the complex implications of this dilemma. This in turn helps to identify the current views of the DoD personnel and decision-makers with regards to the creation of an international regime for STM, which is the focus of Chapter 6.

This chapter is organised as follows. After reminding the reader of the methodology in section 1, section 2 presents a concise legal history of space surveillance data sharing at the DoD. Then, section 3 proposes a detailed description of dynamics at play in the DoD from the inception of the SSA Sharing Program to its current status, before section 4 provides analyses of three elements of the Program's history: its creation, its progressive evolution towards more data transparency and finally its transfer to the DoC. Finally, section 5 concludes the chapter by confronting its findings with hypotheses 1 and 2.

1. Methodology

As presented earlier, Graham Allison and Philip Zelikow identified five steps in the work of foreign affairs analysts: "(1) description, (2) explanation, (3) prediction, (4) evaluation, and (5) recommendation".[4] This chapter covers description and explanation, as follows.

The *description* of the evolution of the US SSA sharing program is done at two levels. The first one, in section 2, concerns the objective legal history of the program from its creation to its transfer from the USSTRATCOM to the newly established US Space Command (USSPACECOM) in late 2019, using open-source materials such as official department-level memoranda and acts of Congress. The second level (sections 3 and 4) covers the more subjective history of the SSA sharing program, that can be colloquially described as 'what happened behind the scenes.' The primary source of information are interviews that the author conducted with around 40 experts, mostly from within the USG. Based on these interviews, subjective by nature and highly dependent on the personal history of the interviewee, as clearly visible on specific events presented in section 4, the author reconstructs a kind of multidimensional picture of the events characterising the historical development of SSA sharing at the DoD, by focussing on four features:

1. *The evolution of the outer space environment*
2. *The changing culture inside the DoD*
3. *The influence of specific individuals in the DoD and USG*

[3] Rick W Sturdevant, 'From Satellite Tracking to Space Situational Awareness: The USAF and Space Surveillance, 1957-2007', *Air Power History* 55, no. 4 (Winter 2008): 18–19.
[4] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, footnote of p. 3.

4. *The pressure exerted by the private space sector*

Beyond *description* comes the need for *explanation*. While section 3 offers clues regarding the reasons why certain decisions were made, section 4 proposes to explain these decisions through Allison's three conceptual lenses, or decision-making theories, extensively described in chapter 3:

1. *Rational Actor Model (Model I)*
2. *Organisation Behaviour Model (Model II)*
3. *Governmental Politics Model (Model III)*

Details on the specific turning points of the SSA sharing program are provided directly in section 4, after necessary background knowledge is introduced in sections 2 and 3.

2. Brief legal history of SSA data and information sharing at the DoD

This section aims to present a brief factual history of USG SSA sharing, with a particular focus on the period from 2003 onwards. It does not contain any explanation or assumption regarding the reasons having led the USG to establish the SSA Sharing Program which is the focus of sections 3 and 4. Moreover, this section does not include the changes happening after the re-establishment of the USSPACECOM on 29 August 2019.[5]

2.1. NASA-led SSA sharing (1958-2000)

Since its creation in 1958 until the early 2000s, NASA has been tasked by the USG to disseminate space surveillance data, including two-line-element (TLE) sets and the official USG SATCAT (Satellite Catalogue), to relevant partners. While data and information sharing was initially done via US Mail, the NASA Goddard Space Flight Centre created in the 1990s the Orbital Information Group (OIG) website to facilitate the registration of trusted partners and their access to USG space surveillance data.[6] However, in 2000, the US DoD started to look at the possibility to provide SSA services to partners directly, without NASA as

[5] Sandra Erwin, 'Trump Formally Reestablishes U.S. Space Command at White House Ceremony', SpaceNews.com, 29 August 2019, https://spacenews.com/usspacecom-officially-re-established-with-a-focus-on-defending-satellites-and-deterring-conflict/.
[6] Charles Spillar and Mike Pirtle, 'Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead' (Advanced Maui Optical and Space Surveillance Technologies Conference 2009, Maui, Hawaii, 2009).

intermediary, leading to the creation of the Commercial and Foreign Entities (CFE) Pilot Program.

2.2. The Air Force Space Command's CFE Pilot Program (2004-2009)

On 10 January 2000, after an action memo of the Deputy Secretary of Defense inquiring on the feasibility of DoD-provided SSA services, the Office of the Secretary of the Air Force and the Air Force Space Command (AFSPC) concluded that establishing such SSA sharing program would require an amendment to 10 US Code. Therefore, in 2002, the AFSPC submitted a legislative proposal to be included in the National Defense Authorization Act (NDAA) of Fiscal Year 2004 (FY04),[7] proposing the addition of §2274 "Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government" in 10 US Code.[8]

On 24 November 2003, FY04 NDAA established what was called the CFE Pilot Program for a duration of three years in order to "determine the feasibility and desirability of providing to non-United States Government entities space surveillance data support".[9] In October 2004, the Secretary of Defense assigned the CFE Pilot Program to the Secretary of the Air Force, who then assigned it to the AFSPC, all the way down to its final implementor, the AFSPC/A3 (Directorate of Air, Space and Information Operations), in December 2004. Then in January 2005, the AFSPC/A3 released its own data sharing platform, the website *space-track.org* which continues to be in activity now, modelled after NASA OIG's website.[10]

On 17 October 2006, FY07 NDAA extended the CFE Pilot Program's duration to 30 September 2009, by amending 10 US Code §2274.[11] Then on 14 October 2008, FY09 NDAA extended it further to 30 September 2010.[12] In 2009 however, the structure of SSA sharing was reorganized in the DoD, leading to the establishment of the current SSA Sharing Program.

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[7] 'National Defense Authorization Act for Fiscal Year 2004', Pub. L. No. 108–136 (2003), https://www.govinfo.gov/app/details/PLAW-108publ136.
[8] 'Space Surveillance Network: Pilot Program for Provision of Satellite Tracking Support to Entities Outside United States Government', 10 US Code § 2274 (2003).
[9] National Defense Authorization Act for Fiscal Year 2004, sec. 913.
[10] Spillar and Pirtle, 'Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead'.
[11] 'John Warner National Defense Authorization Act for Fiscal Year 2007', Pub. L. No. 109–364 (2006), sec. 912, https://www.govinfo.gov/app/details/PLAW-109publ364.
[12] 'Duncan Hunter National Defense Authorization Act for Fiscal Year 2009', Pub. L. No. 110–417 (2008), sec. 911, https://www.govinfo.gov/app/details/PLAW-110publ417.

2.3. The US Strategic Command's SSA Sharing Program (2009-2019)

Having convinced on the "feasibility and desirability" to provide DoD SSA services, the CFE Pilot Program was made a permanent program on 28 October 2009 by FY10 NDAA through the modification of 10 US Code §2274.[13] In fact, the only modification was to remove the term "pilot program" from the title of §2274 which became "Space situational awareness services and information: provision to non-United States Government entities".[14] Soon after, on 22 December 2009, responsibilities for SSA sharing were transferred from the AFSPC to the USSTRATCOM,[15] with the AFSPC keeping its responsibilities to "organize, train and equip".[16] It is during this transition that the program was renamed *SSA Sharing Program*.[17] The latest amendment to 10 US Code §2274 happened with FY19 NDAA by adding section (a)(2) stating that the Secretary of Defense "may" continue sharing SSA information after 1 January 2024 only if it is deemed "necessary to meet the national security interests of the United States".[18] It therefore indicates the expiration of the USSTRATCOM SSA Sharing Program in 2024, and prepares for its transfer to a civilian agency, currently expected to be the DoC as stipulated in SPD-3.[19]

Under the SSA Sharing Program, transparency has been progressively increased regarding the quantity of data offered to registered users of *space-track.org*. In particular, then-USSTRATCOM Commander General John E. Hyten announced on 5 October 2018 the release of "more additional data about some space objects that was not previously available", therefore giving an important push to the USSTRATCOM's SSA transparency policy.[20]

[13] 'National Defense Authorization Act for Fiscal Year 2010', Pub. L. No. 111–84 (2009), sec. 912, https://www.govinfo.gov/app/details/PLAW-111publ84.
[14] 'Space Situational Awareness Services and Information: Provision to Non-United States Government Entities', 10 US Code § 2274 (2009), https://www.govinfo.gov/app/details/USCODE-2018-title10/USCODE-2018-title10-subtitleA-partIV-chap135-sec2274.
[15] Duane Bird, 'Sharing Space Situational Awareness Data' (Advanced Maui Optical and Space Surveillance Technologies Conference 2010, Maui, Hawaii, 2010).
[16] Spillar and Pirtle, 'Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead'.
[17] Tiffany Chow, 'SSA Sharing Program: An SWF Issue Brief' (Washington, DC: Secure World Foundation, 22 September 2011).
[18] 'John S. McCain National Defense Authorization Act for Fiscal Year 2019', Pub. L. No. 115–232 (2018), sec. 1604, https://www.govinfo.gov/app/details/PLAW-115publ232.
[19] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[20] 'USSTRATCOM Expands SSA Data on Space-Track.Org', Air Force Space Command, 10 October 2018, https://www.afspc.af.mil/News/Article-Display/Article/1658619/usstratcom-expands-ssa-data-on-space-trackorg/.

2.4. Legality of SSA sharing agreements between the USSTRATCOM and foreign governmental entities

The Case-Zablocki of 1972 stipulates that any international agreement contracted by a USG organization with a foreign governmental entity – including USSTRATCOM SSA sharing agreements – should be "transmitted to the Congress within sixty days after the execution thereof" by the Department of State (DoS). It also specifies that "Notwithstanding any other provision of law, an international agreement may not be signed or otherwise concluded on behalf of the United States without prior consultation with the Secretary of State".[21] Such consultation with the DoS is governed by Circular 175 of 1955 that describes the review process that any such agreement should go through in order "to confirm that the making of treaties and other international agreements by the United States is carried out within constitutional and other legal limitations, with due consideration of the agreement's foreign policy implications, and with appropriate involvement by the State Department".[22] All USSTRATCOM SSA sharing agreements fall under Circular 175 review procedure. However, due to the repetitive nature of these agreements, one could invoke the following clause of Circular 175: "A 'blanket' Circular 175 authorization may be appropriate where a series of agreements of the same general type are to be negotiated according to a more or less standard formula",[23] clause that is in conformity with the Case-Zablocki Act, stating that consultation with the Secretary of State on the conclusion of international agreements "may encompass a class of agreements rather than a particular agreement".[24] Authorities to negotiate and conclude SSA sharing agreements with allies were granted by the DoS to the DoD in 2011. The DoS recently privately expressed its position on the need to revisit the DoD's approach to SSA sharing with foreign governments due to the change of the global context, the implementation of SPD-3 and the new USSPACECOM's broader strategy for military-to-military cooperation with countries that are not among traditional US allies [US-21]. In particular, General Hyten's speech at the 33rd Space Symposium in 2017, in which he hinted his desire to set up SSA sharing agreements with Russia and China,[25] may be interpreted as going beyond the initial Circular 175 authorisation

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[21] 'Case-Zablocki Act', 1 US Code § 112b (1972).
[22] 'Department Circular No. 175 of 13 December 1955 (US Department of State)', *American Journal of International Law* 50, no. 3 (July 1956): 784–89.
[23] 'Department Circular No. 175 of 13 December 1955 (US Department of State)'.
[24] Case-Zablocki Act.
[25] "I want to see this collage of flags, this set of agreements continue to grow because to me it's so important that we operate safely in space as we go forward in the future. I want to see this expand, ideally, to every nation in the world. I think it is the responsibility of every nation to operate safely, every nation in the world. And yes, that includes Russia and China", in John E Hyten, '33rd Space Symposium - Featured Speech: Integrating and Normalizing Space for the Warfighter', U.S. Strategic Command, 6 April 2017,

given by the DoS. Finally, an issue will arise with the transfer of SSA sharing responsibilities to a civilian agency after the expiration of 10 US Code §2274 in 2024 – the DoC according to SPD-3 – on whether and how the DoD's SSA sharing agreements with civil government agencies and private sector entities will transition to the civilian agency along with SSA sharing responsibilities [US-21,24].

3. The dynamics of space surveillance data and information sharing at the DoD

There were numerous driving forces behind the evolution of the DoD towards more transparency on its SSA data. In order to identify those, the author decided to describe the story of this evolution through four different lenses, namely:

1. The evolution of the outer space environment;
2. The changing culture inside the DoD;
3. The influence of specific individuals in the DoD and USG;
4. The pressure exerted by the private space sector.

In order to facilitate the readers' understanding of personal influences in the US Armed Forces presented in the following subsections, figure 5-1 shows the successive commanders of the US military's main space-related components, namely the USSPACECOM, the USSTRATCOM, the AFSPC and the 14th Air Force, from the year 2000 onwards.

http://www.stratcom.mil/Media/Speeches/Article/1152751/33rd-space-symposium-featured-speech-integrating-and-normalizing-space-for-the/.

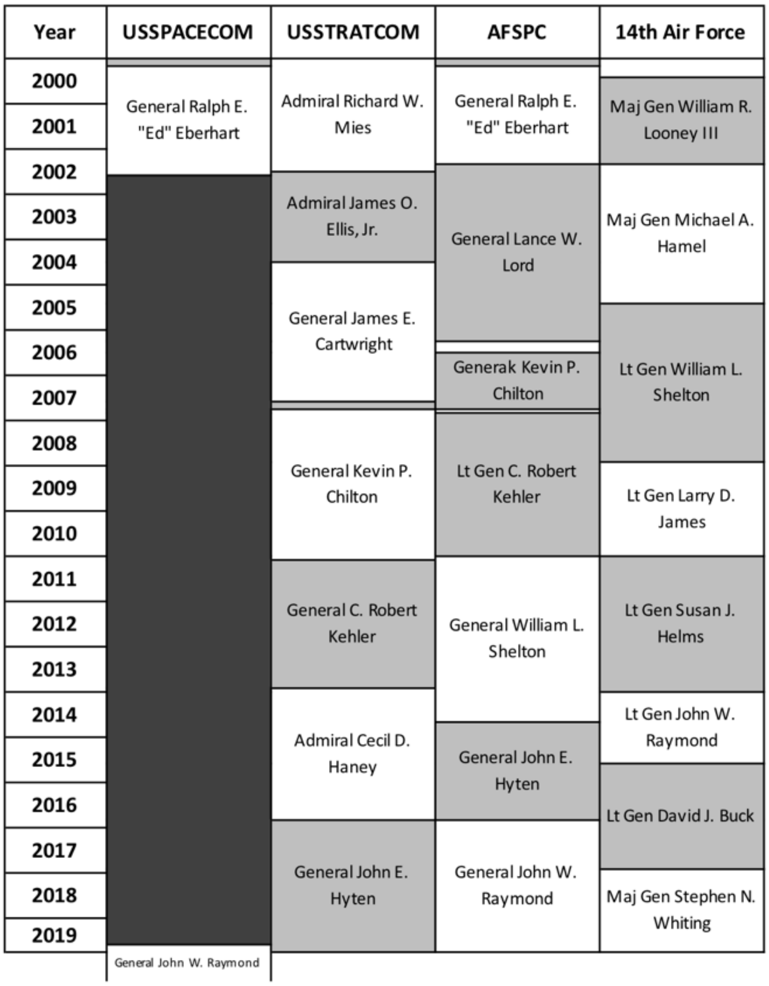

Figure 5-1. Commanders of major space-related structures in the US Armed Forces from 2000 onwards.

3.1. The old trend of increasing transparency of military operations

The progressive evolution of the DoD towards more transparency on SSA data started with an increase of transparency on space operations in general. From the 1960s until the 1990s, all space-related military operations were highly classified, firstly to hide specific capabilities from adversaries and secondly because it was still possible at the time. The US had "a monopoly on information and could choose to keep the information contained" [US-22]. This secrecy was even hampering the utilisation of specific space capabilities by the US military itself. The turning point was Operation Desert Storm, which is considered the first large-scale utilisation of the GPS. It was then "recognized [that] we [at the DoD] couldn't really integrate space into the military without declassifying some aspects of it and by the early 1990s, some of the lower level capabilities like the DSCS [Defense Satellite Communication System] capability had been declassified because we had people, soldiers using that capability who didn't have clearances" [US-22]. From 1992 to the early 2000s and the start the CFE Pilot Program, the situation did not evolve much with tactical space capabilities being declassified while strategic ones stayed highly classified [US-22]. As another interviewee puts it: "we were looking for transitions at that point. Space was not serving the warfighter well at that period. It was too much of a secret architecture, secret capability, unavailable to the warfighter and therefore not useful to the warfighter" [US-25].

3.2. The inception of the CFE Pilot Program

As explained in section 2.1, before the establishment of the CFE Pilot Program, SSA sharing with commercial and foreign entities was dealt with by NASA, first on a case-by-case basis, by shipping via mail compact disks containing relevant orbital information. The data that NASA was sharing was coming from its own sensors as well as those of the USAF. The data collected by the USAF was similarly shared with NASA by shipping CDs [US-20]. Later, the creation of the OIG website facilitated data sharing but was still restricted to very few users on a case-by-case basis. NASA had been the natural USG interface with foreign entities for space surveillance support because of its experience involving human spaceflight operations with Russia [US-12].

The interviewees proposed various reasons for the decision of the DoD to study the possibility to take over SSA sharing missions. For some, there was a growing desire inside the DoD's space components to have a tighter control on the information shared, be it about domestic USG assets or allied foreign assets, and it was therefore preferable that the USAF or other relevant DoD structure took over the sharing responsibility [US-20]. As an interviewee puts it:

> "The back story on the [CFE Pilot Program] was essentially 'we're gonna give the data away so that there is no incentive for somebody to go out and develop something that we can't control'" [US-26].

Others simply mentioned the desire of the DoD and the USG to remove an unnecessary middleman and therefore the big delay in data and information provision [US-20].

In parallel, after the end of the Cold War, outer space became increasingly commercial and while SSA was originally meant for the surveillance of Soviet activities by the US and *vice versa*, it progressively became critical for commercial satellites operators. Operators were therefore in close contact with the USG for punctual support, including the provision of SSA data. There was however no mandate of the DoD to provide data or to carry out specific operations in support to commercial providers. In the 1990s, the DoD was working on various policy issues generated by the growth of commercial space activities. When US commercial communication satellite owner-operator Iridium contacted the USSPACECOM[26] to request space surveillance support to address an on-orbit anomaly when a solar panel on one of its satellites apparently did not properly deploy, the USSPACECOM Commander contacted the OSD/SP on how to address the matter. The DASD considered the request appropriate "as long as it did not interfere with ongoing US national security space operations", and then consulted with the Deputy Secretary of Defense and prepared a policy statement on the support to commercial and foreign space entities to address potential future similar requests, in coordination with other OSD organisations, the Joint Staff (JS), the Military Departments, the USSPACECOM, and the National Reconnaissance Office (NRO) [US-12]. This is what led to the Deputy Secretary of Defense memo of 10 January 2000 that tasked the USAF to propose a framework for SSA sharing.[27] At the JS too, and in particular under Lieutenant General James E. Cartwright, Director of Force Structure, Resources and Assessment (JS/J8) from 2002 to 2004, there was an understanding that the DoD should take over NASA's SSA sharing mission, develop the architecture and later transfer it to a civilian agency such as the FAA [US-25]. This understanding, motivated by the increase of the number of commercial actors but mostly of spacefaring nations at the time, was shared among most actors at the DoD as a "common sense approach" aiming to increase the overall safety of space operations through SSA data services [US-29].

Moreover, at the same time, fiscal constraints [US-12] and manpower reasons [US-15,20] prompted NASA to decline from expanding its role to interact with a broader group of commercial and foreign entities. "Consequently, it fell to DoD to address this issue" [US-12]. Sean O'Keefe, then NASA Administrator, is said to have been closely working with the JS/J8 in particular, to work out a smooth transition [US-25].

The Department of the Air Force (DAF) being concerned about the potential liability risks of implementing the policy designed by the OSD/SP preferred to have the Congress passing legislation [US-12].

Tasked to develop a legislative proposal, the Air Staff has proved to be a very proactive environment. Brigadier General Michael A. Hamel, Director of Space Operations and Integration, overseeing the AF/A3[28] from November 2000 to May 2002 and then Commander

[26] This is the USSPACECOM in its original form (1985-2002).
[27] Spillar and Pirtle, 'Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead'.
[28] Called XOS at the time, different from the AFSPC/A3 mentioned above.

of the 14th Air Force from May 2002 to May 2005 (becoming consequently Major General Hamel), is said to have been a strong supporter of increased transparency in SSA data sharing, while some its AF/A3 staff expressed their opposition to the CFE Pilot Program, partially for national security reasons but mostly for reasons of feasibility, due to the lack of manpower [US-9]. Other general officers were mentioned as having played an important role in initiating the CFE Program: Lieutenant General Roger G. DeKok, Vice Commander of the AFSPC from June 2000 to April 2002 [US-26] and Brigadier General William L. Shelton, who was Director of Requirements at the AFSPC (AFSPC/A5) from November 2000 to May 2002, specifically for the drafting of legislative proposal [US-20]. While not directly involved in the issue, General Lance W. Lord, Commander of the AFSPC from April 2002 to April 2006 and direct superior of Major General Hamel, is said to have given his support to the whole project [US-26]. One key element in understanding the origins of the CFE pilot program but also, to a lesser extent, the other events that followed, is the importance of interpersonal dealings at the DoD and outside of the DoD, including the support of all US Presidents involved, of course limited to the broad idea of having SSA data services transferred from NASA to the DoD and then to a civilian agency when the architecture would be mature enough [US-25].

The actual legislative proposal was drafted in the AF/A3 and coordinated across the various relevant authorities in the DoD, including, inter alia, the Office of the Under Secretary of Defense for Policy (OUSD(P)), the DAF General Counsel (SAF/GC), the DAF International Affairs (SAF/IA) and the AFSPC [US-9]. After coordinating within the DAF and the DoD happened the coordination with the Intelligence Community (IC), in particular the NRO, and at higher level with the National Security Council (NSC) [US-9,12].

3.3. Execution and evolution of the CFE Pilot Program

The beginning of the CFE Pilot Program appeared to have been seamless and was not much commented by interviewees, except regarding the transition between the OIG website and *space-track.org*. While it was expected that the two websites would continue for a certain time to be operated in parallel, the sudden and unexpected degradation of the OIG website two months after the launch of *space-track.org* precipitated the timeline [US-20].[29]

During the interviews, the most commented period was Lieutenant General Shelton's time as Commander of the 14th Air Force, from May 2005 to December 2008. This is an

[29] Spillar and Pirtle, 'Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead'.

interesting time for two reasons: 1) it is the transition period between the original CFE Pilot Program and the permanent SSA Sharing Program, period during which the former was extended twice, and 2) because the amount of SSA data shared by the AFSPC at this time was reduced [US-22]. The reasons of this reduction have been highly debated during the interviews, in particular regarding the supposed personal influence of General Shelton. While some claimed that "General Shelton did not believe that it was the proper role of a military organization (…) that it was not our job to go track everybody else's satellites and it was not our job to do collision avoidance" and that he pushed for, and achieved, "probably with permission from the AFSPC Commander", a reduction of the data shared and the interruption of systematic collision risk notifications initiated under his predecessor General Hamel [US-22], some on the contrary have clearly expressed that General Shelton was from the early stage of his career supportive to more data transparency [US-29]. Most however have a more nuanced view. For them, the issue was simple, whether General Shelton was in favour of transparency or not, this did not matter as he was not, as Commander of the 14th Air Force, in a position to have the final say [US-26]. Retired general officers, directly involved in the issue at the time, provided the author with three interpretations:

1. Stuck between a conservative Air Force leadership opposing transparency and a USSTRATCOM Commander, General Cartwright, strongly pushing for transparency, General Shelton was trying to accommodate both and "was taking the heat for it" [US-25]. Therefore, although there were slowdowns of transparency, there was none "that he was responsible for" [US-25].
2. The reduction was due, not to a struggle between the USSTRATCOM and the USAF, but instead to great concerns expressed by the NRO [US-29].
3. General Shelton "followed the policy rather than orders", that is to say that "General Shelton supported the program only to the extent required by policy. He could have embraced the sharing effort and taken a more aggressive stance on sharing, but he decided to share only what was required by the letter of the policy and no more" [US-28].

A fact supporting the view of General Shelton being in favour of transparency but having limited latitude at the 14th Air Force is that, after he was promoted to the position of Commander of the AFSPC, he made an important move towards transparency by declassifying the existence of the Geosynchronous Space Situational Awareness Program (GSSAP) on 21 February 2014 [US-23].[30]

General Cartwright, on the other hand, benefits from a coherent image of the man having contributed the most to increasing SSA data transparency in the DoD, or at least to accelerating an existing trend [US-25], mostly during his time as JS/J8 Director from 2002 to 2004, as USSTRATCOM Commander from September 2004 to August 2007 and then consequently as the 8th VCJCS from August 2007 to his retirement on August 2011.

In parallel to internal DoD dynamics, the CFE Pilot Program's transition to a permanent program has gained momentum due to pressures from the commercial sector. In particular, one name came up in various interviews: Richard DalBello, then Vice President of Government Relations at Intelsat General. After being alerted of a possible collision between an Intelsat satellite and a Russian one in 2008, DalBello did not receive much support from the Air Force, which prompted him, along with other major satellite operators, to create the Space Data Association (SDA).[31] The SDA, organisation where satellites operators pool their data for enhanced safety, independently from the Air Force's system, was received quite negatively at the DoD [US-26]. Moreover in 2008, in parallel to the creation of the SDA, DalBello launched a lobbying offensive with numerous letters to the DoD, the Congress and the media, asking for the maintenance and the expansion of the CFE Pilot Program, bringing with him numerous other prominent satellite owner-operators' executives [US-16]. DalBello later developed his vision during the International Interdisciplinary Congress on Space Debris organised by McGill University in May 2009.[32] This powerful and quite successful initiative owed him to be celebrated by Space News in 2010 as on the "10 Who Made a Difference in Space".[33]

Finally, in the last year of the CFE Pilot Program, precisely on 10 February 2009, American communication satellite Iridium 33 and defunct Russian military satellite Kosmos-2251 collided. While it did not influence the decision to shift the CFE Pilot Program to a permanent SSA Sharing Program, this generated an "industry outcry to release more information" that further contributed to SSA data transparency [US-16,17].

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[30] Mike Gruss, 'Shelton Discloses Previously Classified Surveillance Satellite Effort', SpaceNews.com, 21 February 2014, https://spacenews.com/39578military-space-quarterly-shelton-discloses-previously-classified/.

[31] '10 Who Made a Difference in Space: Richard DalBello, Vice President of Government Relations, Intelsat General', SpaceNews.com, 30 August 2010, https://spacenews.com/10-who-made-difference-space-richard-dalbello-vice-president-government-relations-intelsat/.

[32] Richard DalBello, 'Commercial Management of the Space Environment' (International Interdisciplinary Congress on Space Debris, McGill University, Montréal, Canada, May 2019).

[33] '10 Who Made a Difference in Space'.

3.4. The SSA Sharing Program

Quickly after the transition to a permanent SSA Sharing Program, decision was made to transfer SSA services responsibilities from the AFSPC to the USSTRATCOM for operational reasons, the latter being a warfighting command [US-9]. The increase of transparency observed from 2010, sharper from 2016-2017, can be explained by a continuation of the degradation of the DoD's secrecy culture, accelerated by key individuals in the Armed Forces and at the OSD.

The first years of the SSA Sharing Program were marked by a continuation of transparency efforts under the leadership of VCJCS General Cartwright, who even managed to shift the opinion of numerous staffers of the JS [US-25]. Coincidentally in 2009, two young space general officers, Brigadier General Hyten and Brigadier General Jay G. Santee were appointed to senior space-related positions at the Pentagon, respectively as Director of Cyber and Space Operations, Directorate of Operations, Air Staff, and Principal Director at the OSD/SP. The two generals, having worked together in the past, allowed a very fortunate synergy between the OSD and the Air Staff [US-28].

Soon after his retirement in August 2011, General Cartwright was succeeded by this young generation of "pure space officers" like Generals Shelton, Hyten and Raymond, pursuing his fight for transparency. The expression of "pure space officers", often heard by the author during interviews in the US, is usually understood as the category of USAF officers having developed a strong expertise in – military – space operations, through aerospace-oriented training and a career mostly composed of space related assignments. Extensive considerations on "pure space officers" and their role in the advancement of space policymaking are presented in Chapter 6, section 3.2. As mentioned in the previous section, when General Shelton became Commander of the AFSPC, he made significant moves towards transparency such as the declassification of GSSAP on 21 February 2014.[34] The two most commented active generals are General Hyten, praised by almost all interviewees as one the most consistent senior officer in the recent history of the Air Force regarding data transparency, and General Raymond who, after having often changed his views of transparency along the course of his career – "where you stand depends on where you sit" – is now considered to be fully committed to the release of more data [US-11].

On the OSD side, a turning point was the appointment of Douglas Loverro as DASD for Space Policy in 2013. He was said to have been instrumental in pushing, on the one hand for

[34] Gruss, 'Shelton Discloses Previously Classified Surveillance Satellite Effort'.

more transparency and on the other hand for the transfer of SSA services to a civilian agency, which at the time was supposed to be the FAA,[35] under the leadership of then-Associate Administrator for Commercial Space Transportation George Nield [US-22].

From the end of 2016 to the signing of SPD-3, there were ongoing discussions between the DoD and the DoC, involving the NSC, on what to do with classified satellites, and that specifically "Jay Raymond, I'm told, and John Hyten, I'm told, are really positive that they want to release as much as possible, and they are pushing for that, and the NRO is pushing back saying 'no'" and that "most of the pressure to not release the information was coming from the Director of the NRO (DNRO), but its opinion began to change at the end of 2016. But its boss at the time, the Office of the Director of National Intelligence (DNI), was dead-set against it" [US-22]. A sign of the change of mindset even at the NRO and in particular of the DNRO is the announcement by the USSTRATCOM in October 2018 of the release of "more additional data about some space objects that was not previously available".[36] It concerned the orbital characteristics of around 700 satellites from the SATCAT restricted list.[37] It appeared to have mostly been driven by a personal initiative, at very high-level, with General Hyten, General Raymond and DNRO Betty Sapp starting discussions in early 2017 before reaching an agreement by the end of the same year [US-11]. Another interviewee mentioned the high probability that the discussion started after an initial push from the NSC [US-22]. The exact outcome of the decision still needs to be nuanced due to the NRO's apparent internal slowrolling of the data release.[38]

To summarise the cultural and personal evolution at the DoD and in the Congress on SSA data transparency, "in that 2016-2018 timeframe, almost everybody's opinion shifted, and it was the avalanche at the end of the snowball" that started to be rolled in 2013-2014 by both influential generals and individuals at the OSD [US-22].

3.5. Semantic shift: from space surveillance to space domain awareness

One interesting aspect of SSA is that its name changed over time. Originally, and as shown in the SSA sharing program's initial name, SSA was called *space surveillance* in the USG. And in late 2019, the AFSPC announced that it would shift from SSA to Space Domain

[35] Weeden, 'Case Study of the Interagency Process for Making Presidential Policy Decisions on Dual-Use Space Technology: The Global Positioning System and Space Traffic Management', 435.
[36] 'USSTRATCOM Expands SSA Data on Space-Track.Org'.
[37] Theresa Hitchens, 'Intel Community's Secrecy Culture Frustrates DoD Sat Safety Effort', Breaking Defense, 26 August 2019, https://breakingdefense.com/2019/08/intel-communitys-secrecy-culture-frustrates-dod-sat-safety-effort/.
[38] Hitchens.

Awareness (SDA). In a memo of 4 October 2019, Major General John Shaw, the AFSPC Deputy Commander directed "AFSPC personnel [to] adopt the concept and definition of SDA to replace SSA moving forward, use the term SDA in all future documents and infuse SDA into doctrine". The memo defined SDA as the "identification, characterization and understanding of any factor, passive or active, associated with the space domain that could affect space operations and thereby impact the security, safety, economy or environment of our nation".[39] This indicates a major shift in the US military's posture with regards to the space environment, that is not seen as benign anymore and therefore a clear desire for the US military to focus on its core purpose – protecting the US, while progressively giving away traffic responsibilities associated with SSA. According to Major General Stephen Whiting, 14th Air Force Commander, this change "highlight[s] the fact that while SSA has served us well over the decades and resulted in the best space traffic capability in the world, it continues to keep our thinking on the way things were done in the past, (…) SDA captures the ability to maintain track and custody of all threatening objects in space".[40] It also shows the desire of the USG to strengthen the thinking of space as a *domain*. To go further, the choice to establish the USSPACECOM as a geographic command indicates the US military conception of space as a geographical domain (like the maritime and air domains) rather than a functional one (like the cyber domain, having its dedicated functional command, the US Cyber Command).[41]

Some experts have however showed some doubts about the actual operational changes implied by this semantic shift, remembering absence of impact of the shift from space surveillance to SSA in the late 2000s.[42] Moreover, the SPD-3 leaving the responsibility of maintaining the authoritative catalogue to the DoD, it seems unlikely that the latter would abandon large-scale SSA in favour of SDA. The balance between a DoD focussing on warfighting and a civilian agency – supposed to be the DoC – on STM or at least civil SSA will likely be one of the major space policy challenges of the USG in the years to come.

4. Explaining decision-making about the SSA Sharing Program

This section shows the applicability of the three-model analytical framework developed by Graham Allison in *Essence of Decision* to two elements of the history of the SSA Sharing

[39] Erwin, 'Air Force: SSA Is No More; It's 'Space Domain Awareness''.
[40] Erwin, 'U.S. Space Command Eager to Hand over Space Traffic Duties to Commerce Department'.
[41] Kaitlyn Johnson, 'Bad Idea: Designating Space Command as a Geographic Command', Defense360, 13 December 2019, https://defense360.csis.org/bad-idea-designating-space-command-as-a-geographic-command/.
[42] Erwin, 'U.S. Space Command Eager to Hand over Space Traffic Duties to Commerce Department'.

Program: 1) the decision to create the program by transferring data sharing responsibilities from NASA to the DoD in the early 2000s, and 2) the progressive evolution of the program towards more transparency. In addition, brief considerations are provided on an ongoing issue in the USG, the transfer of space safety responsibilities from the DoD to the DoC's Open Architecture Data Repository (OADR).

4.1. Decision 1: from NASA to the DoD

How to explain the transfer of SSA data sharing responsibilities from NASA to the DoD in the early 2000s? Based on the historical presentation of events in sections 2 and 3, it is clear that explanations can be found in all three of Allison's models. To be precise, this section analyses the elements having led to the establishment of the CFE Pilot Program.

4.1.1. Model I: Rational Actor

There were inherent rational benefits to the transfer of sharing responsibilities from NASA to the DoD. According to most people interviewed, the initial situation was problematic at various levels. The use of NASA as intermediary, beyond being unnecessary from a practical standpoint, was generating avoidable organisational costs, risks of data security breach during the shipment of CDs – and later electronic transfers – from the DoD to NASA, and most importantly delays in data provision making the process impractical from an operational perspective. Considering that even current USSPACECOM services have practical operational limitations, it is clear – and confirmed by interviewees – that the previous system generated major delays, hence strongly hampering any concrete use of the data. On the other hand, changing the *status quo* by simply removing NASA from the loop would provide numerous benefits for the USG as a whole: reduced budgets, simplified interagency procedures, higher data security with less risk of interception and finally all indirect benefits provided by an improvement of services. These indirect benefits range from better decision-making of *commercial entities*, reducing the overall risk of incidents in outer space, and soft power diplomacy with *foreign entities* having access to higher quality space surveillance data services, all thanks to American generosity. The legislative process required to authorise the DoD to do direct data sharing being minimal, it therefore seemed logical to move forward with the reform. This rational understanding of the creation of the CFE Pilot Program was frequently raised during the interviews conducted by the author.

4.1.2. Model II: Organisational Behaviour

The second explanation level concerns organisational reasons. A recurrent feature of the DoD and the IC (in particular the NRO) is their desire to have control over the release of their data and information, whether they decide to keep them or share them. While controlling the nature and amount of data provided by the USAF to NASA, the delegation of the sharing part deeply restricted the DoD's control over the final recipients of the data. Doing the sharing by itself, although it involves assigning airmen to an unessential mission, allows to have the final say in the choice of eligible *commercial and foreign entities*. In fact, after the establishment of the SSA Sharing Program, the choice to enter into an agreement with a specific organisation was the sole responsibility of the USSTRATCOM (now of the USSPACECOM), based on a blanket Circular 175-agreement with the DoS. On the other hand, there was no reason for NASA to fight to keep a responsibility that was not institutionally its. NASA is a research and development agency and has no organisational mandate to provide safety services beyond its own and other USG agencies' assets. In fact, the Goddard Space Flight Centre which was housing the OIG website, and using resources for it, defines its missions as "build[ing] spacecraft, instruments and new technology to study Earth, the sun, our solar system and the universe",[43] not providing space safety information and services to commercial and foreign entities. Finally, as the DoD was providing most of the SSA data, there was no specific rationale for NASA to keep control on the sharing process.

4.1.3. Model III: Governmental Politics

The final level of explanation of the Deputy Secretary of Defense's decision to instruct the USAF to develop a legislative proposal for the creation of the CFE Pilot Program concerns the personal involvement of influential individuals, both inside and outside the DoD. In fact, the Deputy Secretary of Defense was recommended by both OSD and JS services to take over NASA's sharing responsibility, resulting from two roughly parallel and independent processes, as shown on figure 5-2 below. It perfectly aligns with the comment made by retired senior DoD official met by the author about DoD internal decision-making: "decisions in the DoD are usually never made by one office or one person (…) usually they are consensus activities and normally it's because people in several different areas have arrived to the same conclusion independently" [US-22].

[43] Rob Garner, 'About NASA's Goddard Space Flight Center', NASA, 18 February 2015, http://www.nasa.gov/centers/goddard/about/index.html.

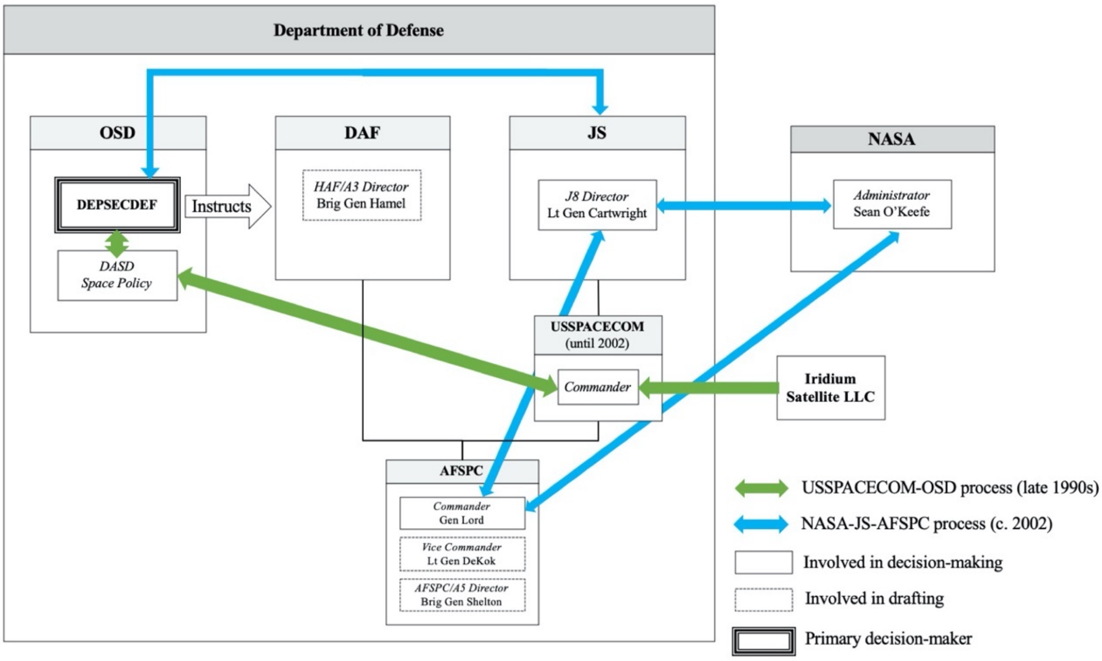

Figure 5-2. Individuals involved in the Deputy Secretary of Defense's decision to establish the CFE Pilot Program[44]

The first process (green arrows), already largely evoked in 3.2, concerns the call for help made by Iridium in the late 1990s to the USSPACECOM and its Commander's subsequent request for policy guidance to the DASD for Space Policy. The latter authorised the USSPACECOM to provide the requested support to Iridium and consulted the Deputy Secretary of Defense on the best way to inscribe such authorisation into stone, leading to the memo of 10 January 2000 instructing the USAF to look at the best legal approach. The second process (blue arrows), happening around 2002 and just briefly touched upon in 3.2, involves discussions initiated between NASA, in the person of Administrator Sean O'Keefe (2001-2004), and the JS, in the person of J8 Director Lieutenant General Cartwright (2002-2004). Via the JS, AFSPC Commander Lance Lord was also put in the loop. The discussions apparently started based on NASA's desire to get rid from a costly role that did not correspond to its core mission. The fact that such financially motivated change happened under O'Keefe's administration is certainly not a surprise for attentive followers of US politics. In his first prominent governmental position as DoD Comptroller (1989-1992), O'Keefe was credited for slashing without second thought programs that he believed unjustifiably costly and for a tough management of the Gulf War spending, reducing massively the overall cost of the war by requesting allies to contribute

[44] Abbreviations: DEPSECDEF = Deputy Secretary of Defense; DAF = Department of the Air Force.

financially.[45] The New York Times even sarcastically rewarded his exploits with the nickname of "The Grim Reaper".[46] On the other side, General Cartwright was initiating his long-term vision consisting in bringing space surveillance services in the DoD, giving them maturity thanks to the DoD's extensive technical and budgetary capabilities before handing them over to a civilian agency.

4.2. Decision 2: progressive drive towards transparency

Using Allison's models to explain the progressive drive of the DoD towards transparency on SSA data is less straightforward than for decision 1. In fact, the issue at stake here is not strictly speaking a punctual decision but rather a diffuse process. Nevertheless, this process still contains elements of rationality, organisational behaviour and governmental politics. Before starting to apply the models, it is important to specify that the decision to increase transparency, for example through the declassification of American military objects, is an operational one and relies *in fine* on the decision of senior commanders (e.g. USSTRATCOM, USSPACECOM) or directors (e.g. DNRO, DNI) with of course coordination with overarching authorities such as the NSC and the National Space Council.

4.2.1. Model I: Rational Actor

The progressive increase in the transparency of military space operations has been justified by many interviewees as the result of a rational analysis of the situation. First, the improvement of space surveillance technologies makes it increasingly difficult to believe in the secrecy of space operations. When amateur astronomers are demonstrating their ability to identify and track NRO satellites, it is very likely that even the US's most modest adversaries can have at least similar performances. Secondly, the excessive level of classification, evoked in the declaration of General Hyten quoted in the opening of this chapter, is hampering the widespread use of specific space technologies inside the DoD. In fact, there is sometime no clear reason why the existence of some satellite is classified while others with similar characteristics have their designator or even their orbital elements published on *spacetrack.org*. Many of these incongruities boil down to past punctual decisions made by a USSTRATCOM Commander or a DNRO for a specific purpose. Therefore, it was recognised that an effort

[45] 'The Gulf War: Off the Hook?', *Time*, 27 May 1991, http://content.time.com/time/magazine/article/0,9171,973049,00.html.
[46] Eric Schmitt, 'Washington at Work; Grim Reaper for Military Budgets', *The New York Times*, 7 May 1992, sec. Business, https://www.nytimes.com/1992/05/07/business/washington-at-work-grim-reaper-for-military-budgets.html.

should be made to rationalise classification practices, in order to stop wasting time and resources to hide satellites which public release would not impact national security. Finally, a rational argument sometimes mentioned was the need to publicly display the extensive space assets of the US military to pursue a deterrence strategy. This very debated point is further commented in Chapter 6.

4.2.2. Model II: Organisational Behaviour

The interviews carried out by the author highlighted the fact that the decision to increase (or decrease) transparency is primarily an operational decision, therefore mostly driven by the two main operational structures for space activities in the DoD, the USSTRATCOM and the NRO, with the addition of the USAF, responsible to 'organise, train and equip' most of the USSTRATCOM's space forces through the AFSPC. Figure 5-3 shows the traditional organisational postures of these three organisations regarding the transparency of space operations, representative of the period during when General Shelton was Commander of the 14th Air Force (2005-2008), largely commented in 3.3.

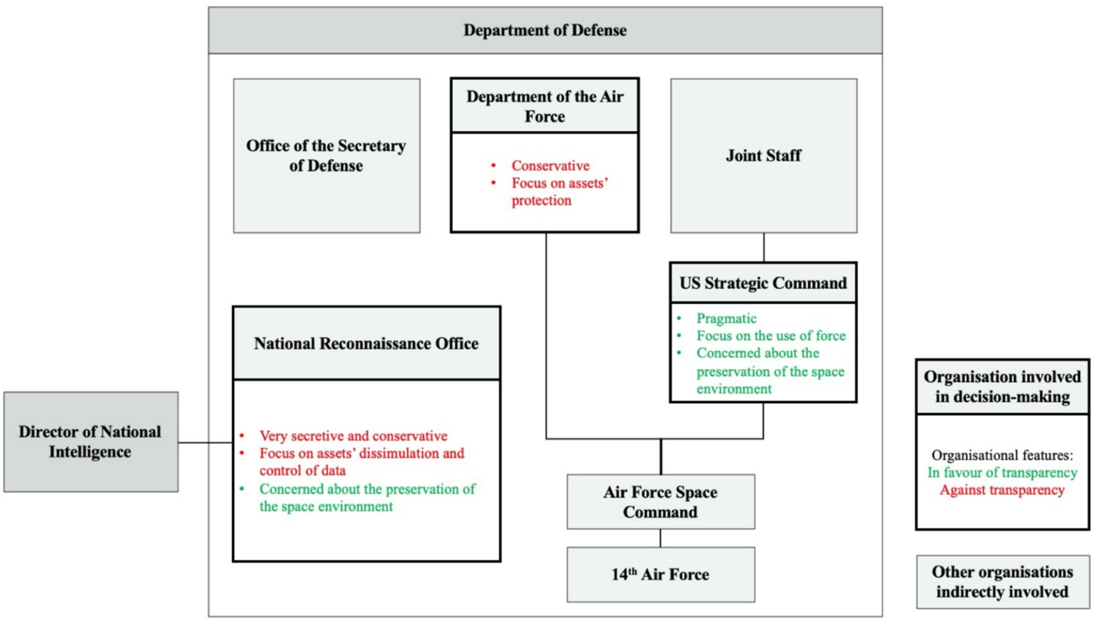

Figure 5-3. Traditional organisation features of key DoD decision-making structure regarding the transparency of space operations

As a purely operational structure, the USSTRATCOM has a pragmatic approach towards transparency, being primarily concerned with operational limitations induced by excessive classification and with the preservation of the outer space operational environment. On the other hand, the USAF, as the main service in charge of space activities tends to have a more cautious approach towards transparency in order to protect the extensive space infrastructure it possesses. The NRO having the two facets, that is to say the organise-train-equip responsibility and the operational focus, has a more complex position on the issue of transparency. On the one hand, its co-affiliation to the IC gives it a propensity towards absolute secrecy, reinforced by its expertise on dissimulation in space. Overall, it seems that part of the NRO still believes in a certain level of secrecy in space. On the other hand, the NRO is also much aware of the importance of transparency for the conduct of safe operations in outer space and therefore the preservation of the space environment. This depiction, corresponding to the years 2005-2008, is still relatively true even though the balance of forces has progressively shifted towards more transparency. In fact, as explained above, the announcement of the USSTRATCOM in October 2018 to release more data on *spacetrack.org*,[47] one among many others, was taken in coordination with the NRO, therefore displaying an evolution in its traditionally secretive posture. Finally, the role of the OSD was not much commented from an organisational perspective but rather on the personal involvement of senior officials.

4.2.3. Model III: Governmental Politics

A 'governmental politics' evaluation of a roughly 10-15-year period would be rather confusing as most commanders, directors and other senior bureaucrats tend to change their position frequently. Therefore, instead of mapping the interactions having led to the DoD's drive towards transparency, this section highlights the importance of interpersonal dealings with a few examples. The first example concerns the USSTRATCOM data release announcement of October 2018. According to information collected by the author, the first discussions were personally initiated by General Hyten, General Raymond and DNRO Sapp. The declassification decision was therefore the product of the personal initiative of two generals believing in transparency rather than the outcome of a rational institutional process. The same can be said on the role of Douglas Loverro as DASD for Space Policy, who put his weight and the one of his office in pushing for more transparency. As explained in the previous section, the OSD's influence in transparency was not seen as significant from an organisational perspective. What however was noticeable was the personal motivation of DASD Loverro to devote himself to the issue. Beyond the actual impact of his involvement, what is important here is to highlight the necessity of personal pushes in initiating, or at least reinforcing, large trends in the DoD.

[47] 'USSTRATCOM Expands SSA Data on Space-Track.Org'.

Finally, the greatest example is General Cartwright's career-long fight for transparency, up to his position of VCJCS. It is only thanks to his personal motivation that he was able to push for the emergence of a new generation of environmentally concerned senior space officers such as General Hyten, now proudly taking over the difficult task.

4.3. Transfer of space safety services responsibilities to the Department of Commerce

The SPD-3 of June 2018 nominated the DoC as national lead for STM, and more specifically instructed it to take over SSA data sharing services from the DoD:

> "To facilitate this enhanced data sharing, and in recognition of the need for DoD to focus on maintaining access to and freedom of action in space, a civil agency should, consistent with applicable law, be responsible for the publicly releasable portion of the DoD catalog and for administering an open architecture data repository. The Department of Commerce should be that civil agency".[48]

In practice, while the DoD (through the USSTRATCOM until late 2019, now through the USSPACECOM) will retain the responsibility to maintain the authoritative catalogue of space objects (SATCAT), other non-military tasks, such as providing conjunction risk assessment notifications for commercial and foreign entities, will be carried out by the DoC from 2024.[49]

Although it does not provide a fully-fledged analysis of the transfer as it did not happen yet and that the details of its implementation are still blurry, appropriations having yet to be approved by the Congress to the DoC's Office of Space Commerce (DoC/OSC), this section gives a few considerations on DoD decision-makers' reactions to this expected shift. What is important to understand it that this decision was not based on the pure top-down desire of the President, the Vice-President and members of the NSpC. It was agreed by the DoD which wanted to get rid of its role to deal with commercial and foreign partners [US-3]. Already in 2015, Lieutenant General Kowalski, then-USSTRATCOM Deputy Commander, questioned the role of the military in providing non security-related SSA services: "We need to revisit how we've allocated military personnel to what may not be really a military mission".[50] In a congressional hearing held a few days after the signature of SPD-3 by President Trump, General

[48] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[49] Executive Office of the President.
[50] Sydney J Jr. Freedberg, 'STRATCOM Must Be Warfighters, Not FAA In Space: Lt. Gen. Kowalski', Breaking Defense, 16 June 2015, https://breakingdefense.com/2015/06/stratcom-must-be-warfighters-not-faa-in-space-lt-gen-kowalski/. Interestingly, the logical view for Lt. Gen. Kowalski was to mention an FAA-like organisation. The rational changed afterwards when it was decided that the DoC was to take over STM/SSA responsibilities.

Hyten, who was then still USSTRATCOM Commander, clarified his view on the transfer of some SSA/STM responsibilities from the DoD to the DoC:

> "We had to take about a hundred airmen, a hundred military people, off of other missions and put them on that in order to do that mission. (…) When we move that now to the Department of Commerce, (…) we will be able to free up those airmen and to focus on warfighting missions that we need to worry about".[51]

In fact, the attribution of space safety services to a civilian agency is the completion of the initial vision of General Cartwright consisting in bringing space surveillance services in the DoD, giving them maturity thanks to the DoD's extensive technical and budgetary capabilities before handing them over to a civilian agency, at the time thought to be the FAA. In fact, after publicly declaring at the 2013 AMOS conference that he would like to see other actors (including commercial) entering the arena of space safety services, DASD for Space Policy Doug Loverro is said to have initiated in early 2014 working relations with FAA Associate Administrator George Nield, head of the FAA-AST, to study how his office could take over part of the DoD's mission [US-22].

The officialization of the transfer by the SPD-3 in June 2018 has actually been received very positively at the DoD, with senior leaders publicly expressing their support, if not their impatience for it to happen. Major General Whiting, Commander of both the14th Air Force and the Combined Force Space Component Command at USSPACECOM even said on 15 November 2019: "We're eager for that to happen. (…) Resourcing Commerce to take on their new work will enable the Air Force and U.S. Space Command to focus on our military unique mission".[52] The DoD has also been supporting to DoC personnel working on the transition by welcoming Mark Daley of the OSC to work with the 18th Space Control Squadron at the Vandenberg Air Force Base.[53]

Further organisational and bureaucratic considerations on the DoD's support to the transfer of space safety responsibilities to the DoC are presented in the following chapters.

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[51] Wilbur Ross, Jim Bridenstine, and John E Hyten, 'Space Situational Awareness: Whole of Government Perspectives on Roles and Responsibilities (Video of Hearing)', § House Committee on Science, Space and Technology (2018), https://science.house.gov/hearings/space-situational-awareness-whole-of-government-perspectives-on-roles-and-responsibilities.
[52] Erwin, 'U.S. Space Command Eager to Hand over Space Traffic Duties to Commerce Department'.
[53] Erwin.

5. Conclusion: the DoD as reluctant space safety services provider

Apart from providing the most comprehensive history of the DoD SSA Sharing Program to date, unveiling an important amount of information previously known only to its most direct stakeholders, this chapter paints the portrait of the DoD as a reluctant space safety services provider. In fact, had NASA been providing excellent services, it is unlikely that the DoD would have ended up requesting responsibilities over a mission that it is clearly not falling within its 'warfighting' mandate. Had Iridium and numerous other commercial owner-operators received appropriate space safety services from a dedicated civilian agency, they would never have had to resort to imploring the USSPACECOM for help. In short, if anyone could have done the job properly, no one would have turned to the DoD and DoD decision-makers would not have considered their duty to engage in space safety, for the short-term stability and the long-term sustainability of the space domain – partially motivated by self-interest.

However, when in the mid-2010s the idea of transferring space safety responsibilities to a civilian agency re-appeared – after General Cartwright's initial vision seemingly fell into oblivion, senior leaders at the DoD expressed a strong support, primarily driven by their desire to focus on warfighting in a time of heightened tensions with China and Russia, therefore confirming the tactical nature of the military's incursion in space safety. This therefore allows a clear validation of Hypothesis 1 (precisely of H1.1 and H1.2.2., reminded below) in the case of the provision of space safety services.

Hypothesis 1: the military as reluctant leader in space safety and sustainability
[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).
[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

The second main takeaway of this chapter concerns Hitchens's "safety versus secrecy security dilemma". In fact, leaders in charge of the CFE Pilot Program and later of the SSA Sharing Program were faced with an essential question: how transparent should the US military be on its space assets? This very complex question, still not fully sorted, was the occasion to see all facets of the DoD at play: its ability to have an overall institutional rationality, the conflicts or alignments among its innumerable agencies, offices and commands, in particular the USSTRATCOM, the USAF and the NRO, and most importantly, the personal influence of its senior military and civilian leaders.

In particular, the role played by what was labelled "pure space officers" such as Generals Hyten and Shelton was critical in moving forward in the safety-secrecy debate. According to numerous interviewees, it is mostly thanks to these officers, having developed an acute understanding of the challenges and implications of space safety and sustainability, that the DoD was able to go beyond its natural reflexes. The declaration of General Hyten quoted at the beginning of this chapter ("In many cases in the department, we're just so overclassified it's ridiculous, just unbelievably ridiculous") is the culmination of the great influence played by these "pure space officers". In fact, both examples used here, Generals Hyten and Shelton, demonstrated significant moves towards transparency for the benefit of safety, such as, respectively, the removal of hundreds of objects from the restricted list of the SATCAT and the declassification of the very sensitive GSSAP program. Hypothesis 2, reminded below, is therefore validated by the case of the SSA Sharing Program.

Hypothesis 2: the need for specialised space officers
The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

Going further, the establishment in late 2019 of the USSPACECOM and of the US Space Force (USSF) – by rebranding the AFSPC – will surely contribute to complexifying internal DoD dynamics and reinforcing the role played by "pure space officers" in the department's drive towards more transparency. The next chapter provides further analysis on this point and completes the validation of Hypothesis 2.

Chapter 6. The DoD's views on STM and participation in domestic decision-making processes

We want this to go to a civilian agency. We don't view ourselves as a police force

Major General Stephen Whiting, 14th Air Force Commander (2019)[1]

With extensive capabilities in terms of both technical equipment and qualified personnel, the US Department of Defense (DoD) is one of the leading national agencies for the definition of the US Government's (USG) posture on space traffic management (STM). This chapter investigates the role of the DoD in shaping the USG position on STM and related issues such as space situational awareness (SSA) and orbital debris mitigation, and to a lesser extent its efforts in the promotion of international norms of behaviour for space safety and sustainability.

The first section introduces the DoD as the primary USG space law and policy think-tank. In fact, the DoD has an impressive array of space law and policy experts spread over numerous bureaus, offices and commands, each having their own strengths and perspectives. Relying on them, the DoD has a strong influence over interagency processes within the Executive Branch as well as over congressional debates. The perceptions of USG agencies interacting with the DoD on a daily basis are also presented in section 1.

The second section aims to conceptualise the position of the DoD as a reluctant participant in governmental efforts in space safety and sustainability, owing to the fact that STM is not a military topic, that would therefore be better served by a civilian lead. A few considerations are also added on the frequently raised topic of 'police of outer space' to finally close a pointless debate.

The third section illustrates the current internal debates at the DoD with regards to STM. After clarifying the reasons for the absence of a unified departmental position, it investigates the influence of the group of experts that has been labelled by numerous interviewees as "pure

[1] Erwin.

space officers". It then delves into what Theresa Hitchens called the "safety versus secrecy dilemma" facing DoD decision-makers.[2]

The fourth section identifies a silver lining in the DoD experts' consensus around the benefits of developing and promoting norms of behaviour in outer space, originating from the traditional attachment of USAF personnel to clear operational guidelines. It then illustrates the role played by the DoD in the promotion of norms of behaviour in outer space through the examples of the 2019 revision of the USG Orbital Debris Mitigation Standard Practices (ODMSP) and of the UN Committee on Peaceful Uses of Outer Space's (UNCOPUOS) Long-Term Sustainability of Outer Space (LTS) guidelines negotiations.

Finally, the last section concludes the US case study by confronting its findings with the initial hypotheses of this dissertation.

1. The DoD's involvement and influence in interagency space policymaking processes

Employing more than 2.9 million people in December 2019,[3] including 23,000 at the Pentagon only, the DoD has extensive capabilities in most fields and is in particular one of the world's leading organisations for space law and policy formulation. In fact, be it at the Pentagon – at the Office of the Secretary of Defense (OSD), the Joint Staff (JS) or services staff – or at the headquarters of major unified commands, the DoD counts in its ranks hundreds of space law and policy experts, playing an important role in the definition of domestic and international norms.

1.1. Internal space law and policy actors at the DoD

Distributed in numerous divisions both at the Pentagon and across the United States, the DoD houses numerous space law and policy experts that are listed below. While the following lists contains the most important internal stakeholders, it does not claim to be exhaustive.

First of all, it is important to differentiate two main poles: operational and non-operational. The latter would include organisations like the OSD and the services Staffs while

[2] Hitchens, 'Space Traffic Management: U.S. Military Considerations for the Future'.
[3] It includes around 1.4 million active duty, 0.80 million national guard/reserve and 0.76 million civilian personnel, both in the US and overseas. Data from 'Number of Military and DoD Appropriated Fund (APF) Civilian Personnel Permanently Assigned - As of 31 December 2019' (Seaside, California: Defense Manpower Data Center, US Department of Defense, 14 February 2020), https://www.dmdc.osd.mil/appj/dwp/rest/download?fileName=DMDC_Website_Location_Report_1912.xlsx&groupName=milRegionCountry.

the former includes by definition operationally oriented structures like the US Strategic Command (USSTRATCOM), the newly re-established US Space Command (USSPACECOM) [4] or the National Reconnaissance Office (NRO). Another level of differentiation concerns the legal or policy inclination of different offices.

Regarding legal affairs, the final authoritative voice at the DoD is the General Counsel at the OSD (OSD/GC) with extensive expertise in international law and law of armed conflicts, including space law [US-1]. The General Counsel (SAF/GC) of the Department of the Air Force (DAF) and his office are the authoritative voice on law and *a fortiori* space law matters at the DAF [US-1], currently overseeing both the US Air Force (USAF) and the US Space Force (USSF). Regarding space law matters, these two offices are working closely with the operational community and its numerous in-house lawyers, in particular the USSTRATCOM, the USSPACECOM and the Air Force Space Command (AFSPC) [US-1], official rebranded as USSF on 20 December 2019 in the National Defense Authorisation Act (NDAA) for Fiscal Year 2020 (FY20).[5] A compelling proof of the quality of DoD space lawyers is their frequent participation in leading international academic discussions on the use of force in space, such as the MILAMOS project and the Woomera Manual working group.[6] While they officially join such projects in their personal capacity, it is common for the DoD to follow their work, and either "reference their conclusions" if appropriate or "speak them out" if inappropriate [US-1].

The policy pendant of the OSD/GC is the Office of the Deputy Assistant Secretary of Defense (DASD) for Space Policy (OSD/SP),[7] itself under the supervision of the Under Secretary of Defense for Policy (OUSD(P)). The OSD/SP is the authoritative DoD voice on space policy matters and is often looked, along with NASA, as a pool of experts by the Department of State (DoS) for international space policy discussions [US-1]. The participation of OSD/SP staffs in the UN Long Term Sustainability (LTS) of outer space discussion,

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[4] Erwin, 'Trump Formally Reestablishes U.S. Space Command at White House Ceremony'.
[5] Section 952(a) of 'National Defense Authorization Act for Fiscal Year 2020', Pub. L. No. 116–92 (2019), https://www.congress.gov/bill/116th-congress/senate-bill/1790?q=%7B%22search%22%3A%5B%22ndaa+2020%22%5D%7D&s=1&r=2.
[6] The Manual on International Law Applicable to Military Uses of Outer Space (MILAMOS) project was initiated in May 2016 by scholars at McGill University to "develop a widely accepted manual clarifying the fundamental rules applicable to the military use of outer space in peacetime". The Woomera Manual is inter-university project "to develop a Manual that objectively articulates and clarifies existing international law applicable to military space operations". Further information in 'Manual on International Law Applicable to Military Uses of Outer Space', McGill University, accessed 23 March 2020, https://www.mcgill.ca/milamos/; 'The Woomera Manual', The University of Adelaide, accessed 23 March 2020, https://law.adelaide.edu.au/woomera/.
[7] The FY20 NDAA created the new position of Assistant Secretary of Defense for Space Policy and tasked the DoD to develop recommendations towards its actual implementation. More details in Section 955 of National Defense Authorization Act for Fiscal Year 2020.

mentioned in Chapter 5 and in the next section, is a significant indicator of the OSD/SP's strong expertise in space policy and undisputable role in USG internal space policy discussions. Another important actor of space policy at the Air Staff is the Assistant Secretary of the Air Force for Space Acquisition and Integration (SAF/SP), called until 20 December 2019 the Principal Assistant to the Secretary of the Air Force for Space.[8]

Apart from space law and policy-designated structures in the DoD, there are other influential offices to take into consideration. In particular, each of the six Under Secretaries of Defense (USD) has its own equities and extensive capabilities within "its own unique fiefdom" of thousands of staff [US-15]. This includes the Under Secretaries for Acquisition and Sustainment (A&S), for Intelligence (I), for Personnel and Readiness (P&R), for Policy (P) for Research and Engineering (R&E) and the Comptroller/Chief Financial Officer ((C)/CFO). In addition to the USDs, other senior DoD officials have an indirect influence on space policy or operational decisions such as the Inspector General (DoDIG). These various officials and their offices, having very different priorities to defend, "don't necessarily come together ever", which is also true within the USAF, for example between the Air Staff and the former AFSPC [US-15].

In terms of internal influence, while the final say for legal affairs is the OSD/GC and for space policy the OSD/SP, the two strongest and most respected operational voices are the NRO and the USSTRATCOM – USSPACECOM after the space responsibilities takeover in late 2019, as they are the two organisations in closest contact with the operational complexities of the outer space environment [US-17]. In fact, the perceived equities of an organisation in a specific issue usually determine its level of influence in internal DoD or interagency discussions [US-13].

Taking into consideration the huge number of direct and indirect stakeholders of space law and policy discussions, understanding the DoD's internal decision-making processes is probably even more difficult than those of the USG as a whole. In fact, as expressed by a retired senior DoD official met by the author:

> "decisions in the DoD are usually never made by one office or one person (…) usually they are consensus activities and normally it's because people in several different areas have arrived to the same conclusion independently" [US-22].

Finally, specific decisions can be quickly upgraded to higher decision-making circles such as the White House's National Security Council (NSC) and National Space Council

[8] National Defense Authorization Act for Fiscal Year 2020, sec. 956(a).

(NSpC). In particular, a complicating factor in the DoD's space law and policy discussions is the dual nature of the NRO, both a DoD agency and a member of the Intelligence Community (IC), therefore responding to both the Director of National Intelligence (DNI) and the Secretary of Defense. Therefore, the extreme sensitivity of and subsequent secrecy of NRO activities can led to discussions being coordinated directly by the NSC and the NSpC.

1.2. Format of the DoD's involvement in interagency discussions

In order to show the typical format of the DoD's involvement in interagency discussions for SSA/STM, this section uses the example of the USG LTS working group, already mentioned in Chapter 3. The composition of the working group is shown on figure 6-1.

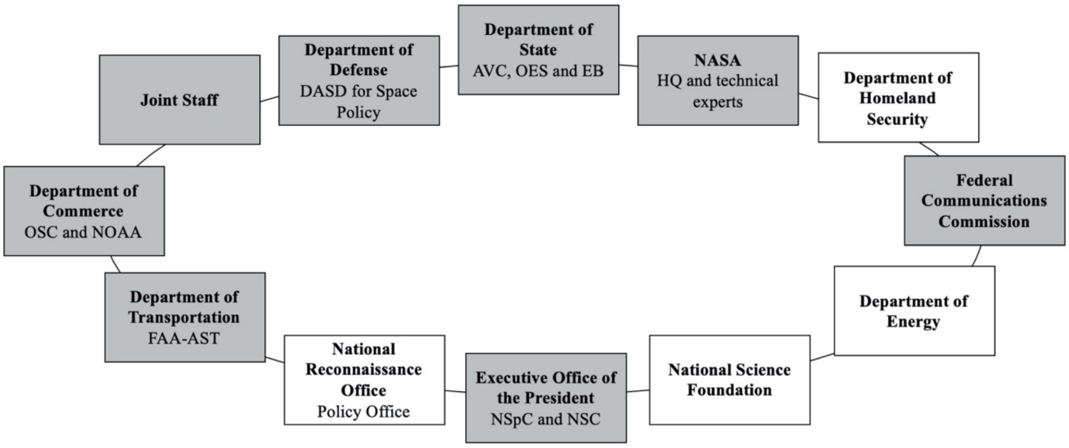

Figure 6-1. Participants in the USG interagency working group on space sustainability[9]

Figure 6-1 clearly shows that the DoD is the most represented organisation in SSA/STM interagency discussions both directly and indirectly. In fact, one could notice the presence in the working group of the three most influential DoD components on space policy matters. First, the OSD/SP, headed by the DASD for Space Policy and official authoritative internal voice on space policy. Then, the two leading space-related operational structures at the DoD: the JS, being the official supervising authority of both the USSTRATCOM and the USSPACECOM,

[9] According to Interviewee US-21 (Department of State). In grey are the organisations whose staffs were interviewed for the study. Abbreviations: AVC: Bureau of Arms Control, Verification and Compliance; EB: Bureau of Economic and Business Affairs; OES: Bureau of Oceans and International Environmental and Scientific Affairs; NSpC: National Space Council; NSC: National Security Council; FAA-AST: Office of Space Transportation, Federal Aviation Administration; NOAA: National Oceanic and Atmospheric Administration; OSC: Office of Space Commerce (technically part of NOAA); DASD: Deputy Assistant Secretary of Defense.

and the NRO, represented by its Policy Office.[10] The DoD's indirect influence can be found in the participation of the NSpC and the NSC, whose security space officials are usually active duty officers. This working group is meeting around three or four times a year [US-5].

1.3. Interactions with the Congress[11]

The previous section showed an example of the DoD's involvement in interagency space policy discussions within the Executive Branch, but what about its interactions with Congress? In fact, compared to most countries, the US Congress is extremely powerful and has full authority for the authorisation and appropriation of activities conducted by agencies of the Executive Branch. In the Senate, mainly two committees are dealing with space affairs: the Senate Committee on Commerce, Science, and Transportation (including the Commerce Subcommittee on Aviation and Space) and the Senate Committee on Armed Services (SASC). In the House of Representatives, there are three space-related committees: the House Committee on Science, Space, and Technology (including the Science Subcommittee on Space and Aeronautics), the House Committee on Transportation and Infrastructure and the House Committee on Armed Services (HASC). In addition to those and in particular for NRO-related matters, the Senate has the Select Committee on Intelligence and the House the Permanent Select Committee on Intelligence.

For what concerns space sustainability, SSA or STM discussions at the Senate, the Commerce Committee works in close coordination with the SASC. The input of the DoD, critical to understand the full picture of SSA/STM issues, is provided through the SASC only. As explained by a senior staffer at the Commerce Committee:

> "The process by which DoD views are made known to us or we receive those, informally or formally, is through the Senate Armed Services Committee, primarily. It isn't like the DoD requests to have a meeting with us. Generally speaking, if there's a piece of legislation or something that would touch on SSA/STM (…), they will work through the Armed Services Committee because we will be working with Armed Services on that provision, and then Armed Services sends it over to DoD, to both the combatant commander and the particular service: 'what are your views on this?' Those views are given back to Armed Services and they come back and tell us how much they hate it or love it" [US-7]

[10] The author's direct requests for interview with senior NRO officials were not answered.

[11] The processes described in this section are based on interviews conducted by the author with staffers of the Senate Committee on Commerce, Science, and Transportation and of the Office of Senator Ted Cruz (R-TX), Chairman of the Commerce Subcommittee on Aviation and Space. They are similar to existing processes at the House of Representatives.

These views are corroborated by US-8, working for Senator Ted Cruz, Chairman of the Commerce Subcommittee on Aviation and Space. Even outside of his committee work, the normal process for a congressman to have official interaction with the DoD is through the Armed Services Committee.

The process is the same when it involves the IC. The NRO, both very knowledgeable on and very concerned by SSA/STM policy, is intensively participating in congressional debates through both Intelligence Select Committees, that then relay IC and NRO positions to their "sister committees" [US-7].

Although it failed to get approval by the House for purely political reasons not developed here, the Space Frontier Act of 2018 is considered a "good example of a back and forth between the executive branch and the legislative branch, ultimately coming to an outcome that all sides could live with", having shown healthy "interactions between the Department of Defense, Intelligence Community, our committee [*note: Senate Commerce Committee*], the Armed Services Committee, the Senate Select Committee on Intelligence, over concerns on remote sensing and allowing commercial companies to have better resolution, concerns about what they might be taking pictures of, concerns about their operations, their information assurance, who has access to their catalogues, things like that" [US-7].

Finally, an important factor of the DoD's influence in congressional discussions is the personal role played by specific very senior military leaders, whose undeniable expertise and integrity is recognized in Armed Services Committees and beyond [US-7,8]: "I cannot overstress the importance of specific individuals within the Department of Defense, namely General Hyten and General Raymond" [US-7].

1.4. Perceptions of DoD' role and influence from other governmental entities

There is a consensus among all space-related USG agencies that the DoD is one of the most – if not the most – significant players in interagency discussions on SSA/STM policy. The reasons for this great influence are explained below, based on the perceptions of the DoD's counterparts in interagency processes.

The first explanation of the DoD's prominent influence on domestic SSA/STM policymaking is the acknowledgment that the **DoD is the agency with the most equities in space**. According the Union of Concerned Scientists (UCS), as of 30 September 2019, the US government was operating 189 military satellites, which corresponds to 19% of all American satellites in orbit (commercial included) and 8.5% of all satellites in Earth orbit.[12] Therefore, one could consider the US military as the second largest satellite operator in the world after SpaceX. As already mentioned above, no agency has an absolute weight in interagency discussions: each agency is representing its interests and its weight naturally depends on the discussion topic. An NSpC interviewee explained:

> "There's a recognition of how much equity… Voting is never about just one person one vote it's about who feels the most intensely and do others correctly assess how intensely they feel about that, (…) every agency is equal before the President but some agencies are more equal than others, depending on if their equities and interests are impacted, not just because they have a big budget and so forth but because they represent a national interest that has to be considered" [US-13]

Secondly, what many call the "enlightened safe interest" of the DoD [US-5,12,13 among others] also reveals **the recognition of the DoD's strong commitment to ensuring the long-term sustainability of space**. In particular, the DoD is perceived as very concerned by the issue of space debris, allowing it to have a strong influence in the recently concluded discussions on the revision of the ODMSP [US-2]. The important role played by OSD/SP officials in the LTS negotiations at the UNCOPUOS in Vienna are the demonstration of the DoD's willingness to promote the adoption of global norms of behaviour and good practices for the preservation of the outer space environment. Moreover, the important progress made by the DoD regarding the compliance of its national security launches with the USG Orbital Debris Mitigation Standard Practices (ODMSP), known fact in most USG agencies, further contributes to supporting the DoD's image of a responsible actor in outer space (cf. Chapter 4 for more details).

Thirdly, another important reason for DoD's influence on interagency discussions is **the recognition of the DoD's unrivalled technical capabilities** both in terms of personnel and infrastructure, acknowledged by all interviewees without exception. First of all, in terms of space development history, the DoD was the first space organisation in the US, then *a fortiori* for space surveillance: the DoD has an "extraordinary amount of influence because they have been doing this for six decades; as the only one who has done this [*extensive space surveillance*], obviously they have a lot to say about this" [US-3]. An NSpC interviewee sees its unrivalled technical capabilities as the main driver of DoD's influence, although acknowledging that it would not last forever: "DoD sways the opinion (…) Why? They have

[12] The UCS operates the largest satellite database based on public sources, available at: 'Union of Concerned Scientists Satellite Database'. The number of military satellites indicated here is therefore a minimum value.

the tools; they have the manpower. Nobody else has the ability to do the functions currently, but that world is changing" [US-14].

Fourthly, as already mentioned in the previous section, the DoD benefits from the **great personal influence of specific senior military leaders**. Often mentioned, General Jay Raymond, currently both Chief of Space Operations (CSO: head of the USSF) and USSPACECOM Commander, but most importantly General John Hyten, Vice-Chairman of the Joint Chiefs of Staff (VCJCS) and previously USSTRATCOM Commander, are highly trusted as reliable and upright space experts. A strong position taken by any of these two generals would certainly have tremendous influence over senatorial discussions in particular [US-7].

Fifthly, it is important to realise that in budgetary terms, the DoD's space activities are considered by experts to be the largest space budget of any USG agency, even before NASA.[13] It therefore implies that the DoD is the main source of income for a large number of extremely **powerful space and defence contractors**, which in turn can put their extensive lobby teams at the service of the DoD's strategic directions [US-2].

1.5. A "national security trump card"?

Taking into account the five main drivers presented in section 1.4, it is undeniable that the DoD is a major player in SSA/STM policy, but how does this influence concretely materialise in interagency processes? Beyond its important prescriptive influence in domestic debates, developed above, the greatest strength of the DoD relies on its proscriptive influence:

> "The DoD plays a major role in policy formulation because in my view, it has this national security trump card. It'd be very difficult for the Administration or Congress to really go against the Department of Defense and try and make them commercialize or civilianize a function that they are not ready to give up control on" [US-7]

Another congressional interviewee used almost the same terms: "when it comes to space, I don't want to say the Department of Defense holds a veto, but they damn near hold a veto" [US-8]. He adds that because of classification issues, "if the Department comes back and says 'this is going to put us an operational jeopardy', we should have to take their word for it" [US-8]. This ability of the DoD to hide behind classification, even when facing congressmen, is related to the fact that for particular issues involving the IC (e.g. NRO) even congressmen do not necessarily have access to some classified information. Although the National Security Act

[13] The author uses the term "considered" as published NRO budgets are only estimations, the actual figure being classified.

of 1947 requires the Administration to inform the Congress of intelligence activities, it also contains a disposition allowing the President to limit reporting to only a few congressmen under "extraordinary circumstances affecting vital interests" of the country. These congressmen, nicknamed the 'Gang of Eight' are the Senate and House leaders of both parties and the chair and ranking members of both House and Senate Select Intelligence Committees.[14]

1.6. A sustainable influence?

Will this influence last? While the DoD will likely retain extensive capabilities, the attribution by Space Policy Directive 3 (SPD-3) of the official lead on SSA/STM policymaking to the Department of Commerce (DoC) may change the current imbalance of USG interagency dynamics on this topic. An interviewee, mentioning the delays in congressional authorisation and appropriation slowing down the DoC's ability to take over the mission mandated in SPD-3, considers that current DoD leadership on STM policymaking is "only because Congress has not acted. Once Congress acts and authorises a civilian agency for on-orbit authority, I think that all changes, I think that the Department of Defense is no longer the primary player" [US-20]. The same view is shared by US-14, who considers that the main question to be answered by the USG and Congress is:

> "Who will be the proponents (*sic*) of capabilities and sway in the future and I offer you it's not going to be DoD, it's probably going to reside within Commerce for identification of objects, it will reside in Transportation for the rules of the road" [US-14].

2. The DoD's reluctance to involve in STM

Although its unrivalled capabilities and knowledge gives it a great natural influence, the US military seems to be reluctant to assume the domestic leadership on issues related to space safety and sustainability. In fact, STM is not a military topic and current times prompt the DoD to focus on its warfighting missions, favouring a support position to a civilian lead.

2.1. STM is not a military topic: need to focus on warfighting

As demonstrated by the annual independent reports of the Secure World Foundation (SWF) and the Centre for Strategic and International Studies (CSIS), the worldwide

[14] Eric Rosenbach and Aki J Peritz, 'Informing Congress of Intelligence Activities', in *Confrontation or Collaboration? Congress and the Intelligence Community*, ed. Eric Rosenbach and Aki J Peritz (Cambridge, Massachusetts: Belfer Center for Science and International Affairs, Harvard Kennedy School, 2009), https://www.belfercenter.org/publication/informing-congress-intelligence-activities.

development of counterspace capabilities has never stopped to grow in recent years, in particular driven by the rise of China.[15] This clear resurgence of space as a warfighting domain is the main driver of all recent USG initiatives with regards to space security: the re-establishment of the USSPACECOM, the creation of the USSF, etc. The culmination of this strategic shift came with the Defense Space Strategy (DSS) of June 2020. As early as its first page, it declares:

> "Space is now a distinct warfighting domain, (…) vital to our Nation's security, prosperity, and scientific achievement. (…) Space, however, is not a sanctuary from attack and space systems are potential targets at all levels of conflict. In particular, China and Russia present the greatest strategic threat due to their development, testing, and deployment of counterspace capabilities and their associated military doctrine for employment in conflict extending to space. China and Russia each have weaponized space as a means to reduce U.S. and allied military effectiveness and challenge our freedom of operation in space."[16]

It also insists on the disturbance that can come from minor rising powers: "China and Russia present the most immediate and serious threats to U.S. space operations, although threats from North Korea and Iran are also growing."[17]

In this context, there is a desire for the US military to focus its efforts on its core mission, and to not use personnel on missions that could be carried out by other – civilian – agencies. This movement has been present for many years already, as shown by the declarations of senior space military officers, already quoted in the previous chapter. Already in 2015, Lieutenant General Kowalski, then-USSTRATCOM Deputy Commander, questioned the role of the military in providing non security-related SSA services: "We need to revisit how we've allocated military personnel to what may not be really a military mission".[18] In a congressional hearing held a few days after the signature of SPD-3 by President Trump, General Hyten, who was then still USSTRATCOM Commander, clarified his view on the transfer of some SSA/STM responsibilities from the DoD to the DoC:

> "We had to take about a hundred airmen, a hundred military people, off of other missions and put them on that in order to do that mission. (…) When we move that now to the Department of

[15] Weeden and Samson, 'Global Counterspace Capabilities: An Open Source Assessment 2020'; Harrison et al., 'Space Threat Assessment 2020'.
[16] 'Defense Space Strategy: Summary', 1.
[17] 'Defense Space Strategy: Summary', 3.
[18] Freedberg, 'STRATCOM Must Be Warfighters, Not FAA In Space: Lt. Gen. Kowalski'. Interestingly, the logical view for Lt. Gen. Kowalski was to mention an FAA-like organisation. The rational changed afterwards when it was decided that the DoC was to take over STM/SSA responsibilities.

> Commerce, (…) we will be able to free up those airmen and to focus on warfighting missions that we need to worry about".[19]

While this concerned specifically the case of space safety services provided by the DoD – through its SSA Sharing Program – to "commercial and foreign entities", it is also true to STM in general, which is clearly not a topic falling under the scope of military activities or responsibility.

Although SSA – itself, not SSA services provided to a third-party – is a critical tool to provide the DoD with a precise understanding of outer space as an operational environment, STM is rather a regulatory or a promotional function, therefore naturally falling within the purview of other USG agencies like the DoC or the Department of Transportation (DoT). As an OSD interviewee puts it: "the DoD entered spaceflight safety by accident because it had the infrastructure for missile warning" [US-16]. The inception of the Space Fence was marked by intense debates in this regard. In fact, in 2013, officials at the OSD's Cost Assessment and Program Evaluation (OSD/CAPE)[20] advised that the Space Fence program be killed before it is awarded because it is an STM system, not adapted to warfighting needs, and therefore not part of a fundamental DoD task [US-22]. The late agreement that it was not a DoD mission is considered to be the primary reason for the abandon of the second Space Fence [US-22]. Therefore, while DoD personnel may have views on elements related to STM, it is not the function of the DoD to develop a comprehensive unified view on a prospective international or domestic STM regime.

2.2. The DoC is a "better storefront" for STM activities of the US Government

Signed by President Trump in June 2018, the SPD-3 has officially defined STM responsibilities in the USG by assigning the DoC as lead agency. In practice, while the DoD (through the USSTRATCOM until late 2019, now through the USSPACECOM) will retain the responsibility to maintain the authoritative catalogue of space objects (SATCAT), other non-military tasks – such as providing conjunction risk assessment notifications for "commercial and foreign entities" and leading the development of the USG STM-related policies – will be carried out by the DoC from 2024.[21] What is important to understand it that this decision was

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[19] Ross, Bridenstine, and Hyten, Space Situational Awareness: Whole of Government Perspectives on Roles and Responsibilities (Video of Hearing).
[20] 'Cost Assessment and Program Evaluation', cape.osd.mil, accessed 23 March 2020, https://www.cape.osd.mil/.
[21] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.

not based on the pure top-down desire of the President, the Vice-President and members of the NSpC. It was agreed by the DoD which wanted to get rid of its role to deal with commercial and foreign partners [US-3], for the reasons presented in the previous paragraph.

In addition to the desire of the DoD to free personnel from non-priority tasks to focus on warfighting – therefore rather space domain awareness than SSA *per se* – the DoC is seen as a "better international storefront" [US-1]. In fact, promoting norms, whether it is domestically or internationally, requires important investments – not restricted to financial terms – to reach a wide array of space actors: governmental, commercial, international, etc. It is a complex mission that requires the full commitment of a dedicated office or bureau, which the DoD cannot and does not want to afford in the current situation where it should focus on its core missions. However, it is committed to supporting the efforts of a civilian lead, as reaffirmed in the DSS of June 2020: the DoD will "uphold internationally accepted standards of responsible behaviour as a good steward of space; and support U.S. leadership in space traffic management and the long-term sustainability of outer space activities".[22]

Moreover, apart from the need to prioritise warfighting, too much involvement of a military organisation on the promotion of a norm can be counterproductive, while a civilian organisation like the DoC, not even a regulatory organisation like the Federal Aviation Administration (FAA), could be seen as more benevolent, with less hidden agenda, hence the "better international storefront" label given by a DoD interviewee to the DoC [US-1].

Apart from the rational explanations presented above of the DoD's support to being deprived of space safety responsibilities in favour of the DoC, Chapter 9 provides insights from organisational and bureaucratic theories.

2.3. DoD as outer space police: not possible nor desired

The answer to the question whether the US military could or should become a sort of outer space police seems obvious to anyone even remotely familiar with the matter. However, its recurrence in the public debate makes it necessary to be addressed here and concluded once and for all. To put it simply and clearly: although the DoD is the only existing organisation capable of doing some form of global space traffic monitoring, it has neither the capabilities nor the willingness to "manage" space traffic [US-1].

[22] 'Defense Space Strategy: Summary', 2.

2.3.1. The DoD cannot technically manage space traffic

It is critical to understand that the DoD, as any other organisation in the world, does not currently have actionable STM technical capabilities. To be precise, the DoD's SSA data handling system is antiquated and would require a significant upgrade to conduct STM. In fact, the USSPACECOM's current SSA capabilities are based on the use of SPADOC. SPADOC, acronym of Space Defense Operations Center, is the space surveillance data handling system currently used by the DoD, dating back from 1979 when it was first installed in the North American Aerospace Defense Command's (NORAD) Cheyenne Mountain Complex, with its latest upgrade in 1989.[23] Speaking at the Air Force Association Multi-Domain Command and Control Conference in Colorado Springs, Colorado on 24 August 2017, General Raymond, then-AFSPC Commander and now both USSPACECOM Commander and CSO, declared about SPADOC:

> "The other thing that we're gonna have to do is we're gonna have to be able to execute this command and control across multiple operations centers, multiple classification levels, multiple – and link multiple sources of information. That's not easy to do. And again, today the system that we have, which is called SPADOC (Space Defense Operations Center) – anybody ever hear of SPADOC? I can't wait until we can take a hammer to SPADOC and just blow it to bits. It's an old clunker and it's a catalog system: it's not a warfighting command and control system. It's not a multi-domain system. It's full, it's tired, and it's limping across the finish line until we can get this thing called JMS (Joint Space Operations Center Mission System) up."[24]

Since General Raymond's speech however, the JMS project has been dropped, generating a pure loss of around USD 1 billion of DoD investments, and leaving SPADOC as the only system currently available to the 18th SCS, all hopes residing in a new project with an unpronounceable acronym, the Enterprise Space Battle Management Command & Control (ESBMC2) system.[25] Beyond JMS's huge waste of taxpayers' money, the main consequence of a continued use of SPADOC is the important limitation on the data that can be ingested and digested by the system. In fact, SPADOC functions under a single file type and already

[23] Colin Clark, 'What About JMS? Air Force Reanimates "Old Clunker" Space Tracking System', Breaking Defense, 8 April 2019, https://breakingdefense.com/2019/04/what-about-jms-air-force-reanimates-old-clunker-space-tracking-system/.
[24] John W Raymond, 'General Raymond's Speech at the Air Force Association Multi-Domain Command and Control Conference, Colorado Springs, Colorado', Air Force Space Command, 24 August 2017, https://www.afspc.af.mil/About-Us/Leadership-Speeches/Speeches/Display/Article/1311033/multi-domain-command-and-control-conference/; Clark, 'What About JMS? Air Force Reanimates "Old Clunker" Space Tracking System'.
[25] Clark, 'What About JMS? Air Force Reanimates "Old Clunker" Space Tracking System'; Hitchens, 'Space Traffic Management: U.S. Military Considerations for the Future'.

struggles to integrate data from foreign SSA partners of the DoD [US-9]. Moreover, the new Space Fence, supposed to revolutionise American capabilities with a tenfold increase of data collection, cannot under the current situation be integrated to the system, as its huge data input would likely precipitate SPADOC' demise [US-22]. Fortunately for the DoD, the Space Fence was developed with its own data handling system allowing an independent use until the upgrade of the 18th SCS's.[26]

2.3.2. The DoD does not want to manage space traffic

The DoD is neither allowed not willing to manage space traffic. In other words, it is not an enforcement agency and it does not aim to obtain police powers in space. At the initial stages of the discussion on the establishment of the USSF, quickly discarded proposals of US Space Guard (USSG) appeared in both the journalistic and academic literature.[27] Its proponents envisioned the creation of an agency modelled after the US Coast Guard (USCG), that is to say under civilian control in peacetime and military control in wartime, with responsibilities ranging from licensing – taking over all responsibilities from the NOAA, the FAA and the FCC, law enforcement in outer space and active debris removal.[28] Such proposals were inappropriate at various levels: contradiction with US national interest, unjustified and unilateral extension of American jurisdiction over outer space in violation of international space law, etc. They were therefore not taken seriously by any prominent USG decision-maker. Moreover, another element having brought some confusion over the role of the US military in space is the already mentioned definition of the USSPACECOM as a geographic command, while its responsibilities are in practice those of a functional command.[29]

3. The DoD's internal debates on STM

The challenge of commenting DoD's posture on STM is that there is neither any official nor unofficial one. In fact, there are numerous, sometimes conflicting views on STM among different DoD components. In particular, there exist an important divide between "pure space officers" – space "military technologists" to borrow from Morris Janowitz – having a coherent

[26] Clark, 'What About JMS? Air Force Reanimates "Old Clunker" Space Tracking System'.
[27] Not to be confused with a Space National Guard, that could be a well-justified reserve component of the USSF, like the Army National Guard and the Air National Guard, all together forming the US National Guard.
[28] Anna Gunn-Golkin, 'Space Guardians', The Space Review, 25 June 2018, https://www.thespacereview.com/article/3520/1.
[29] Johnson, 'Bad Idea: Designating Space Command as a Geographic Command'.

and complex understanding environment and the rest of the military establishment. Finally, this section addresses the issue of the transparency of space operations, which is at the centre of the STM debate, including within the DoD.

3.1. The absence of a unified position on STM at the DoD

All interviewees familiar with the matter agreed on the absence of consensus in the DoD over STM, be it about its definition, its scope or even less about the modalities of its implementation. Apart from the fact that STM is not a military topic (cf. 2.1), what are the main reasons behind this absence of unified position on STM?

The first and foremost reason for the absence of clear and consensual position of the DoD on STM is the fact that **space operations have no history to inform decision-making**. In fact, the development of a military doctrine is a long a complex process that cannot be improvised. On the contrary, it is built upon a long history of trial and errors, that allows the development a clear understanding of an operational domain or a technology. If compared to the multi-millenary history of naval operations and even to the century of aviation history, space does not have neither the history nor the scale to provide an undisputable course of action. Moreover, the domination of space by a few powerful nations did not contribute to the development of a shared understanding, extremely valuable to develop efficient operational policies [US-1].

Secondly, even if it wanted to reach a unified position, it would be a very arduous tasks due to the **institutional complexity of the Department**. As presented in section 1.1., there is a huge number of internal structures with both strong expertise and unique equities to defend. In other words, the DoD is composed of numerous organisations having their own, irreconcilable, cultures. The JS is often described as primarily focussing on preserving the autonomy of forces and therefore by nature always opposing anything that may go against military freedom of movement [US-22]. Chapter 5 demonstrated the conflicting views of the USAF leadership on the one hand, quite conservative and not fully convinced by the idea of more transparency on DoD space activities, and on the other hand the USSTRATCOM having a more pragmatic inclination towards transparency [US-25]. Going even further than the USAF leadership, the NRO is primarily focussing on protecting and maintaining intelligence gathering capabilities that were already launched [US-5] and therefore extremely concerned by the fact that "more transparency will create unacceptable vulnerabilities and so are likely to resist" any evolution of the DoD on SSA/STM issues [US-7]. Building upon the previous point, it seems unlikely that senior leaders of the DoD, including VCJCS General Hyten, would use their very limited time to pursue the quasi-unsurmountable and unnecessary challenge of defining a unified DoD position on STM [US-22]. Finally, beyond institutional differences, one interviewee goes further by considering that everybody in the DoD has its own opinion, individuals, not even organisations [US-22].

While this section focussed on the complexity of the DoD in terms of formal agencies, bureaus and commands, the following section delves into the role played by informal structures, such as what has been labelled by numerous interviewees as "pure space officers", in the development of an understanding of space safety and sustainability at the DoD.

3.2. The growing influence of pure space officers

In *The Professional Soldier*, Morris Janowitz prophesised the growing dichotomy between generalist "military managers" and high-specialised "military technologists".[30] In the US military, such "space military technologists" have been labelled "pure space officers" by several interviewees. They are said to have been playing a very important role in driving the internal debate on space safety and sustainability by bringing a unique and acute understanding of the challenges facing the outer space environment and their consequences on the ability of the US military to utilise space technologies. How to characterise this informal and influential structure within the DoD?

"Pure space officers" are usually understood as USAF officers having developed a strong expertise in – military – space operations, through aerospace-oriented training and a career mostly composed of space related assignments. In order to give concrete examples of such profiles, this section looks at two of the most emblematic space officers mentioned in this dissertation, General Hyten, currently 11th VCJCS and General Shelton, former AFSPC Commander, based on their official biographies available on the USAF website.[31] General Hyten joined the USAF after graduating from Harvard University with a bachelor's degree in engineering and applied sciences, supported by an Air Force Reserve Officer Training Corps (ROTC) scholarship. As indicated by his official USAF biography, "the general's career began in engineering and acquisition before transitioning to space operations". In fact, whether in the USAF or in joint assignments, General Hyten progressively assumed most of the major space-related assignment in the US military, such as Director, Cyber and Space Operations, Headquarters U.S. Air Force, AFSPC Commander and USSTRATCOM Commander, last

[30] Janowitz, *The Professional Soldier*, 425.

[31] 'General John E. Hyten: Biography', U.S. Air Force, accessed 18 June 2020, https://www.af.mil/About-Us/Biographies/Display/Article/108115/general-john-e-hyten/; 'General William L. Shelton: Biography', U.S. Air Force, accessed 18 June 2020, https://www.af.mil/About-Us/Biographies/Display/Article/104749/general-william-l-shelton/.

assignment before its current one (VCJCS). General Shelton started his career in a more traditional way, graduating from the USAF Academy with a degree in astronautical science before having almost exclusively space assignments (one of the 'purest' space officers in that sense) culminating with the AFSPC Commandership. On a side note, these two officers are perfectly representative of Janowitz's definition of "military technologists" within a constabulary force, which he imagined being primarily recruited from civilian universities via ROTC programs or from highly specialised program in military academies.[32]

Concretely, such officers bring a perspective and an understanding of the challenges of space operations that helps weakening certain innate tendencies of the military establishment, such as its attachment to absolute secrecy, quite relative but clearly damaging in space (cf. 3.3 for more analysis). The difference between "pure space officers" and other USAF officers occasionally given a space-related assignment is quite visible for officers trained before 2013. Until early 2013, there was no designated career track for space officers, the specialisation in space operations being merged with missile operations.[33] The training was even imbalanced: "more than 50 percent of space-coded company grade officers' development time was spent as a missileer".[34] Therefore, discrepancies tended to appear after this initial training, depending on the career pattern of the officer. In practice, 'pure space officers' such as General William Shelton, General Hyten or General Raymond, tend to be more inclined towards transparency and less subjected to preconceived military postures against transparency ("not as aggressive at sharing" information of US national security assets) while officers with different background, such as General Bob Kehler, former USSTRATCOM Commander, with background in intercontinental ballistic missile (ICBM) operations, were "more aggressive to having the [data sharing] architecture set up" [US-25].

Most of the senior space officers studied in this dissertation were trained in the traditional way, that is to in joint missile and space programs. What can then be expected about the evolution of this informal structure of "pure space officers"? The separation of the space and missile career tracks in 2013, mentioned above, was a major change as its led to the apparition of an official body of career space officers, formalising the previously informal structure of "pure space officers" fashioned by decades of coherent space-related assignments. Finally, the establishment of the USSF in 2019 is expected to foster – "organise, train and equip" – a

[32] Janowitz, *The Professional Soldier*, 425.
[33] 'AF Splits Space, Missile Career Field for Officers', Air Force Space Command, 15 February 2013, https://www.afspc.af.mil/News/Article-Display/Article/249198/af-splits-space-missile-career-field-for-officers/.
[34] 'AF Splits Space, Missile Career Field for Officers'.

consistent population of space officers. However, effects on the DoD's posture on space policy in general and STM policy may only be visible in the long-term for two reasons: 1) it will take one or two more decades for officers trained in the pure space career track to reach senior level positions and 2) the USSF is currently only a rebranding of the AFSPC with no particular structural or personnel changes, although the new organisational structure unveiled on 30 June 2020 includes the establishment, as one of the three major commands of the USSF, of a Space Training and Readiness Command (STARCOM) that will "train and educate space professionals, and develop combat-ready space forces to address the challenges of the warfighting domain of space".[35] It will be then interesting to follow how the USSF manages to create its own identity distinct from the USAF, similar to the USAF's quest for legitimacy and relevance after separating from the US Army in 1947.[36] In fact, the DSS of June 2020 define as one the axes of to achieve "line of effort 1: build a comprehensive military advantage in space" the need to "develop and expand space warfighting expertise and *culture*" (emphasis added).[37]

3.3. The safety/security versus secrecy dilemma

The question of transparency is central to the STM debate. An important element largely discussed in Chapter 5 is the internal DoD debate on how to balance the necessary sharing of SSA information to ensure a safe and sustainable space environment while maintaining enough secrecy to preserve critical national security assets in space. This section does not focus specifically on the US SSA Sharing Program to avoid redundancies with Chapter 5 but goes deeper into the implications of secrecy or transparency.

3.3.1. Is secrecy in outer space really a myth?

A structuring factor of the safety versus secrecy dilemma is the actual existence of secrecy in outer space. In other words: can a country or organisation effectively hide a specific asset in outer space? Most interviewees met by the author did not believe in actual secrecy, claiming that all organisations really willing to know the position of a spacecraft can know it, and in particular leading space military powers such as the US, Russia and China. As a retired US general officer told the author: "what's a secret if everybody knows?" [US-25]. This quasi-consensus in the space community, including most DoD personnel interviewed by the author,

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[35] Marcia Smith, 'Space Force Unveils Organizational Structure', SpacePolicyOnline.com, 30 June 2020, https://spacepolicyonline.com/news/space-force-unveils-organizational-structure/.
[36] Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, 27–29.
[37] 'Defense Space Strategy: Summary', 7.

is mostly based on a fashionable game in the amateur astronomer community: detecting classified military satellites, the greatest prize being NRO ones.[38] Therefore, if there is no secrecy, there is no dilemma: why then debating the issue? Because the actual situation is more complex.

The first element complexifying the debate is the issue of stealth technology.[39] The NRO, one of the most vocal opponents of transparency, is also said to be the world leader in the development of advanced stealth satellite technology [US-15]. The level of classification and secrecy around NRO's activities being one of the highest in the USG and the world, if the NRO adopts a strong stance against transparency by claiming its ability to actually hide in space, its counterparts, be they from the Executive or Legislative Branches, "have to take their word for it" [US-8].[40]

The second element is that most proponents of more transparency are focussing on the US's major adversaries, namely China and Russia. It is true that these countries are very likely able to collect extremely precise SSA data on American satellites, in order to support potential counterspace operations. But is it a good enough reason to push for further transparency? Some believe that it is not and regret the excessive focus on competition with major space powers. In fact, there are numerous other potential opponents that would directly benefit from more transparency. In the case of France, which relies on advanced reconnaissance satellites for its fight against Islamic terrorists in Middle East and in the Sahel region, the knowledge of precise orbital elements would allow terrorist groups to carry out small but efficient counterspace activities such as laser blinding [FR-6].

3.3.2. Operational benefits of transparency

One of the main hurdles facing military operators in space is the **identification of hostile acts**, in particular in crowded orbital regimes in low Earth orbit (LEO) and geostationary orbit (GEO). In the absence of clear notification on the intentions of a given manoeuvre, it is virtually impossible to differentiate a benign close approach from an anti-satellite operation, what a DoD interviewee called the "operator's dilemma" [US-1]. One interviewee remembered an international debate (setting unspecified) where some participants thought about defining space weapon as "constant bearing decreasing range", which is basically the same definition as the

[38] Daniel Oberhaus, 'Meet the Amateur Astronomers Hunting for Spy Satellites', Supercluster, 27 June 2019, https://www.supercluster.com/editorial/meet-the-amateur-astronomers-hunting-for-spy-satellites.
[39] Leonard David, 'Anatomy of a Spy Satellite', Space.com, 3 January 2005, https://www.space.com/637-anatomy-spy-satellite.html.
[40] Cf. section 1.4.

one of a successful rendezvous manoeuvre ("it is the definition of doing anything right") [US-25]. The identification of hostile acts is the most common concern of senior military space officers interviewed the author, therefore making them have a certain inclination for enhanced transparency and advanced notifications on manoeuvres. The same issue was once solved in the case of high seas encounters:

> "The way we got around it was to say: 'if you just identify yourself, publish a track, and then transmit deviations intended, etc. then you are cooperative and therefore you are not an adversary. It doesn't mean that you can't do harm but at least you have demonstrated a reasonable opportunity to not do harm and to be controlled'. But in space, people went, first it was 'oh we're going too fast' and it was 'we can't change our orbit', it was all sorts of dog-ate-my-homework type arguments, not really legitimate arguments of trying to solve the problem or arguments of trying to avoid the problem. And so that became a really difficult issue. To my knowledge, it actually hasn't been solved yet. In other words, we can't define what is a hostile track, uncooperative, versus what is a non-hostile cooperative track, but we are getting better but it's still for the most part done by sensing not by reporting" [US-25].

Finding appropriate mechanisms for advanced notifications on manoeuvres to avoid misunderstandings and therefore a rise of tensions between adversaries would be key in maintaining a certain level of safety of space operations and could be an acceptable approach for most senior military space officers.

Another unexpected benefit of transparency on a nation's own assets could be to **expose an adversary's hostile behaviour**. In 2019, famously hostile Russian satellite Olymp-K "Luch" [41] was navigating in close proximity of an American geostationary military communication satellites of the Wideband Global SATCOM (WGS) constellation. However, after the USSTRATCOM released the orbital elements of WGS satellites, including the one spied on by Luch, the latter suddenly changed its course and went far away from the WGS satellite. "It was almost like the Russians going: 'oh fuck, we didn't know you were right there, we will move away now that we see that you're there'" [US-9].

[41] Olymp-K, nicknamed "Luch" is a geostationary satellite of the Russian Ministry of Defense and Federal Security Service (FSB), believed to be a signals intelligence satellite, that is to say a satellite intercepting communications of other geostationary satellites, in particular those providing critical military communication services for NATO-affiliated armed forces. Numerous official complaints have been addressed by NATO countries to the Russian government.

3.3.3. Transparency and deterrence

The 2011 National Security Space Strategy (NSSS) defines as the first element of the DoD's "multi-layered deterrence approach" the requirement to "support establishing international norms and transparency and confidence-building measures in space, primarily to promote spaceflight safety but also to dissuade and impose international costs on aggressive behaviour". The DASD for Space Policy at the time, Ambassador Gregory L. Schulte defended this point in 2011 in front of the US-China Economic and Security Commission by saying that "increasing the transparency of space operations" would reduce risks of miscalculation thanks to the building of a "common understanding of the operating domain".[42]

What was labelled "deterrence through norms" is still a very debated topic in the space security community, with a clear divide between, on one side, those welcoming such approach as a way to further advanced diplomacy and confidence-building, and on the other side, partisans of traditional deterrence doctrines regretting a severe misuse of the concept.

The former, supportive of what Theresa Hitchens and Joan Johnson-Freese called in 2016 "diplomacy and positive deterrence",[43] believe in the security benefits of transparency and support the evolution of the concept of deterrence towards a "positive" form. For them, an increase of transparency can serve both safety and security in outer space,[44] following some arguments developed in 2.3. and 2.4.2. such as the identification and exposition of hostile acts.

On the other hand, analysts following traditional interpretations of deterrence strongly oppose what they consider dramatic misunderstanding and misuse of the concept of deterrence in the NSSS. One of the main proponents of this view, space analyst Christopher Stone even argues that:

> "[*The NSSS*] appears to be an incomplete strategy focused heavily on a perceived diplomatic framework for the promotion of an arms control agenda in support of the sanctuary spacepower theory, not the deterrence of aggression and the active protection of United States freedom of action in space".[45]

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[42] Cited in: Christopher M Stone, 'Reversing the Tao: A Framework for Credible Space Deterrence' (Master's Thesis, Missouri State University, 2015), 24, https://bearworks.missouristate.edu/cgi/viewcontent.cgi?article=2506&context=theses.

[43] Theresa Hitchens and Joan Johnson-Freese, 'Toward a New National Security Space Strategy: Time for a Strategic Rebalancing', Atlantic Council Strategy Paper No. 5 (Washington, DC: Atlantic Council, June 2016), 53, https://www.atlanticcouncil.org/wp-content/uploads/2015/08/AC_StrategyPapers_No5_Space_WEB1.pdf.

[44] Hitchens and Johnson-Freese, 29.

[45] Christopher M Stone, 'Security through Vulnerability? The False Deterrence of the National Security Space Strategy', The Space Review, 13 April 2015, https://www.thespacereview.com/article/2731/1.

For Stone, an approach focussing on the development of shared norms of behaviour and on an increase of transparency is not appropriate and falls within the 'mirror imaging' cognitive bias leading decision-makers to assume their adversaries share similar beliefs and worldviews.[46]

Finally, some experts have chosen a third, middle way, such as Peter Marquez, former NSC Space Policy Director under Presidents Bush and Obama, who, while strongly opposing the terminology of 'space deterrence' and regretting the misuse of deterrence in lieu of compellence, sees the promotion of norms as the way to realise the "signalling" part of a deterrence strategy. For him the clear expression by DoD of what it considers an unacceptable – or on the contrary a responsible – behaviour in outer space is crucial, and "the U.S. should continue to lead and shape this discussion.[47] However, he also acknowledges that:

> "International norms could unintentionally limit U.S. deployment and development of satellites that track orbital debris and other satellites in space. It leaves open the door also for the United States to be forced to disclose the nature of its intelligence collection activities and capabilities from orbit."[48]

3.3.4. The costs of secrecy

While national security actors tend to focus on the cost of excessive transparency, the cost of excessive secrecy can prove much higher. Most satellite operators do not have their own extensive SSA capabilities or do not use high-quality services like those of AGI, LeoLabs or ExoAnalytics. Therefore, their operations may be gravely endangered by a lack of knowledge on the whereabouts of national security assets. The typical behaviour of the DoD in case of potential collision between one of their 'secret' assets and a commercial asset is to deal with manoeuvres on their own without the counterpart even knowing what may have happened. Let us however consider a situation in which the said-commercial operator is aware that it may impact this unidentified object but cannot, by definition, coordinate with its anonymous owner. Both sides, unaware of the knowledge and approach of the other, may decide to conduct utterly incompatible manoeuvres ending up in a catastrophic collision. As example of such behaviour,

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[46] Stone; To support his claim, Stone quotes: Keith B Payne, *The Fallacies of Cold War Deterrence and a New Direction*, Military Studies 2 (Lexington, Kentucky: The University Press of Kentucky, 2001), 100.

[47] Peter Marquez, 'Space Deterrence: The Prêt-á-Porter Suit for the Naked Emperor', in *Returning to Fundamentals: Deterrence and U.S. National Security in the 21st Century* (Washington, DC: George C. Marshall Institute, 2011), 16–17.

[48] Elie Lake, 'Report Calls for Restraints in Space Activity', The Washington Times, 7 February 2011, https://www.washingtontimes.com/news/2011/feb/7/report-calls-for-restraints-in-space-activity/; Cited in: James D Rendleman, 'Strategy for Space Assurance', in *Space Strategy in the 21st Century: Theory and Policy*, ed. Eligar Sadeh, Space Power and Politics (Oxon, UK: Routledge, 2013), 109.

Hitchens mentions the case of the DSP-23 missile warning satellite, which dangerous drifting across the geostationary belt was not announced by the DoD, putting in jeopardy numerous other satellites, if not the stability of the whole belt.[49] Beyond sustainability, the fact that military secrecy could lead to important incidents with increasingly numerous commercial assets, and therefore to very important economic losses, was a decisive factor for increased transparency at the DoD [US-25].

How to avoid this type of dramatic situation? The answer is quite simple and understood by most military actors: the development of "rules of the road" to standardise the course of action for avoidance manoeuvres (cf. 2.4.1), and the promotion of more transparency on space operations. The latter also provides an interesting parallel with the high seas.[50] In 2017, two major incidents involving USN ships colliding with civilian vessels put the spotlight on the importance of civil-military coordination in heavy traffic zones. Navy vessels, difficult to detect by civilian ships due to their design and due to the voluntary deactivation of their AIS, are at constant risk of being hit.[51] The first accident, on 17 June 2017, saw the destroyer *USS Fitzgerald* being hit by a large Filipino container ship, which caused the death of seven members of her crew. Then two months later, on 21 August 2017, *USS John S. McCain* – same *Arleigh Burke*-class destroyer as *USS Fitzgerald* – collided with Liberian merchant ship *Alnic MC* off the coast of Singapore, ending with the death of ten American sailors. It has been confirmed that at the time of the accidents, none of the Navy ships were broadcasting their AIS signal, "consistent[ly] with the Navy's general practice".[52] Following these two deadly accidents, the Navy's leadership was summoned for a Senate Hearing. From its preliminary statement, Secretary of the Navy Richard V. Spencer insisted on the importance of the AIS in highly congested zones:

[49] Hitchens, 'Space Traffic Management: U.S. Military Considerations for the Future'.
[50] The following paragraphs of this subsection have been published by the author in Quentin Verspieren and Hideaki Shiroyama, 'From the Seas to Outer Space: The Reverse Dynamics of Civil-Military Situational Awareness Information and Responsibility Sharing', *Space Policy* 50 (November 2019), https://doi.org/10.1016/j.spacepol.2019.07.003.
[51] Keith Bradsher and Hannah Beech, 'Naval Vessels, Shadowy by Intent, Are Hard for Commercial Ships to Spot', The New York Times, 25 August 2017, https://www.nytimes.com/2017/08/25/world/asia/navy-collision-uss-mccain-oil-tanker.html.
[52] 'CNO: U.S. Navy Warships Will Start Transmitting AIS', The Maritime Executive, accessed 24 March 2020, https://www.maritime-executive.com/article/cno-us-navy-warships-will-start-transmitting-ais.

> "The CNO[53] will address a list of actions the Seventh Fleet is taking immediately to address the situation at hand, ranging from ship-to-ship materiel inspections to the activation of AIS radar identifications while we're trafficking specific areas".[54]

Later, the CNO, Admiral John Richardson, gave more details about the Navy's plan to avoid future similar incidents:

> "That's been an immediate action, is that there is this Automatic Identification System, AIS, that the Secretary mentioned. And we had, I think, a distorted perception of operational security that, if we kept that system secure – off in our – on 230 our warships. One of the immediate actions following these incidents is that, particularly in heavily trafficked areas we're just going to turn it on".[55]

He also added that, in heavily trafficked areas, using the AIS does not contravene operational security as Navy ships are anyway directly visible from other ships. These unfortunate events illustrate of the evolution of maritime security and maritime situational awareness towards more transparency. A direct parallel can be made for crowded orbital regimes in outer space.

4. Point of agreement: DoD's support to norms of behaviour in space

While it is clear that the DoD has strong equities in space and understands the importance of having clear lines of action, the remaining interrogations concern the nature of a prospective STM regime and the vehicle for its promotion.

4.1. Air Force-driven attachment to guidelines

As described above, being a rebranding of the AFSPC, the mentality of the USSF officers is currently difficulty dissociable from the traditional USAF one. While it limits the development of genuinely independent views on STM and on the sustainability of outer space in general, it however ensures a certain inclination for rulemaking among space-related officers. An important characteristic of military organisations is that policy is driven by operations, and therefore that operators' mentality is transcribed in organisation-wide policy [US-9]. For example, a clear distinction is traditionally made between USAF and Navy pilots: "Navy pilots, when they fly, they fly in such a way that they'll do anything in the air as long as it does not violate any specific rules or guidance. Air Force pilots fly in such a way that they always comply

[53] Chief of Naval Operations, most senior officer in the US Navy.
[54] Richard V Spencer, John M Richardson, and John H Pendleton, 'Recent United States Navy Incidents at Sea (Stenographic Transcript)', § U.S. Senate Committee on Armed Services (2017), https://www.armed-services.senate.gov/download/?id=04BC41B3-CB25-4E78-8A0E-E6DAA530C232&download=1.
[55] Spencer, Richardson, and Pendleton.

with only known guidance and rules" [US-9]. In other words, for Navy pilots, what is not forbidden is allowed, while for USAF pilots, what is not allowed is not allowed.

In *Masks of War*, Carl Builder defines independence as an intrinsically naval value: "if tradition is the altar at which the Navy worships, then one of the icons on that altar is the concept of independent command at sea, which, like the Holy Grail, is to be sought and honored by every true naval officer".[56] He cites Commode Perry as an important mythological figure of the USN, being at the same time "presidential emissary, ambassador, commander in chief, secretary of state, and trade commissioner, all under the guns of his ships, as he threatened war and negotiated treaties with feudal Japan".[57]

Conversely, Builder outlines the concerns about "legitimacy and relevancy" of the USAF, that used to be part of the Army. While the Navy retained an internal air force in support of naval operations, the Army did not keep its own means of air support for ground operations. The USAF relevancy therefore needed to be based on strategic bombing capabilities.[58] Having the responsibility to wage the most absolute form of military power may have influence the USAF desire for strictly justified course of action. In turn, this legalistic USAF mentality has deeply permeated USAF space officers, and by transitivity USSF officers. This can be an important factor in the push for more principles, rules, norms or norms of behaviour in outer space.

4.2. The DoD's understanding of norms of behaviour in space

A common lexical element of all USG interviewees, *a fortiori* DoD ones, is their use of the term "norms of behaviour":

> "We say 'norms of behaviour' rather than 'norms', because if we say 'norms' alone that implies some sort of authority. A 'norm' might derive from like an arms control agreement but a 'norm of behaviour' would be something that maybe would come from customary international law, to be non-binding. So, you'll see us being careful about what phrase we use. We're not interested in binding ourselves to some transnational [*instrument*]" [US-13].

The establishment of norms of behaviour in outer space is the pendant of the increase of transparency in avoiding confusion between benign manoeuvres and hostile operations. In fact, internationally agreed norms of behaviour combined with an increase in SSA transparency would help to normalise behaviour in space and simplify the detection of "deviant behaviours".

56 Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, 18.
57 Builder, 18–19.
58 Builder, 27–28.

In a comparison with ground practice, it is commonly agreed that specific behaviours are acts of aggression by themselves, such as massing troops at a border [US-28]. Being based, not on any binding rule and enforcement mechanism, but on goodwill and voluntary adherence, "norms of behaviour are generally found to be very stabilizing and very hopeful" [US-13]. A DoD interviewee however specified the importance to differentiate between norms of "safe behaviour" and norms of "appropriate behaviour" [US-1]. While the former embodies the idea of shared values and understanding for the preservation of outer space, the latter constitute unacceptable limitations to the freedom of – military – activities in outer space: "safe and responsible principles are useful" [US-1]. Confusion was however raised by the DSS of June 2020 which instructs the DoD to "partner with the Department of State (DoS) to work closely with allies and partners in order to develop common understandings of *appropriate* behavior in space" (emphasis added).[59]

Some interviewees went further by making comparison with arms control by invoking the issue of verification [US-1,24]. While rejecting the idea of actual norms, agreeing with US-13's comments above, they see norms of behaviour as the mean to establish a form of monitoring with a "very high verification threshold" [US-1].

4.3. The DoD as promoter of norms of behaviour?

> "There's definitely an interest in having norms [*of behaviour*] and promoting them. So, then the question is: what's the modality, what's the vehicle by which you promote these norms?" [US-13].

Beyond the aforementioned understanding that a civilian agency – possibly the DoC – would be a most appropriate "vehicle" for the promotion of norms of behaviour in outer space, the reality is that the DoD, based on the legitimacy it acquired as a responsible actor in space, has occasionally played a direct role in the negotiations for domestic regulations and international norms for the preservation of the outer space environment.

While the DoD's involvement in domestic interagency processes is fully justified, its participation in the LTS negotiations highlights the existing contradiction in the DoD on the international promotion of norms of behaviour, reaffirmed in the DSS of June 2020: "DoD will partner with the Department of State (DoS) to work closely with allies and partners in order to

[59] 'Defense Space Strategy: Summary', 8.

develop common understandings of appropriate behavior in space", and "promote standards and norms of behavior in space favorable to U.S., allied, and partner interests".[60]

4.3.1. Earning legitimacy as a responsible actor in outer space

The DSS of June 2020 requires the DoD to "uphold internationally accepted standards of responsible behavior as a good steward of space".[61] In fact, both because of its commitment to the long-term sustainability of space and in order to be a legitimate participant in the definition and promotion of norms of behaviour protecting its equities, the DoD has to build or strengthen its reputation as a responsible actor in outer space. As said by a senior DoS interviewee, it is important for the DoD "to set an example in contrast to the Russians and the Chinese in particular, (…) in terms of what we're trying to do to mitigate the impact that debris has" [US-5]. Several factors evoked in previous chapters contribute to this goal such as its commitment to reduce space debris, its public involvement in the LTS negotiations at the UNCOPUOS or the transfer of more and more objects from the restricted and exclusions lists of the SATCAT to the public list. Even when it concerns critical military operations, the DoD leadership is heavily concerned by its public image regarding space sustainability, as revealed by the following example. Shortly after its launch on 14 December 2006, NRO satellite USA-193 malfunctioned and started to progressively decay, posing the risk of ground casualty due to uncontrolled re-entry.[62] It was then decided by the President to shoot down the satellite in its re-entry course, on 21 February 2008, under the code name *Operation Burnt Frost*. Several reasons were proposed by the USG and by experts to explain this decision: the environmental and public health risks posed tanks full of toxic fuel (hydrazine) that may resist atmospheric re-entry and cause extreme harm when exploding on the ground, the possibility for adversaries to retrieve classified satellite technologies that may have survived re-entry, or the desire of the US military to react to China's anti-satellite (ASAT) test of 11 January 2007 with an ASAT of its own.[63] Whatever the actual reason, what matters here is the careful consideration that was put in ensuring a very limited impact on the space environment of this ASAT operation. In fact, after having heavily criticised the irresponsible Chinese 2007 ASAT, it was critical for the USG's – and *a fortiori* the DoD's – credibility to destroy USA-193 properly. A senior officer

[60] 'Defense Space Strategy: Summary', 8.
[61] 'Defense Space Strategy: Summary', 2.
[62] The New York Times, 'U.S. Spy Satellite, Power Gone, May Hit Earth', *The New York Times*, 27 January 2008, sec. U.S., https://www.nytimes.com/2008/01/27/us/27spy.html.
[63] James Oberg, 'Assessing the Hazards of Space Hydrazine, and the Media Reportage of It', The Space Review, 25 August 2008, https://www.thespacereview.com/article/1195/1.

directly involved with the matter explained the author that the decision was made to wait until the last moment of USA-193's re-entry to allow a destruction at very low altitude using a Navy Standard Missile-3 (SM-3) launched from *USS Lake Erie* [US-25]. The choice of timing and altitude was primarily motivated by space debris mitigation concerns and backed by concordant analyses carried out independently by NASA and the DoD, therefore securing the agreement of then-US President George W. Bush [US-25].

4.3.2. In USG interagency processes: the ODMSP

In December 2019, Dr. J.-C. Liou, NASA Chief Scientist for Orbital Debris and Program Manager for the NASA Orbital Debris Program Office and Colonel Curtis Hernandez, Director of National Security Space Policy at the NSpC, unveiled the latest revision of the USG ODMSP. This much-awaited revision led to some disappointments in the space safety community due to its upholding of the 25-year rule for post-mission disposal. NASA defended its position by quoting internal studies showing that "reducing the 25-year rule to, for example, a 5-year rule, only leads to another 10% debris reduction over 200 years, which is not a statistically significant benefit".[64] The more-than-a-year-long time taken by the working group to come up with such light revision (commented extensively in Chapter 4) led to speculations over interagency disputes, mostly between the chair, NASA, and the other most prominent actor in the discussions, the DoD, on the relevance of the 25-year rule.[65] In fact, some DoD delegates in the working group have been anonymously expressing to the press their frustration over NASA's desire to stick with the 25-year rule, wanting to highlight the fact that "of all people, it's the 'space warmongers' doing the most to try to sustain the [*outer space*] environment", by fighting for a shorter post-mission disposal deadline.[66] While it seems to support the idea that the DoD is at the forefront of the fight for the long-term sustainability of space, some experts raised doubts about what could be a DoD public relations campaign at the expense of NASA. In early 2020, Secure World Foundation expert Brian Weeden questioned the supposed NASA-DoD opposition, writing that while some at the DoD may have been in favour of tighter regulations, it was not, based on discussions he had with DoD officials, a shared position in the department.[67] An anonymous source consulted by the author and familiar with the matter has the following view: the DoD and NASA agreed on the benefit of maintaining the status quo over the 25-year

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[64] Liou et al., 'Project Review: The 2019 U.S. Government Orbital Debris Mitigation Standard Practices'.
[65] Hitchens, 'New Space Debris Rules Stalled by Year-Long Interagency Spat'.
[66] Hitchens.
[67] Weeden, 'The United States Is Losing Its Leadership Role in the Fight against Orbital Debris'.

rule while both the DoC and the FAA favoured a five-year deadline. This source however explained that there were debates within the DoD with the OSD/SP in favour of tighter rules while military operators wanted to protect their best interests with laxer rules. The source added that leaks having led to Hitchens's article may have been aimed at supporting the DoD's image of an institution deeply concerned with the long-term sustainability of outer space [US-30].

However, notwithstanding a possible public relations stunt, the debate behind the actual role played by the DoD in the revision of the ODMSP reveals the vibrant internal debate at the DoD on the need for tighter domestic regulations, and therefore the non-negligible number of DoD experts fully committed to the preservation of the outer space environment.

4.3.3. In international fora: the UNCOPUOS LTS guidelines

The guidelines for the Long-Term Sustainability (LTS) of outer space are a set of 21 recommendations aimed to provide any good-willing space actor with a basic framework to mitigate the impact of space activities on the space environment and inspire the adoption of appropriate rules in domestic space legislations (cf. Chapter 2, section 4.2.1).

Although the lead USG agency for UNCOPUOS discussions is the DoS, through the Bureau of Oceans and International Environmental and Scientific Affairs (DoS/OES) or the Bureau of Arms Control, Verification and Compliance (DoS/AVC), a conjunction of elements has led the DoD to play the leading role in defending USG interests during the LTS negotiations. Over the almost decade of debates, two structures were at play: an overarching *working group* where the USG was represented by UNCOPUOS veteran Kenneth Hodgkins, Director of the Office of Space and Advanced Technology at the DoS/OES, and four *expert groups* (A to D).[68] The largest of the expert groups, group B "Space Debris, Space Operations and Tools to Support Collaborative Space Situational Awareness" being co-chaired by other DoS UNCOPUOS veteran Richard Buenneke of the DoS/AVC, the latter was enclosed in a neutral role. It was therefore necessary for another USG expert group B member to step up and take the lead in defending the unified USG position [US-21]. Although this role usually falls on a NASA representative by default, the frequent change of NASA representatives led the natural selection of a stable and knowledgeable DoD representative, Audrey Schaffer of the OSD/SP [US-21]. Later, during the transition from expert groups to the main working group,

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[68] All information on group members and points of contact can be found in: 'Points of Contact for the Working Group on the Long-Term Sustainability of Outer Space Activities, and Members of Expert Groups A through D' (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 8 February 2013), https://www.unoosa.org/pdf/limited/c1/AC105_C1_2013_CRP18E.pdf.

Ms. Schaffer retained the technical lead, in support to Mr. Hodgkins, "not by design but by default" [US-16]. Another OSD/SP staff is said to have played a prominent role in the development of the LTS, Jessica Tok [US-5]. While Ms. Schaffer's and Ms. Tok's roles were restricted to promoting the unified USG position, their work during the LTS negotiations put the spotlight on the extensive expertise of the DoD on space debris and space surveillance, by far the largest among USG agencies. It can be seen as a demonstration by the DoD of its commitment to the development of international norms of behaviour for the preservation of the outer space environment. However, some experts viewed the DoD's involvement in the LTS negotiation as a way to prevent the adoption of too strict guidelines, that could have a negative impact on US national security.[69]

Although it is a minor event, the lead taken by Ms. Schaffer in the LTS expert group B because NASA was once more not properly fulfilling its responsibilities further strengthens the idea that the DoD is a reluctant participant in STM, taking the lead only if not one else can do it, following a sense of duty inherent to military organisations.

5. Conclusions: full validation of the hypotheses by the US case study

This chapter, core of the dissertation, provided numerous clarifications and explanations of the DoD's internal debates on STM and their impact on USG-wide discussions on STM policymaking.

Thanks to its numerous space experts covering all aspects of law, policy and operational practices, the DoD has earned its place as one of the major space law and policy think-tanks in the USG, on par with, if not superior to NASA. The efficiency of the DoD's involvement in both interagency discussions within the Executive Branch and in congressional debates relies on the perceptions of its counterparts. As often in internal USG discussions on a given issue, a natural emphasis is put on the agency having the most equities. As second largest satellite operator in the world, the DoD is undoubtedly seen by its counterparts as the agency having the most legitimacy in promoting its views. Other reasons for the DoD's ability to shape domestic SSA/STM debates are the deep recognition of its commitment to the long-term sustainability of space and of its unrivalled technological capabilities, the personal influence of well-respected senior military leaders, and the extensive lobbying capabilities of powerful space and defence contractors. Finally, the possibility to invoke the national security or classification "trump

[69] Brian Weeden and Victoria Samson, 'New UN Guidelines For Space Sustainability Are A Big Deal', Breaking Defense, 4 April 2018, https://breakingdefense.com/2018/04/new-un-guidelines-for-space-sustainability-are-a-big-deal/.

cards" gives the DoD what could be assimilated to a veto power. **It is therefore clear that hypothesis 3, reminded below, is fully validated by the US case study:**

Hypothesis 3: military as most influential actor in STM policymaking
[H3.1] If the military opposes a position on space safety and sustainability, then this position is perceived as inacceptable by other agencies involved in domestic decision-making (*absolute proscriptive influence*).
[H3.2] Conversely, if the military supports a position on space safety and sustainability, then this position is perceived very favourably by other agencies involved in domestic decision-making (*strong prescriptive influence*).

While the DoD has a strong influence on domestic STM discussions, it is challenging to clearly identify its views. In fact, the DoD does not have any unified position on the issue, which can be explained by various reasons such as the fact that STM is not an intrinsically military topic, that the DoD has too many internal stakeholders with different rationales and equities. However, the development of an informal structure of "pure space officers", opposed to occasional space officers (usually missileers), contribute to the progressive change of the overall DoD's approach to space safety and sustainability, with a stronger focus given to the transparency of space operations, to the adherence of the DoD's space components to the best international debris mitigation standards as well as the promotion of norms of behaviour in outer space. **Hypothesis 2, reminded below, is therefore also validated by the US case study.**

Hypothesis 2: the need for specialised space officers
The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

In addition, an interesting common characteristic of most space officers is their attachment to operational guidelines, in line with their USAF heritage. Such traditional USAF way of apprehending space operations strongly contributes to DoD space experts' support to the widespread adoption of norms of behaviour in space, although they acknowledge that other agencies, such as the DoC, could be a more appropriate promotion vehicle, in particular at international level. In fact, the behaviour of the DoD in the last 20 years demonstrates that although the DoD is clearly committed to the preservation of the space domain, it is reluctant to directly involve in space safety and sustainability issues.

The first level consists in the provision of space safety services, necessary for the short-term protection of, among others, US national security assets in space. Witnessing the inability of NASA to provide useful large-scale services, numerous senior DoD leaders asked Congress to authorise the USAF to take over the mission. This incursion in civilian responsibilities was a necessary tactical move for the DoD: in short, someone had to do the job and no one else could. However, 20 years later, the assignment by the Trump Administration of space safety responsibilities to the DoC, accompanied with assurances of funding – yet to be approved by the Congress – allowed the DoD to complete the initial plan of its early 2000s' decision-makers: hand over the mission to a competent and legitimate civilian agency. As already explained in Chapter 5, General Cartwright, then JS/J8 director and one of the initiators of the NASA-DoD transfer in the early 2000s, had a long-term vision consisting in bringing space surveillance services in the DoD, giving them maturity thanks to the DoD's extensive technical and budgetary capabilities before handing them over to a civilian agency. This partially validates hypothesis 1 (H1.1 and H1.2.2).

The second level concerns the involvement in space safety and sustainability – or STM – policymaking. Being a new field with limited direct impact on the DoD's space activities, the DoD never positioned itself to be the government lead on an intrinsically regulatory or promotional issue – except its unexpected role during the LTS negotiations, again taking over due to a failure from NASA. Consequently, when the DoC was named as the first ever STM lead in the USG, the DoD did not oppose to be constrained to a support function, hence validating H1.2.2. **Hypothesis 1, reminded below, is therefore also validated by the US case study.**

Hypothesis 1: the military as reluctant leader in space safety and sustainability

[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).

[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

The US case study has provided a full validation of this dissertation's hypotheses. The next chapters then introduce the cases of France and Japan, to investigates if these hypotheses, derived from theories built on the example of the US military (e.g. Janowitz's constabulary force), also hold in other liberal democracies.

Part II

Two representative allied second-rank space powers: France and Japan

Chapter 7. The French military's approach to SSA and STM

Space must not become a Wild West

Florence Parly, Minister of the Armed Forces, France (2019)[1]

Third country to independently launch a satellite in 1965 thanks to successive visionary military leaders, France always took pride in maintaining its strategic autonomy in space. Being both the beating heart of European space initiatives and the most advanced military in the region, it well represents what could be a European approach to space situational awareness (SSA) and space traffic management (STM). In fact, along with other prominent space nations like Italy or Germany, the French space program cannot be limited to national enterprises anymore. The high-level of integration of space initiatives in Europe, starting with the Ariane rocket program, now piloted by the European Space Agency (ESA), and continuing with initiatives of the European Union (EU) such as Galileo and Copernicus, has an impact on all space policy decisions of major European powers. Therefore, through the case of France, it is the case of Europe as a whole that is investigated. Even for technologies as sensitive as those used for SSA, there exist European initiatives such as the ESA SSA Program and the EU Space Surveillance and Tracking (EU SST) program.

Its co-evolving strong reliance on the military uses of space and on further regional integration of space capabilities makes France a very interesting example on how a deeply military issue can be part of inter-state discussions and collaborations. Specifically focussing on the two interrelated issues of SSA and STM, this chapter investigates the role of the French military in both domestic interagency policy discussions and European approach on SSA/STM.

After a presentation of the early years of the French space program and an explanation of the immense contribution of the French military in section 1, section 2 proposes a detailed

[1] Michel Friedling, 'French Space Defence Strategy: Context and Perspectives' (Keynote Speech, International Workshop on Ensuring Stable Use of Outer Space, Tokyo, Japan, 27 February 2020), http://www.jsforum.or.jp/stableuse/pdf/KS-2_20200220_INTERNATIONAL-SYMPOSIUM_Keynote-speech_MGEN-Friedling%20A4.pdf.

analysis of the current and future French SSA capabilities, showing the clear monopoly of the military on space surveillance and tracking, drawing in particular from the latest 2019 Space Defence Strategy. Then, section 3 comments the French whole-of-government approach to SSA, with a focus on European collaboration programs. Section 4, the core of the chapter, delves into the complexities of inter-ministerial processes for the definition of French position on SSA/STM, and evaluates that actual influence exerted by the French military. Then, section 5 briefly comments the participation of the French military in international space law and policy discussions. Finally, section 6 provides a comprehensive analysis of the current re-organisation of French military with regards to space operations, going beyond the official version, before the section 7 concludes on the validity of the initial hypotheses of this dissertation.

1. The military origins of the French space program

The French space program originates from the great motivation of visionary military leaders, who knew how to leverage the pioneering work done by French engineers and scientists in the early 20th century and the intelligence gathered from German missile programs at the end of World War II. They however had to adopt intelligent strategies to maintain research initially opposed by reluctant and short-sighted political leaders.

1.1. *Véronique* and *Astérix*: a military success

Discovering the existence of the German V2 rocket in 1944, the French government adopted the same approach as its American and Russian counterparts by collecting as much information as possible on this exceptional technology, including *in-situ* from 1945. Based on the data brought back from Germany by French scientists and engineers, the Centre for the Study of Self-Propelled Projectiles (CEPA[2]) was established within the Army's Directorate of Armament Studies and Manufacturing (DEFA[3]) on 24 August 1945. However, as early as at the end of 1946, the CEPA's activities were frozen and the overall French military strategy on ballistic missiles was halted. Priority was given to the reconstitution of conventional forces in preparation to the coming Indochina War (December 1946 - July 1954). Even with thin budgets, the CEPA insisted in maintaining a study on the information collected on the V2 from Germany: *Study 4213*. This study however disguised the development of an operational rocket under technological intelligence. Therefore, when the idea of the International Geophysical Year

[2] French acronym of *Centre d'études des projectiles autopropulsés*.
[3] French acronym of *Direction des études et fabrication d'armement*.

(IGY; 1957-1958) started to appear, visionary military leaders at the National Defence Scientific Action Committee (CASDN[4]), pushed by civilian scientists, decided to finalise the development of the rocket studied under *Study 4213*, called *Véronique*, in order to give French scientists the ability to contribute to the international efforts for the observation of the upper atmosphere. At the end of 1957, the CASDN, in the absence of national policy, independently decides to fund 15 *Véronique* rockets.

After the Général de Gaulle came to power in 1958, the French rocket program accelerated with the first two successful flights of *Véronique* rockets and the establishment of the Society for the Study and Development of Ballistic Missiles (SEREB[5]). Although the establishment of the National Centre for Space Studies (CNES[6]) in 1961 progressively increased the civilian side of the French space program, the military continued the development of launch vehicles, in particular with its *Precious Stones* program (*Programme Pierre Précieuses*). It is in fact with the launch of the military *Diamant* rocket that France became the third nation to independently launch a satellite, Astérix on 26 November 1965, after the Soviet Union in 1957 and the US in 1958.[7]

1.2. The dual nature of the French space agency

An important defining element of the French space agency CNES is its dual nature. Compared to the US clear differentiation between NASA's civilian activities and the DoD's military applications, the budgetary constraints of a middle-ranking power like France imposed the concentration of both civil and military space expertise in a single structure. It was therefore chosen to establish CNES under three "tutelar authorities"[8]: the ministry in charge of space affairs, the ministry in charge of research and the ministry in charge of defence. Currently it means that CNES is under the administrative supervision of the Ministry of Higher Education, Research and Innovation (MESRI) for the two counts of 'space' and 'research' and the Ministry of Armed Forces for 'defence', delegated to the Defence Procurement Agency (DGA[9]).[10]

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4 French acronym of *Comité d'action scientifique de la Défense nationale*.
5 French acronym of *Société pour l'étude et la réalisation d'engins balistiques*.
6 French acronym of *Centre National d'Études Spatiales*.
7 A comprehensive history of the early steps of the French space program can be found in : Philippe Varnoteaux, 'La part du CNRS dans les débuts de la conquête de l'espace (1945-1965)', *La revue pour l'histoire du CNRS*, no. 6 (2002), https://doi.org/10.4000/histoire-cnrs.3601; Philippe Varnoteaux, 'La naissance de la politique spatiale française', *Vingtième Siècle. Revue d'histoire* 77, no. 1 (2003): 59–68, https://doi.org/10.3917/ving.077.0059.
8 In French: "Autorité de tutelle"
9 French acronym of *Délégation Générale pour l'Armement*, in English *General Delegation for Armament*.
10 'Décret n°84-510 du 28 juin 1984 relatif au Centre national d'études spatiales' (Premier Ministre, 28 June 1984),

Table 9-1 shows the sources of CNES budget as defined in the annual *Finance Law* in which the Parliament (National Assembly and Senate) appropriates all government activities.

Table 7-1. Sources of CNES budget

Program in annual Finance Law	*Supervising ministry*
172 – Multidisciplinary Scientific and Technological Research	MESRI
193 – Space Research	MESRI
191 – Dual Use Research (Civil and Military)	MINARM
144 – Defence Policy Environment and Forecasting	MINARM
146 – Forces Equipment[11]	MINARM

The main source of CNES funding is Program 193, representing more than 80% of the national space budget with in average 1.1 to 1.4 billion euros for CNES's contribution to the European Space Agency (ESA), 550 to 600 millions for CNES's own programs and 60 to 90 millions for the French national meteorological agency's (Météo France) contribution to the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) [FR-6].

Since the beginning of the military uses of space in France in the 1980s, and in particular since the launch of intelligence-gathering satellites (IGS) Helios-1 in 1995, the MINARM has delegated all control operations to CNES, currently the most knowledgeable institution on space operations in the French government. It is again a major difference with the US where each organisation (e.g. NASA, DoD, NOAA, intelligence agencies) independently operates its own satellites. With regards to space activities, the MINARM has minimal capabilities and a very limited budget [FR-1]. Specific details on SSA activities are explained in a later section.

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https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000337492&categorieLien=cid. Art. 1: "Le centre national d'études spatiales est placé sous la tutelle du ministre de la défense, du ministre chargé de l'espace et du ministre chargé de la recherche"

[11] In French: *172 - Recherches scientifiques et technologiques pluridisciplinaires ; 193 - Recherche spatiale ; 191 - Recherche duale (civile et militaire) ; 144 - Environnement et prospective de la politique de défense ; 146 - Équipement des forces.*

1.3. Limited interest for space in the French Armed Forces

While MINARM interviewees clearly stated the understanding of the strategic importance of outer space in the French Armed Forces [FR-2,3,4], other opposed this vision. The latter described space as of secondary importance in the minds of the leaders of the French Armed Forces. According to them, the clear domination of the Army on the French military ecosystem limits the focus on space to surveillance and communication satellites – thanks to the Navy's push to the Syracuse Program[12] – but clearly excludes space surveillance from the picture, in favour of traditional ground equipment [FR-1,5]: "for them [Army leaders], a new radar means less assault rifles and less shielded vehicles" [FR-1]. In fact, the Army represents more than half of all French military personnel (55.5% as of 2018)[13] and since the end of conscription in 1997 and the subsequent professionalisation of the French armed forces, five Chiefs of Defense Staff[14] out of six were Army generals. Therefore, the only important moves towards an increase of French space surveillance capabilities can be credited to political leaders, in particular President Nicolas Sarkozy (2007-2012) and President Emmanuel Macron (2017-) [FR-1].

Ordered by President Sarkozy right after his election, the 2008 French White Paper on Defence and National Security clearly mentioned the importance of space surveillance to protect strategic national space assets, on which the French military is heavily dependent.[15] Having a good strategic vision of the military use of space, President Sarkozy and his government pushed for the creation of a joint space command and the establishment of an "advanced space surveillance system" including a long-range space surveillance radar and a space-based SSA system [FR-1]. Even with the great motivation and influence of President Sarkozy, the project of advanced SSA system did not come to fruition due to the opposition of then-Chief of Defence Staff Army General Jean-Louis Georgelin who later reluctantly established the Joint Space Command (CIE[16]) but making it "without arms nor legs" [FR-1]. Space security analyst Xavier Pasco provides some nuance by explaining that despite its modest

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[12] Syracuse is a French military communication program involving satellites and ground segments, initiated in 1984 to provide secured communication channels between France and all military theatres of operations abroad. The fourth generation of Syracuse satellites is currently under development.
[13] 'Defense 2018: Key Figures' (Paris, France: Ministère des Armées, 2018), 16, https://www.defense.gouv.fr/content/download/542046/9287765/file/Defense%20Key%20Figures%202018.pdf.
[14] The Chief of the Defence Staff is the most senior military officer in the French Armed Forces (OF-9), called in French *Chef d'État-Major des Armées* (literally *Chief of Staff of the Armies*).
[15] *The French White Paper on Defence and National Security* (New York: Odile Jacob Publishing Corporation, 2008), 178–79, https://web.archive.org/web/20111118135452/http://merln.ndu.edu/whitepapers/France_English2008.pdf.
[16] French acronym of *Commandement Interarmées de l'Espace*.

size (around 30 staff), the CIE has proved efficient in coordinating space support to French military operations by leveraging its status of joint structure under the direct responsibility of the Chief of Defense Staff. He identifies the *Serval Operation* against Islamic jihadists in Northern Mali (2013-2014) as the first large-scale use of space technology for a French foreign intervention, followed by numerous other successful ones.[17]

The second attempt to enhance French military space capabilities, including space surveillance, was initiated by President Macron[18] when he requested the 2019 Space Defense Strategy (SDS2019).[19] Piloted by the Minister of the Armed Forces Florence Parly, it recommends the development of numerous capacities, including space surveillance as described later, and the upgrade of the CIE. Following the presentation of the report's conclusions, President Macron established the Space Command (CDE[20]) to replace the CIE by incorporating the few CIE staff with the other space-related officers spread in various divisions of the MINARM [FR-2,3,4], for a current total of around 230 staff, expected to grow to 500 by 2025. To outline the low importance of space for the French Armed Forces, FR-1 ironically pointed out that there are less space experts in the whole MINARM than musicians in the French Air Force Band (*Musique de l'Air*), before adding that the CDE may not survive a defeat of President Macron at the 2022 Presidential Elections or at least be weakened again to resemble the former CIE [FR-1]. MINARM interviewees strongly opposed this view [FR-2,3,4].

Detailed analyses of the respective roles and responsibilities of the CIE and the CDE are provided in section 6.

2. French space surveillance capabilities

After the United States and Russia, France has been one of the leading countries in the development of SSA capabilities, *a fortiori* military ones. This section introduces the past, current and future capabilities at the disposal of the French government.

[17] Xavier Pasco, 'A New French Space Command', *Space Alert* VII, no. 4 (September 2019): 2–3.
[18] The unusually close relationship between Presidents Macron and Sarkozy could be seen as a reason for this similarity of approach.
[19] 'Stratégie Spatiale de Défense : Rapport du groupe de travail « Espace »' (Paris, France: Ministère des Armées, July 2019), https://www.defense.gouv.fr/content/download/563618/9727385/Strate%CC%81gie%20spatiale%20de%20de%CC%81fense%202019.pdf.
[20] French acronym of *Commandement de l'Espace*.

2.1. No consensus on definitions of SSA in the French government

First of all, it is necessary to specify that there is no consensus over the definition of SSA in the French government, that can be source of confusion [FR-1]. The government as a whole, led on space issues by the MESRI, considers SSA as the combination of space surveillance and tracking (SST), space weather monitoring and forecasting, and Near-Earth object detection. It is aligned with the definition used by European Union (EU) institutions. The MINARM on the other hand equals SSA to SST. Interviewee FR-1 praised the clarification made by the US military with the use of space domain awareness (SDA) instead of the confusing SSA and would welcome a similar initiative of the MINARM [FR-1].

2.2. Historical development of SSA capabilities in France

According to a 2019 parliamentary report, the development of SSA capabilities in France was motivated primarily by "imperious reasons of strategic autonomy (…), the possession of space surveillance and cataloguing capabilities assuming great stakes of sovereignty".[21] In fact, on 24 July 1996, French military satellite Cerise, operated on behalf of the French Armed Forces by UK company Surrey Satellite Technology suddenly started to spin out-of-control. Unable to understand the situation due to its lack of space surveillance capabilities, France had to request the support of NASA and of the UK Space Track Network, which identified that the satellite was damaged by a piece of debris coming from an abandoned third stage of Ariane 1 rocket launched ten years earlier in 1986, making Cerise "space's first confirmed victim of a hit-and-run accident."[22] It therefore made the French government realise the importance to have autonomous space surveillance capabilities and motivated the establishment of the GRAVES system presented below.[23]

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[21] "impérieuses raisons d'autonomie stratégique (…), la possession de capacités d'observation spatiale et de tenue de catalogue revêt ainsi un grand enjeu de souveraineté" in Olivier Becht and Stéphane Trompille, 'Rapport d'Information déposé en application de l'article 145 du Règlement par la Commission de la Défense Nationale et des Forces Armées en conclusion des travaux d'une mission d'information sur le secteur spatial de défense' (Paris, France: Assemblée Nationale, 2019), 23, http://www.assemblee-nationale.fr/dyn/15/rapports/cion_def/l15b1574_rapport-information.pdf.

[22] Mark Ward, 'Satellite Injured in Space Wreck', New Scientist, 24 August 1996, https://www.newscientist.com/article/mg15120440-400-satellite-injured-in-space-wreck/.

[23] Becht and Trompille, 'Rapport d'Information déposé en application de l'article 145 du Règlement par la Commission de la Défense Nationale et des Forces Armées en conclusion des travaux d'une mission d'information sur le secteur spatial de défense', 23–24.

2.3. Current French SSA capabilities

With the exception of GRAVES, most existing French SSA capabilities were not originally developed for SSA purposes. In particular, Air Force SATAM radars and the Navy's *Monge* tracking ship are primarily used for trajectory analysis during French – strategic – missile tests and the optical telescopes operated by CNES were initially built for scientific research before being applied to GEO surveillance. All existing capabilities are presented below.

2.3.1. The Air Force's GRAVES system

The core of the French SSA capabilities is the GRAVES[24] system, operated by the Air Force's Air Defense and Operations Command (CDAOA[25]) since November 2005. Funded by the DGA and developed by the French Aerospace Lab (ONERA[26]) over 15 years, GRAVES is a bistatic radar used by the CDAOA's Operations Centre for the Military Surveillance of Space Objects (COSMOS[27]) to detect space objects located between 400 and 1000 km altitude,[28] with a radar cross section superior to 1 sqm.[29] GRAVES currently maintains a catalogue of 3000 objects in this orbital range, including 900 active satellites.[30] The GRAVES system is distributed over three locations in metropolitan France:[31]

- The emission site in Burgundy, where the radar signal is emitted towards outer space.
- The reception site in Provence, where the reflected signal is received, containing all necessary information for the detection of space objects.
- The analysis centre – the COSMOS – in the suburbs of Lyon, were the data is processes to support military space operations.

As mentioned in 2.2, a recent parliamentary report presented the idea of a conscious planning of the GRAVES system. While there is undeniably some truth is the understanding of decision-makers of the benefits of independent space surveillance capabilities, interviewee FR-1 opposes this idea, by explaining that GRAVES was not part of military programming but that

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24 Acronym of *Grand Réseau Adapté à la VEille Spatiale*, in English *Large Network Adapted to Space Surveillance*.
25 French acronym of *Commandement de la défense aérienne et des opérations aériennes*.
26 French acronym of *Office National d'Études et de Recherches Aérospatiales*, in English *National Office for Aerospace Studies and Research*.
27 French acronym of *Centre Opérationnel de Surveillance Militaire des Objets Spatiaux*.
28 'COSMOS arrive officiellement sur la BA 942', Ministère des Armées, 1 October 2014, https://www.defense.gouv.fr/actualites/communaute-defense/cosmos-arrive-officiellement-sur-la-ba-942.
29 Bastien Delprat, 'Surveillance et sécurité des objets spatiaux : le radar GRAVES', Pensée Mili-Terre, 6 October 2018, https://www.penseemiliterre.fr/article-niv4_1013077.html.
30 Delprat.
31 Delprat.

the Air Force simply seized the opportunity to take over a particularly successful ONERA experimental program [FR-1]. It was in fact corroborated by other interviews: the development of the GRAVES system was funded under Program 144 *Upstream Programs*, action item 07 *Defence Forecasting*, sub-action item 07-03 *Upstream Studies*,[32] administered by the DGA [FR-4].

2.3.2. Other national capabilities

The French government possesses additional SSA capabilities completing the GRAVES system, namely:

- For the precise tracking of LEO space objects identified by the GRAVES system, the French Air Force operates three SATAM[33] tracking radars, which original purpose is the tracking of aircraft and missiles.[34] These radars do not have the ability to handle a large number of objects like GRAVES and are therefore used as a complement, to refine the trajectory of specific objects.[35]
- For the monitoring of activities on orbits higher than those monitorable by GRAVES and SATAM (above 1000 km), in particular the GEO belt, the French government can rely on the network of TAROT[36] telescopes owned by the National Scientific Research Centre (CNRS[37]) in Chile, Southern France and Réunion Island, operated by the CNES.[38]
- A third tracking tool used by the French military is the Navy's tracking ship *Monge*[39] equipped with numerous sensors – mostly radars – and which main purpose is to analyse the trajectory of French nuclear missiles during test campaigns.
- For GEO objects monitoring, the French government also relies on a network of six telescopes developed, owned and operated by Ariane Group called *GEOTracker*, located in France, Spain and Australia.

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32 In French: *Action 07 - Prospective de Défense, Sous-Action 07-03 - Études Amont.*
33 French acronym of *Système d'Acquisition et de Trajectographie des Avions et des Munitions*, in English *Aircraft and Ammunition Acquisition and Trajectography System.*
34 Delprat, 'Surveillance et sécurité des objets spatiaux : le radar GRAVES'.
35 Becht and Trompille, 'Rapport d'Information déposé en application de l'article 145 du Règlement par la Commission de la Défense Nationale et des Forces Armées en conclusion des travaux d'une mission d'information sur le secteur spatial de défense', 22.
36 French acronym of *Télescope à action rapide pour les objets transitoires*, in English *Rapid-Action Telescope for Transitory Objects.*
37 French acronym of *Centre National de la Recherche Scientifique.*
38 Delprat, 'Surveillance et sécurité des objets spatiaux : le radar GRAVES'.
39 Named after Gaspard Monge, Comte de Péluse (1746-1818), prominent French mathematician and politician under the French Revolution and First Empire.

A map of the French SSA network is presented on Figure 7-1.

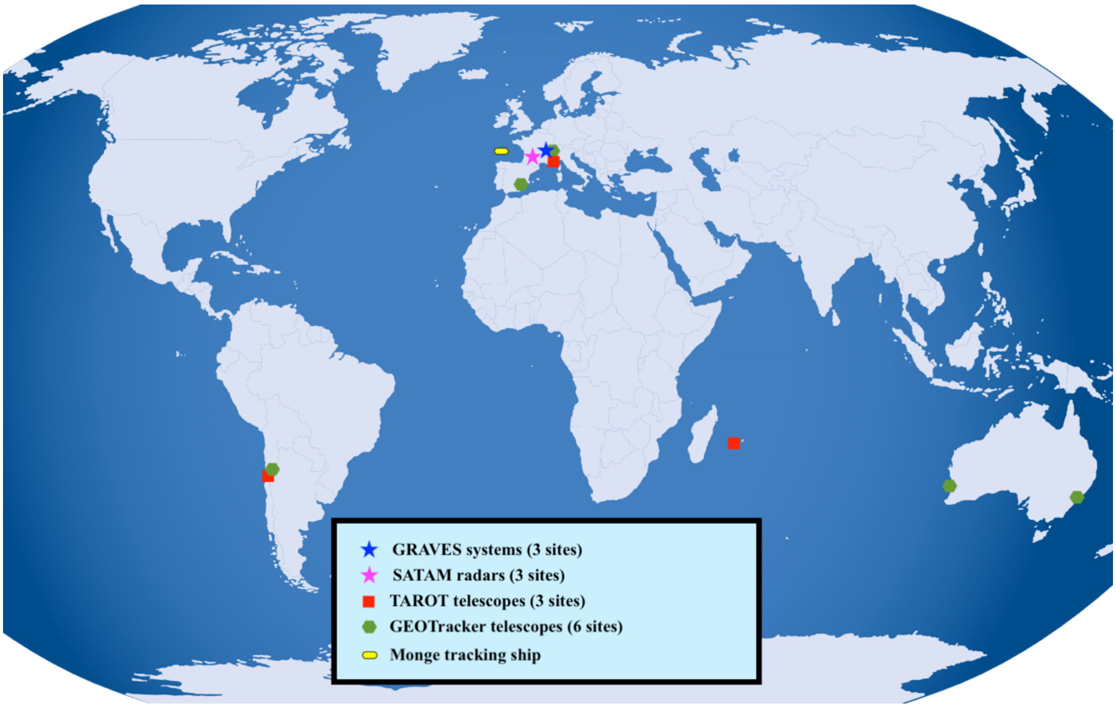

Figure 7-1. French government SSA network[40]

2.4. Future plans for French SSA capabilities

The quickly changing nature of the outer space environment prompts the French government to upgrade its existing capabilities.

2.4.1. Challenges to the current capabilities

When the GRAVES system was developed in the late 1990s and early 2000s, the outer space environment was radically different from now. In particular, the nanosatellite revolution had not yet occurred, leading to the surge of barely detectable and uncontrollable objects in LEO. The choice made at the time of a frequency of 143 MHz, adapted to the detection of objects with a radar cross section superior to 1 sqm was perfectly understandable but is now inappropriate for the detection of objects in the submeter range. GRAVES therefore requires urgent modernisation to cope with this new space environment.[41] In December 2016, understanding and acknowledging this review, Bruno Sainjon, then-CEO of ONERA, the agency having built the GRAVES system, announced having signed a contract with the defence

[40] Developed by the author based on multiple sources.
[41] Delprat, 'Surveillance et sécurité des objets spatiaux : le radar GRAVES'.

procurement agency DGA for an upgrade of the system in order to increase its performances and keep it running until 2030.[42]

2.4.2. Planned upgrade of French capabilities

The planned upgrade of French space surveillance capabilities is fully defined in the SDS2019, only existing authoritative source on the subject. It outlines the following projects:

- The announcement of the upgrade of the GRAVES system described in the previous section is reaffirmed in the SDS2019, and its completion confirmed for 2022.[43] It also announces the allocation of credits for the "successor of GRAVES" from 2025.[44] The desire of the MINARM would be to be able to detect and track objects down to 10 cm size.
- SATAM tracking radars will be renovated as part of the Military Programming Law 2019-2025[45] and planned to be replaced in 2030.[46]
- An "evaluation of industrial projects of observation of space from space", precursor to potential French space based SSA capabilities.[47]
- The progressive establishment of "future autonomous European space capabilities" around a French-German core".[48]

3. French government approach to SSA utilisation and sharing

The previous sections showed that France has extensive SSA capabilities, rivalled only by the United States, Russia and China, but what is the actual approach of the French government with regards to SSA utilisation and sharing?

3.1. Governmental utilisation of SSA data

French governmental SSA date is primarily collected by the MINARM thanks to its extensive capabilities presented in 2.3, in particular the GRAVES radar. As for the processing of the data, both the CNES and the MINARM are involved in different roles based on what is

[42] 'GRAVES : vers une surveillance spatiale française plus performante' (Office National d'Études et de Recherches Aérospatiales, 12 December 2016), https://www.onera.fr/sites/default/files/communiques/pdf/2017-06/20161212-CP-Graves-ONERA.pdf.
[43] 'Stratégie Spatiale de Défense 2019', 50.
[44] 'Stratégie Spatiale de Défense 2019', 50.
[45] In France, military programming is governed by a pluriannual Military Programming Law (*Loi de Programmation Militaire*) covering four, five or six years.
[46] 'Stratégie Spatiale de Défense 2019', 51.
[47] 'Stratégie Spatiale de Défense 2019', 13.
[48] 'Stratégie Spatiale de Défense 2019', 11.

facing the French asset in question: a risk or a threat. Risk analyses, like collision avoidance, are carried out by the CNES, while threat analyses fall under the responsibility of the MINARM [FR-7].

The MINARM focusses on highly sensitive tasks related to intelligence gathering and characterisation. The Military Intelligence Directorate (DRM[49]) serves as the MINARM's node for the characterisation of threats and hostile assets in outer space, in collaboration with the COSMOS, being the structure handling classified SSA data for the French government [FR-1]. The CNES can occasionally be associated with intelligence missions via specific requests to analyse objects that the COSMOS and the DRM cannot track properly (e.g. the Luch-Olymp Russian spy communication satellite) [FR-1].

For all low-sensitivity tasks having to deal with safety rather than security, the CNES is the core agency. The CNES gets most of the SSA data, as well as necessary information on satellite operations, via a secured linked between the COSMOS and its main data processing centre [FR-1]. This includes unclassified data obtained from the US military through an SSA sharing agreement. In fact, most of the SSA data – including US – is analysed by CNES using its CAESAR (*Conjunction Analysis and Evaluation Service, Alerts and Recommendations*) tool. These technical abilities for data processing and analysis (risk estimation, conjunction assessment, computation of collision avoidance manoeuvres, etc.) make CNES the primary agency in the French government in terms of trajectory analysis knowledge [FR-1].

For what concerns data and information sharing with non-governmental entities, the CNES is using its CAESAR tool, initially designated as a "trial public service provided by CNES" when it was launched in mid-2012. In order to benefit from this service, satellite operators – not restricted to French or European entities – should sign a contract with CNES.[50] As of February 2019, CAESAR was providing SSA services to 106 satellites worldwide, through the EU SST (cf. 3.2.2).[51]

3.2. Participation in European SSA initiatives

The SDS2019 emphasises the development of SSA capabilities at European level – while acknowledging the current limits of the EU SST. This section presents past and current

[49] French acronym of *Direction du Renseignement Militaire.*
[50] 'CAESAR | Préservation de l'environnement Spatial', Centre National d'Études Spatiales, accessed 19 April 2020, https://debris-spatiaux.cnes.fr/en/node/179.
[51] Laurent Francillout, '2018 Space Debris Activities in France: Highlights' (56th Session of the UNCOPUOS Science and Technology Subcommittee, Vienna, Austria, February 2019), 4, https://www.unoosa.org/documents/pdf/copuos/stsc/2019/tech-23E.pdf.

initiatives for a European SSA infrastructure and their importance in the overall French military strategy.

3.2.1. The ESA's SSA Program

The ESA's SSA Program was initiated in 2009 to develop an independent European SSA architecture, currently approved up to 2020. In the ESA definition, SSA includes space weather, the detection of near-Earth objects and SST.[52] France has been part of the 19 states having participated in the establishment and funding of this optional ESA program.[53] However, the MESRI, in charge of coordinating the French participation in the ESA SSA Program as it falls under budget Program 193, decided that France would stop supporting the ESA SSA due to years of poor management and very limited results [FR-6]. The prominent role that the ESA SSA program was expected to play in the creation of strong European autonomous SST capabilities is now entrusted to the EU SST.

3.2.2. The EU SST Support Framework

The EU SST Support Framework (thereinafter EU SST) was established on 16 April 2014 by the *Decision No. 541/2014/EU of the European Parliament and of the Council*.[54] It was set up following an "institutional approach" by creating an intergovernmental structure, composed of some EU member states leading the SSA domain like France and Germany, for the integration of the resources and expertise of the European scientific, commercial and military communities, in order to take into account the duality and the security dimension of the SSA domain and to reach a higher level of strategic autonomy in Europe [FR-7]. It is believed by its creators to be different from the commercially driven approach chosen by the US government and entrusted to the Department of Commerce [FR-7]. Moreover, the EU SST focusses on providing a service, similarly as the Galileo and Copernicus flagship programs [FR-7]. While these three programs do involve the development of assets, their primary purpose is to offer high quality operational services to European users.

The SDS2019 specifies that the EU SST "is at this stage not fully satisfactory" but without providing any context to this comment.[55] MINARM officials interviewed by the author explained that the main reproach to be made to the EU SST is its very slow establishment. In

[52] 'SSA Programme Overview', European Space Agency, 2020, https://www.esa.int/Safety_Security/SSA_Programme_overview.
[53] Optional programs are not part of the mandatory funding provided by all ESA member states.
[54] 'Decision No 541/2014/EU'.
[55] 'Stratégie Spatiale de Défense 2019', 51.

fact, France has for a long time played the lonely role of engine of the program, until it finally changed in late 2019 with a major increase of the British and Spanish contribution [FR-2,3,4]. Moreover, the overall governance of the program is thought to be rather "unclear" [FR-8].

3.2.3. Strategic collaboration with Germany

The SDS2019 gives a great importance to the strategic relationship with Germany. In fact, it envisions European cooperation "from a Franco-German core around complementary SSA means, in order to constitute the base of future autonomous European space capabilities."[56]

The primary reason is the great complementarity between the French and German systems. As explained in section 2.2, the French GRAVES system, while being one of the most advanced detection systems in the world, has limited tracking capabilities and therefore needs to be complemented by SATAM tracking radars. Since 2006, a bilateral cooperation agreement also allows the combination of GRAVES observations with those of the German space observation radar TIRA (*Tracking and Imaging Radar*), developed and operated by the Fraunhofer Institutes.[57] Moreover, the DLR is currently developing the *German Experimental Space Surveillance and Tracking Radar* (GESTRA) system, having provided its first observations in late 2019 for an official entry into service in 2020.[58] As its name indicates it will bring advanced tracking capabilities, seen by the French military as the natural complement to GRAVES "and its successor".[59]

Moreover, it is important to specify that, although not focussing on SSA, French-German collaboration on military observation satellite development and utilisation has a longstanding history. Relying on each country's comparative advantage, optical observation for France and radar observation for Germany, the two countries signed in 2002 a bilateral agreement on various defence issues in Schwerin (colloquially known as the *Schwerin Agreements)*, putting into stone the development of complementary capabilities to avoid unnecessary duplication of efforts. This led to the further specialisation of both countries and the development of two

[56] "Une coopération au niveau européen sera principalement recherchée à partir d'un noyau franco-allemand autour de moyens complémentaires de SSA, en vue de constituer le socle d'une future capacité spatiale autonome européenne" in 'Stratégie Spatiale de Défense 2019', 11.
[57] Patricia McCormick, 'Space Situational Awareness in Europe: The Fractures and the Federative Aspects of European Space Efforts', *Astropolitics: The International Journal of Space Politics & Policy* 13, no. 1 (2015): 46–47, https://doi.org/10.1080/14777622.2015.1012002; Marie-Madeleine de Maack, 'Entre Confrontation et Coopération pour l'Utilisation d'un Terrain Stratégique, l'Espace Extra-Atmosphérique', *Stratégique* 2013/1, no. 102 (2013): 438.
[58] 'GESTRA Space Radar Passes Its First Test', German Aerospace Center (DLR), 29 November 2019, https://www.dlr.de/content/en/articles/news/2019/04/20191129_latest-radar-technology.html.
[59] 'Stratégie Spatiale de Défense 2019', 36.

generations of satellites: at first, the French *Helios*-class optical IGS and the German *SARLupe*-class radar IGS, and the currently ongoing development of their successors *CSO* and *SARah*.[60]

It is however important to specify that there is a natural tendency for French authorities to include bilateral cooperation with Germany in national strategy without preliminary discussion or at least agreement with the said-partner [FR-1]. This is typical of the usual difference of approach between France and Germany: while French authorities proceed vertically by deciding first and then announcing their position, German authorities usually announces a topic of political interest before initiating horizontal concertation for defining their position [FR-2,3,4].

3.3. SSA data and information sharing with the US

Apart from European SSA initiatives, France has a strong partnership with the US for SSA data and information exchange through the US military's SSA Sharing Program. CNES also recently initiated discussions with the Department of Commerce for future collaboration.

3.3.1. The US SSA Sharing Program

The CIE and the US Strategic Command (USSTRATCOM) signed in January 2014 an SSA sharing agreement covering unclassified data. In April 2015 however, the agreement was expanded in order to include exchanges of classified data.[61] According to a 2019 French parliamentary report, although the data provided by the US is the most comprehensive in the world, it however contain some "erroneous or imprecise information", that can be corrected or at least improved by GRAVES measurements. It therefore concludes that "far from being redundant, French and American capabilities are deeply complementary".[62]

[60] The whole cooperation is not perfect though as Germany violated in 2017 the Schwerin Agreements by ordering optical IGS to its domestic satellite manufacturing giant OHB, after another attempted violation in 2009. Germany however defended itself by explain that the optical IGS was ordered by the BND, the national intelligence services under the supervision of the chancellery and that, as a civilian agency, it was therefore not covered by the Schwerin Agreements [FR-1]. More information in Michel Cabirol, 'Observation spatiale : quand l'Allemagne se joue de la France', La Tribune, 8 December 2017, https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/observation-spatiale-quand-l-allemagne-se-joue-de-la-france-760854.html.

[61] Mike Gruss, 'US, France Expand Space Situational Awareness Data-Sharing Agreement', SpaceNews.com, 16 April 2015, https://spacenews.com/us-france-expand-space-data-sharing-agreement/.

[62] Becht and Trompille, 'Rapport d'Information déposé en application de l'article 145 du Règlement par la Commission de la Défense Nationale et des Forces Armées en conclusion des travaux d'une mission d'information sur le secteur spatial de défense', 24.

In addition, the ability to independently operate a large-scale SSA network "allowed France to regain the conditions of a more balanced dialogue with the United States".[63] Having been able to identify and precisely track US national security assets in space, the French government was able to exchange its discretion with the assurance from the US government of the non-disclosure of the location of French key military assets (e.g. Hélios-2, Syracuse-2 and Essaim).

Finally, France is one of the few countries officially collaborating with the US Space Command's Combined Space Operations Command (CSpOC), in charge of "execut[ing] the operational command and control of space forces to achieve theatre and global objectives".[64] As such, France is believed to be one of the very few nations having been provided with the classified part of the US Defense Space Strategy of June 2020.[65]

3.3.2. Future relations between CNES and the US Department of Commerce

On 23 October 2019, during the 70th International Astronautical Congress in Washington, DC, Secretary of Commerce Wilbur Ross and CNES President Jean-Yves Le Gall signed a letter of intent (LoI) "for collaboration on space situational awareness and space traffic management".[66] It included working towards the sharing of SSA information, the development of a vision on STM and the signing of a memorandum of understanding in the near future.[67] The signature of this LoI was however received quite coldly in France and Europe, seeing it as a unilateral decision of CNES to work with the US on the establishment of an STM framework. CNES's supervisory authority on civil matters, the MESRI, cautious about the use of a vague concept like STM, admonished CNES for its uncoordinated decision to sign this LoI and specifically instructed it "not to go further" in its collaboration with the DoC [FR-6]. Other government agencies involved in the issue did not appreciate CNES's move either [FR-8].

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[63] a permis à la France de retrouver avec les États-Unis les conditions d'un dialogue plus équilibré" in Becht and Trompille, 24.

[64] 'USSPACECOM Expands Key Allied Space Partnerships through Multi-Nation', United States Space Command, 27 December 2019, http://www.spacecom.mil/MEDIA/NEWS-ARTICLES/Article/2047780/usspacecom-expands-key-allied-space-partnerships-through-multi-nation-operations/.

[65] Theresa Hitchens, 'DoD Space Strategy Focuses On Allies, Commercial; Where Was Intel Community?', Breaking Defense, 17 June 2020, https://breakingdefense.com/2020/06/dod-space-strategy-focuses-on-allies-commercial-where-was-intel-community/.

[66] John Sheldon, 'France's CNES And U.S. Department Of Commerce Sign Agreement Opening Up Cooperation On SSA And Space Traffic Management', SpaceWatch.Global, 28 October 2019, https://spacewatch.global/2019/10/frances-cnes-and-u-s-department-of-commerce-sign-agreement-opening-up-cooperation-on-ssa-and-space-traffic-management/.

[67] The scan of the LoI is available at https://www.commerce.gov/sites/default/files/2019-10/DeclarationofIntentDOCCNES.pdf (accessed 26 February 2020).

Using the term STM was a mistake that led to misinterpretations from both national and European partners, even if the LoI's text was actually quite clear in its understanding of STM as civil SSA. In fact, one of the objectives written in the LoI clearly rules out the regulatory aspects often included in STM and that created heated reactions in Europe:

> "c. Discussions with the view to share our common understanding and objectives of STM, while acknowledging that international regulation in space traffic management is neither necessary nor desirable in the short term".[68]

4. Inter-ministerial processes for space policymaking

Two elements should be taken into consideration when analysing French government decision-making processes. Firstly, the French Fifth Republic is characterised by a strong imbalance between a powerful executive branch and a weak legislative one - except on rare *cohabitation* periods. It is for this reason and not based on a choice of the author that all decision-making processes described in this section exclude the National Assembly and the Senate. Secondly, the French government being quite small – in particular if compared with the US government – inter-ministerial discussions usually do not require the formality of American ones, as only a handful of experts need to interact.

4.1. Brief introduction to the French legal framework for space activities

The French legal framework for space activities primarily relies on the 2008 national space law as well as the endorsement of international rules and norms.

4.1.1. The 2008 Law on Space Activities

The legal basis of all activities under the responsibility of the French state is the *Law n°2008-518 of 3 June 2008 on space activities* (LOS2008).[69] By defining "space operators" and "space operations", it clarifies the conditions under which a given activity requires a license from the French authorities and defines related licensing procedures. In particular, it indicates that the licenses granted by the French government can be associated with a set of "prescriptions

[68] CNES-DoC LoI, 1.
[69] 'Loi n°2008-518 du 3 juin 2008 relative aux opérations spatiales' (République Française, 3 June 2008), https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000018931380.

enacted in the interest of the safety of people and goods and of the preservation of public health and the environment, especially with the goal to mitigate the risks related to space debris".[70]

The LOS2008 was then supplemented by technical guidelines in March 2011.[71] These guidelines define all the technical requirements based on which the French government provides authorisations, after a technical review and recommendation by the CNES. Requirements include the production of an environmental impact assessment report (art. 8), with a focus on space debris (art. 21), on-orbit collisions (art. 22), among others.

Finally, as requested by President Macron and Minister Parly, and reaffirmed in the SDS2019, a working group was established for the revision of the LOS2008, mostly for military considerations [FR-2,3,4]. Figure 7-2 shows the organisations involved in the working group.

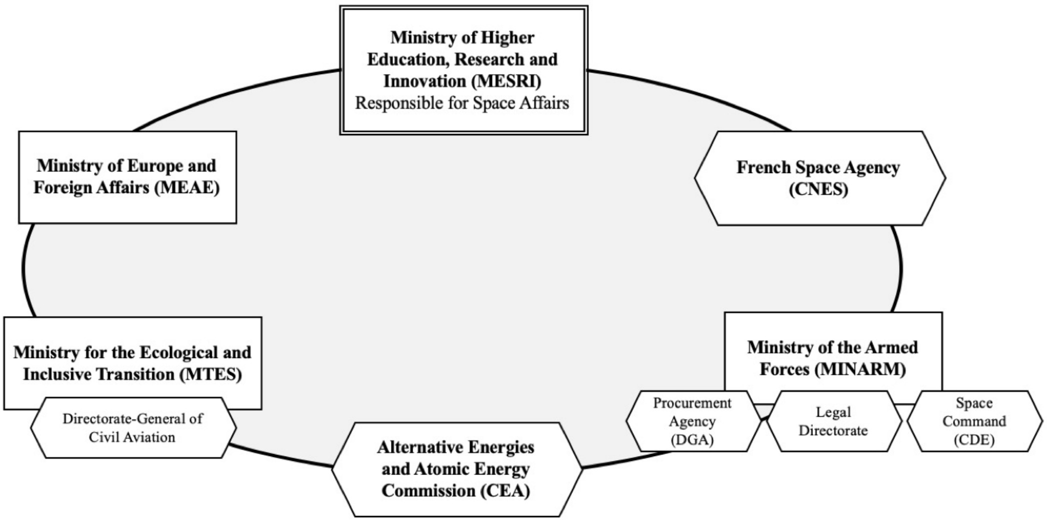

Figure 7-2. Inter-ministerial working group on LOS2008 revision

Piloted by the MESRI, ministry in charge of space, the working group primarily consists of experts from CNES, from the MINARM and the Ministry of Europe and Foreign Affairs (MEAE[72]). Other minor participants are the Alternative Energies and Atomic Energy

[70] "Les autorisations délivrées en application de la présente loi peuvent être assorties de prescriptions édictées dans l'intérêt de la sécurité des personnes et des biens et de la protection de la santé publique et de l'environnement, notamment en vue de limiter les risques liés aux débris spatiaux" in 'Loi n°2008-518 du 3 juin 2008'. Art. 5.

[71] 'Arrêté du 31 mars 2011 relatif à la réglementation technique en application du décret n° 2009-643 du 9 juin 2009 relatif aux autorisations délivrées en application de la loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales' (République Française, 31 March 2011), https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000024095828&fastPos=2&fastReqId=1249436313&categorieLien=cid&oldAction=rechTexte.

[72] French acronym of *Ministère de l'Europe and des Affaires Étrangères.*

Commission (for specific considerations on nuclear power sources in space) and the Directorate-General of Civil Aviation.

4.1.2. Endorsement of international rules and norms

Beyond its ratification of all major space law treaties – including a barely understandable signing of the Moon Agreement – and its involvement in all UN discussions on space since their inception, France is directly participating in numerous fora aimed to developed rules and norms for the long-term sustainability of space. Through CNES, it is a founding member of both the Inter-Agency Debris Coordination Committee (IADC)[73] and of the Consultative Committee for Space Data Systems (CCSDS),[74] and it is part of the International Organisation for Standardisation's working group on space systems and operations.[75]

4.2. Structure of inter-ministerial SSA/STM policy discussions

First of all, let us directly clarify an important point about the current space policy situation in France: there is no official interagency structure to discuss SSA and STM issues as such [all interviewees]. STM does not involve any informal coordination either, as even its definition is subject to debate. In fact, there is no paragraph on STM in the current draft revision of the LOS2008 (not yet released), as the topic is considered "not mature enough" [FR-3].

The absence of official inter-ministerial committee on SSA issues is due to the absence of a dedicated European SSA programme until now, compared to the two large EU flagships programs Galileo and Copernicus which have dedicated committees. This situation will change in the next EU space programme 2021-2027 where SSA will become the third flagship programme of the European union [FR-7]. A certain coordination framework was however developed, mostly between CNES – the most proactive organisation in inter-ministerial discussions [FR-5] – and the MINARM, as described on figure 7-3 below.

[73] 'Member Agencies List', iadc-home.org, accessed 20 April 2020, https://www.iadc-home.org/member_agencies_list.
[74] 'Member Agencies', CCSDS.org, accessed 20 April 2020, https://public.ccsds.org/participation/member_agencies.aspx.
[75] 'Participation: ISO/TC 20/SC 14 - Space Systems and Operations', International Organisation for Standardisation, accessed 10 April 2020, https://www.iso.org/committee/46614.html?view=participation.

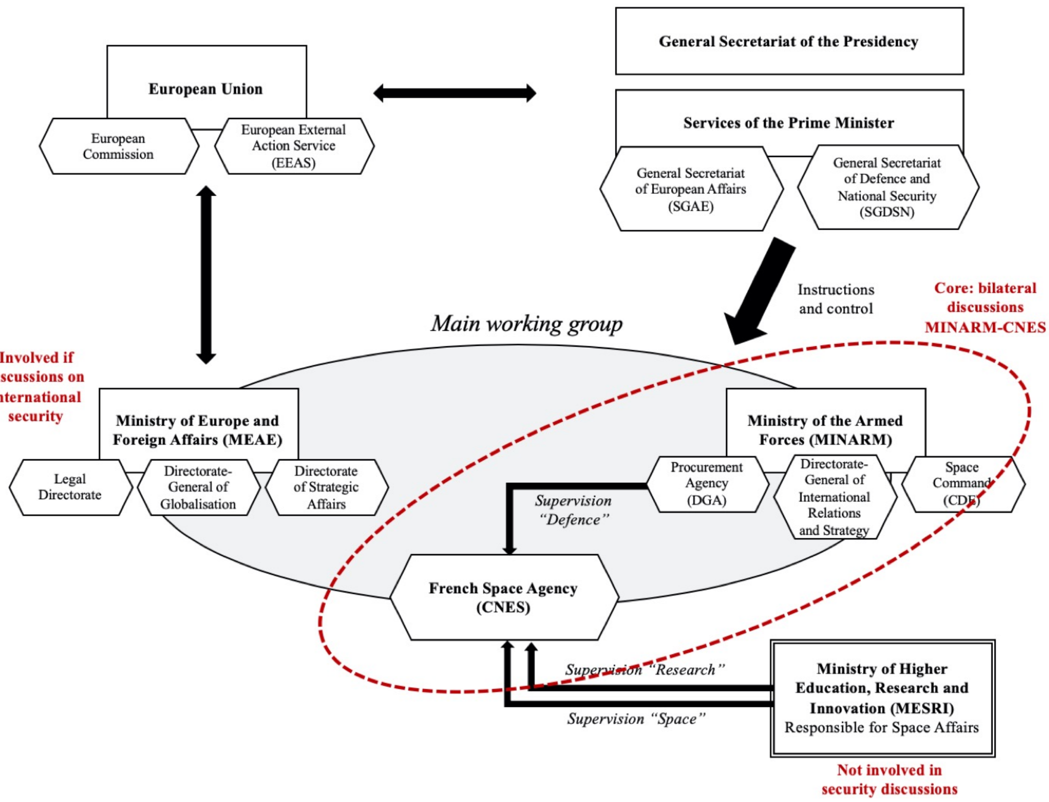

Figure 7-3. Inter-ministerial working group on SSA-related issues and associated actors

SSA falling in the category of dual-use technologies, and therefore of national budget Program 191, interagency discussions involve primarily CNES and its tutelar authority for military and dual issues, the MINARM, through the DGA. The MESRI, supervising CNES on purely civilian matters, does not involved in SSA discussions. As for the development of SSA *capabilities* (e.g. new radars), it follows a different approach and is included in the pluriannual military programming law, as any other military equipment topic [FR-1].

4.3. Views on STM in the French government

While there is no working group on STM nor official position of each of the main actors, the following subsections are based on comments made by representatives of these organisations during interviews with the author. It should therefore be clearly understood that the views presented in the following paragraphs are not concerted agency-wide positions but simply represent the personal views of experts.

4.3.1. Too vague concept: management or coordination

The first reaction of most interviewees was to ask the author what he meant by STM and to comment on the vagueness of the concept. As extensively discussed in Chapter 2, there are numerous possible definitions of STM, making it a difficult topic to comprehend by governments. Moreover, STM is a very recent topic for European governments, not more than three to four years old [FR-8], requiring before actual discussions a lot of clarification efforts on regulatory concepts: "what is meant by regime, by governance? etc." [FR-8]. The recent clarification of the US military, now using the term SDA in lieu of SSA, was welcomed as an example to follow in the case of STM [FR-8]. The fact that STM is "not mature enough" from the French government perspective is the reason why it will not be included in the revision of the LOS [FR-3].

The initial partial answer on what means STM for French government experts consisted for most in rejecting the terminology itself. In fact, an official interviewed by the author expressed the reserves of MEAE experts on the term STM as chosen by the US government in Space Policy Directive-3, favouring the use of 'coordination' instead of 'management', which they believe is closer to the reality of the situation [FR-5]. This view was widely shared by other interviewees in particular at the MINARM. For them, the concept of 'management' is not adapted to military activities, whereas the idea of "STCoordination", that is to say a coordination structure for alerts and communication backed by norms of behaviour only, would provide actual operational benefits while not hampering the military uses of space [FR-2,3,4].

4.3.2. Reaction to the STM hype: cautionary approach

The intrinsic lack of clarity of the concept of STM leads French government experts to adopt a cautionary approach, in particular vis-à-vis American initiatives.

At the MESRI in particular, hesitations on the actual scope and format of a prospective regime are sources of internal discussions, specifically on whether STM should be mostly "preventive" or "prescriptive". While a "preventive regime" has the benefit of preserving the freedom of actors and is easier to set up at regional and international levels, it is seen by many at the MESRI as quite limited in actual efficiency, except in the very specific case of large constellations, where information-sharing and coordination will be key in avoiding a catastrophe [FR-6]. On the other hand, the case of a prescriptive regime is the source of important concerns at the MESRI. In fact, the establishment of a prescriptive STM regime is seen as opening the gates of France and Europe to an "American Trojan Horse", therefore bearing the risk of enhancing American capabilities to gathering economic intelligence on the European space industry [FR-6].

Part of the cautionary approach of the French government consists in the close monitoring of worldwide initiatives on STM by the MEAE and CNES, both to identify those that can have adverse effects on French and European activities in space, or on the contrary good practices that can inform French decision-makers; the main focus of the French authorities being clearly the evolution of space policy in the US [FR-5].

4.3.3. Favourable to a unified European position

Beyond internal discussions and monitoring of foreign activities, it is important for the French government to build a clear position in order to be able to efficiently defends its equities. To do so, most interviewees believe in the definition of a unified position with France's European partners.

The preliminary development of a comprehensive European approach to STM, backed by technical capabilities, would allow to initiate discussions with the US "based on a relationship of equals" [FR-6]. This explains the cold reception at the MESRI of the announcement of the quick signature of the CNES-DoC LoI on STM cooperation [FR-6], that created in Europe the false impression that France was willing to advance on its own.

The technical capabilities evoked above are the main *raison d'être* of the EU-SST. What started as a way to establish a formalised dialogue between France and Germany on SSA [FR-8] is the element that could back European ambitions to be on par with the world's leading space powers, with the progressive participation of more countries and the allocation of credits by the EU for increased capabilities (e.g. in Spain) [FR-2,3,4].

It is however important to differentiate unified European views on STM with potentially unilateral initiatives from EU institutions. As ministry in charge of European Affairs, the MEAE puts a lot of care in monitoring EU-level initiatives, in order to "fight the proliferation of initiatives blurring/parasitizing existing activities". For example, the independent decision of the European External Action Service (EU diplomats) to initiate space law and policy activities is a source of concern for MEAE officials, who need to make sure that such activities are in line with French interests (i.e. reactive posture) [FR-5].

4.3.4. Main focus: maintaining French and European autonomy

Overall, while the modalities of STM are not yet defined, the main goals are very clear for French authorities, and *a fortiori* for the MINARM, with regards to any prospective STM framework: maintaining French – and European – strategic autonomy and freedom of access to and use of outer space [FR-8].

This desire to protect French equities while working towards the preservation of the outer space environment is the main reason for the MINARM's and other ministries' attachment to non-binding instruments [FR-2,3,4]. In fact, the SDS2019 makes numerous references to the definition and promotion of norms of behaviour for safe operations in space. The specific role that can be played by the MINARM on this aspect is further commented in section 5. When asked if the MINARM would accept to go further than non-binding norms of behaviour, an expert mentioned that, in accordance with the SDS2019, the MINARM could support the creation of an actual international "norm prohibiting actions that create pieces of long-lived debris".[76] It would however require strict conditions including a favourable international context, the agreement of France's main allies and guarantees of reciprocity from all leading space actors [FR-8].

In sum, the MINARM being mostly preoccupied with its core tasks of carrying efficient operations to ensure national security, experts tend to regret the excess of discussion on STM, which intrinsic confusion leads to ungrounded proposals that are in turn dangerous for the MINARM's activities and interests [FR-8]. The moderate interest of the MINARM for STM is clear in the expected revision of the LOS: although it is revised primarily for military purposes, there will be no single paragraph on STM [FR-2,3,4].

4.4. The MINARM's discretion in inter-ministerial discussions on SSA/STM

After consulting most of the actors involved in inter-ministerial discussions on SSA/STM, it seems that the MINARM, although influential, tends to be relatively discreet in SSA/STM discussions. Why is that?

As explained earlier, the MINARM has a relatively limited knowledge and very limited budget on SSA issues, even though it is planning to enhance its capabilities through closer interconnections between CNES and the CDE, as defined in the SDS2019. On the other hand, CNES already has experience in dealing with SSA from a policy standpoint: its Defense and Security Office is the interface with the EU SST and its Legal Office is the key focal point for the promotion of international norms for SSA and STM. However, CNES's potential involvement in STM regulatory research is under the MESRI's administrative supervision, the MINARM/DGA supervising primarily launch systems and observation satellites. The MINARM is however currently trying to add SSA/STM policy to the agenda of CNES-DGA supervision dialogue – beyond existing technical discussions on SSA. Moreover, the frequent work rotation of MINARM staff – mostly military personnel – complicates the establishment of a durable dialogue with professionally stable CNES experts [FR2,3,4]. It also implies the

[76] 'Stratégie Spatiale de Défense 2019', 29.

high dependency of MINARM's influence with the personality of the staff involved in inter-ministerial discussions [FR-5].

Apart from its limited indirect influence through its supervision of CNES, is the MINARM directly involved in inter-ministerial STM policy discussion? According to interviewees interacting with the MINARM, it seems that while CNES is very proactive, the MINARM tends to be in a reactive posture with the information shared by CNES and the MEAE, mostly coming from foreign – American – sources [FR-5]. Why? First of all, the French military has been known for its very discreet posture on domestic politics. As stated by interviewee FR-2, the Armed Forces' "vocation is to say very little" [FR-2], hence its old nickname *The Great Mute*.[77] Secondly, experts at the MINARM are very cautious, not to say dubious about the current debate over STM, seeing it as a manoeuvre of 1) some regulatory institutions to get a new role and associated funding and 2) commercial actors willing either to protect existing rights and prevent the adoption of US extraterritorial rules (satellite operators and manufacturers) or to create a new market (SSA data or service providers). Thirdly, and partially due to the previous point, there is currently no internally defined position on STM, let alone a consensus among the different competent entities in the ministry [FR-2,3,4].

However, reactive does not mean passive. As further developed in section 5, although the CNES is the main source of technical and policy information for the French government on SSA/STM issues, any government-wide position requires the MINARM's approval, including postures defended by French delegations in bilateral or multilateral negotiations [FR-8].

The positive consequence of MINARM's discretion on political issues is the important echo given to its rare statements [FR-3]. In particular, although they usually do not address space security issues, all major French and European media outlets relayed in September 2018 the speech of Florence Parly, Minister of the Armed Forces, in which she disclosed that the infamous Russian satellite Luch-Olymp has been caught spying on French-Italian military communication satellite Athena-Fidus thanks to Ariane Group's GeoTracker demonstration system.[78]

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[77] In French: *La Grande Muette*. This nickname was given during the Third Republic (1870-1940) when military personnel was banned from voting, out of fear that they would threaten the republic.

[78] Michel Cabirol, 'La guerre dans l'espace a déjà commencé, la Russie espionne la France', La Tribune, 7 September 2018, https://www.latribune.fr/entreprises-finance/industrie/aeronautique-defense/la-guerre-dans-l-espace-a-deja-commence-la-russie-espionne-la-france-789663.html.

4.5. Internal dynamics of the Ministry of Armed Forces

Compared to the study of the internal dynamics of the US DoD with regards to space policy presented in previous chapters, there is not much to be said about the MINARM. In fact, as explained in section 1.3, the number of space-related staff at the MINARM is extremely limited, around 230. If looking at experts well-versed in space law and policy, that could have a valuable impact in internal space policy discussions at the MINARM, their number can be counted on one or two hands. These experts being working so closely together, there is no real process than can be analysed from an organisational perspective [FR-8]. Will the progressive staffing of the CDE to 500 staff by 2025 initiate a change in internal MINARM dynamics? This question is analysed in section 6.

5. Involvement of the French military in international policy discussions on SSA and STM

The SDS2019 contains a clear mandate for the French authorities to involve in the development and promotion of norms for the preservation of the outer space environment:

> "France will continue to give its full backing, in the relevant multilateral forums, to the pragmatic and effective regulation of space, with a particular focus on standards of behaviour in order to ensure strategic stability and avoid possibilities for misunderstandings or escalation. […]. In particular, France could support the promotion of a norm prohibiting actions that create pieces of long-lived debris".[79]

However, when reading this section of the SDS2019, it is unclear whether it mandates the MINARM to be directly involved in the development and promotion of STM norms in the future, or simply the French government as a whole. The recently concluded LTS negotiations can provide an overview of the MINARM's involvement.

By definition, it is the MEAE's role to coordinate the French participation and contribution to the discussions at the UNCOPUOS and at other international fora. The French Permanent Representation to the United Nations in Vienna therefore naturally assumed the leadership of the French delegation for the LTS discussions [FR-5]. Due to its usual discretion but mostly to staff limitations, the MINARM has been relatively absent from LTS negotiations in particular in its final years when CIE experts stopped attending [FR-1]. Therefore, the technical lead was logically given to CNES [FR-5]. But does it mean that the MINARM did not contribute significantly? As an expert explained to the author, the MINARM's traditional

[79] From official English version of 'Stratégie Spatiale de Défense 2019', 29.

absence from Vienna does not imply in any way its absence of involvement in the definition of the position defended by the French delegation [FR-8]. The MINARM usually favour contributing behind-the-scenes at domestic level and does not envision a public diplomacy role like the one played by DoD representatives at the very same LTS negotiations. An interviewee summarised the role of all actors with the following image: "the French delegation is carried by the MEAE with the support of CNES and the blessing of the MINARM".

Coming back to the initial question, is the mandate of the SDS2019 going to change the degree of the MINARM's involvement in international discussions? It is unlikely that the MINARM will be present at the UNCOPUOS in the near future but its progressive increase of capacity will allow it to enhance its participation in the "definition, development and promotion of norms of behaviour" in French inter-ministerial discussions, and even internationally through its relations with allied ministries of defence interested in the issue [FR-8].

6. Understanding and evaluating France's reorganisation of military space responsibilities

Although it seems to demonstrate a willingness to put more stress on the utilisation of space technologies in the French Armed Forces, the decision to replace the CIE by the CDE in 2019 can appear as contradictory, in particular from an organisational perspective. The CIE was established in 2010 by President Sarkozy as an *organisme interarmées* (OIA, in English: *Joint organism*) under the direct authority of the Chief of Defense Staff. [80] The 2019 CDE is however an *organisme à vocation interarmées* (OVIA, in English: *Joint-purpose organism*),[81] part of the Air Force, and with mostly Air Force personnel. How to explain this decision? While the SDS2019 provides a convincing rational explanation, organisational and bureaucratic politics theories can provide an interesting perspective.

[80] 'Arrêté du 7 juillet 2010 portant création du commandement interarmées de l'espace et modifiant l'arrêté du 16 février 2010 portant organisation de l'état-major des armées et fixant la liste des autorités et organismes directement subordonnés au chef d'état-major des armées' (République Française, 7 July 2010), https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000022484887&dateTexte=20190907.

[81] 'Arrêté du 3 septembre 2019 portant création et organisation du commandement de l'espace' (République Française, 3 September 2019), https://www.legifrance.gouv.fr/affichTexte.do;jsessionid=FA24C82843C13B96BEBEDDCA8B3ED23A.tplgfr25s_1?cidTexte=JORFTEXT000039060428&dateTexte=20190907.

6.1. The official version: nothing but a rational decision

When asked in February 2020 about this surprising choice, CDE Commander Major General Michel Friedling sarcastically commented on the MINARM's traditional naming issues: when it was called CIE (*Joint Space Command*) it was joint but not a real command – view shared by General Friedling's predecessor, General Jean-Daniel Testé[82] and another researcher using the term of "soft command" to describe the CIE.[83] Now that the CDE lost the name 'joint', it effectively became an actual joint command. To clarify any misunderstanding, the added: "If I dare to make the comparison, the CDE is both the [US] space command and the [US] space force".[84] It seems however that real comparison is the following: from an institutional perspective, the CDE is closer to what the Air Force Space Command (now US Space Force) was.

The SDS2019 provides a logical and rational analysis of this change, explaining that the pre-2019 situation had operational limitations due to the "geographical and functional spread" of space-related capabilities and responsibilities among various actors.[85] General Testé, former Commander of the CIE, publicly explained that the latter "was never anything else than a vector of communication and international relations", while all important responsibilities on the operations, use of satellite data, budgeting and planning were held by other entities. General Testé's informal but very informative description of each organisations' respective role is shown on figure 7-4. In addition, figure 7-5 shows the organisation chart of the CIE based on official information provided by the MINARM on its website. It confirms the explanation of General Testé that the CIE had very limited operational capabilities but was rather focussing on coordination, communication and international relations.

[82] Jean-Daniel Testé, 'Commandement de l'espace : une locomotive pour l'Europe ?', La Tribune, 9 September 2019, https://www.latribune.fr/opinions/tribunes/commandement-de-l-espace-une-locomotive-pour-l-europe-827709.html.
[83] Lou Villafranca, 'Stratégie spatiale : continuité et évolution du programme spatial militaire français', Note d'analyse (Brussels, Belgium: Groupe de recherche et d'information sur la paix et la sécurité, 6 April 2020), 16–17, https://www.grip.org/sites/grip.org/files/NOTES_ANALYSE/2020/na_2020-04-06_fr_lv-strategie-espace-france.pdf.
[84] Said during the Q&A following: Friedling, 'French Space Defence Strategy: Context and Perspectives'.
[85] 'Stratégie Spatiale de Défense 2019', 44.

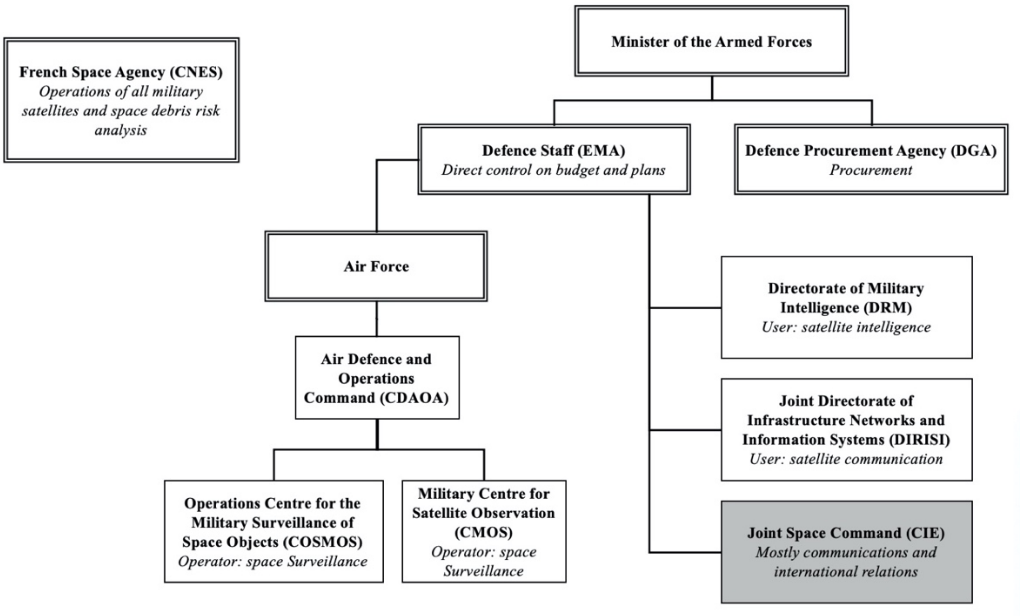

Figure 7-4. Institutional place and role of the CIE, according to its former Commander General Jean-Daniel Testé.[86]

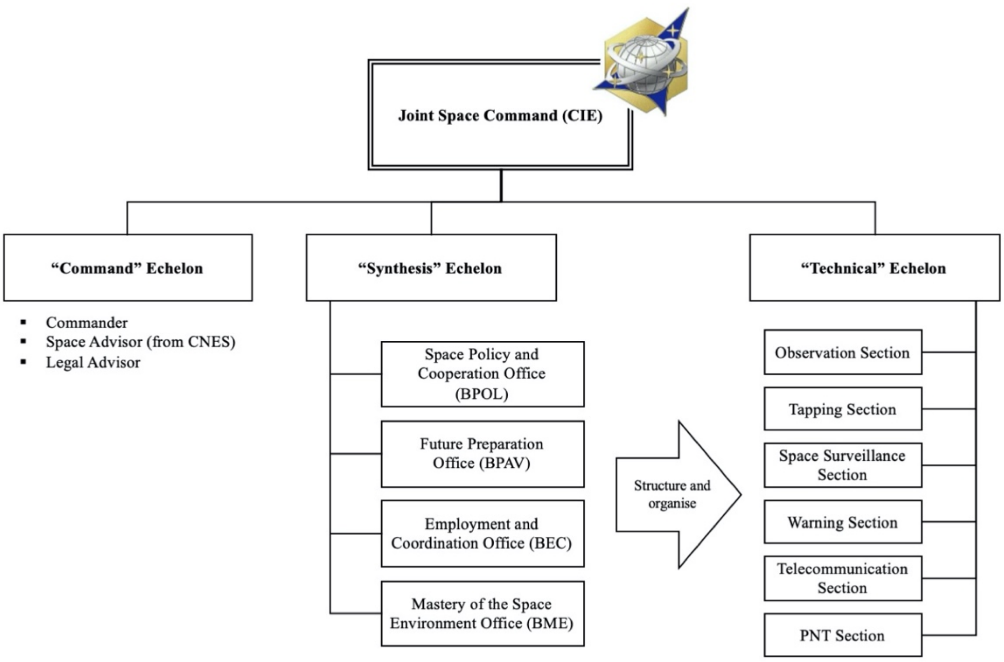

Figure 7-5. Organisation chart of the CIE.[87]

[86] Testé, 'Commandement de l'espace : une locomotive pour l'Europe ?'
[87] 'Le Commandement Interarmées de l'espace', Ministère des Armées, 26 March 2012, https://www.defense.gouv.fr/espanol/portal-de-la-defensa/dossiers/l-espace-au-profit-des-operations-militaires/fiches-techniques/cie; 'Les missions du Commandement interarmées de l'espace', Ministère des Armées, 26 March 2012, https://www.defense.gouv.fr/english/portail-defense/dossiers/l-espace-au-profit-des-operations-militaires/le-commandement-interarmees-de-l-espace-cie-et-le-cloud-spatial/les-missions-du-commandement-interarmees-de-l-espace.

By hosting the CDE at the Air Force, the former will be able to rationalise and enhance space capacity building while the Defense Staff will retain its prerogatives on operations and programming. The strategy also insists the fact that the Air Force is "the sole service capable to support the constitution of pool of competencies and to guarantee career tracks indispensable to the attractivity of the [space] field",[88] including through the creation of a Space Academy and the creation of a space track at the Air Military Academy.[89] The Air Force will, for reasons of coherence, be renamed "Air and Space Force". Such approach focussing on what the American would label 'organise, train and equip' reinforces the author's understanding that the CDE is nothing more than the former US Air Force Space Command. The new institutional place of the CDE is shown on Figure 7-5, based on the explanation provided in a MINARM press brief.[90]

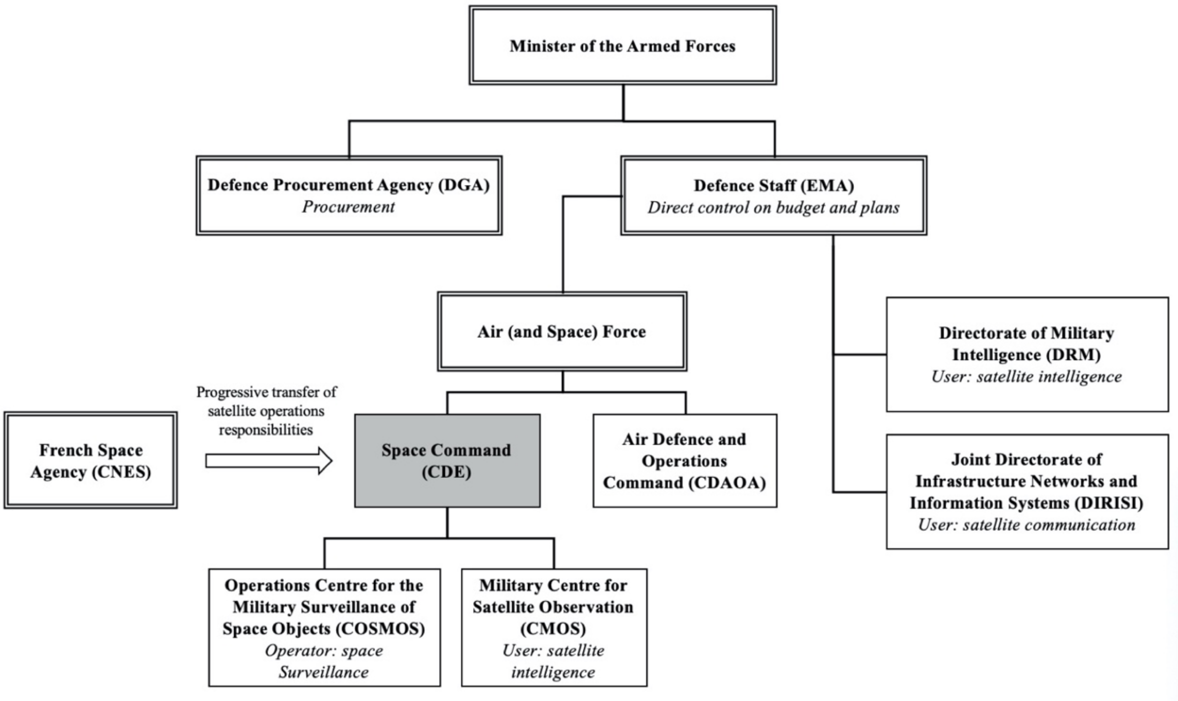

Figure 7-6. Institutional place and role of the CDE.[91]

[88] In French: 'seule à même de soutenir la constitution d'un vivier de compétences et de garantir les parcours de carrière indispensables à l'attractivité du domaine' 'Stratégie Spatiale de Défense 2019', 44–45.
[89] 'Stratégie Spatiale de Défense 2019', 56–57.
[90] 'Visite de Florence Parly, ministre des Armées - 21 février 2020 : visite du Centre national d'études spatiales (CNES) de Toulouse', Dossier de Presse (Paris, France: Ministère des Armées, 21 February 2020), https://www.defense.gouv.fr/content/download/577578/9875522/Dossier%20de%20presse_Commandement%20de%20l%27espace.pdf.
[91] 'Visite de Florence Parly, ministre des Armées - 21 février 2020 : visite du Centre national d'études spatiales (CNES) de Toulouse'.

6.2. Lessons from organisational and bureaucratic politics theories

Trying to go beyond the official rationalistic explanation given by the SDS2019, what other explanations can be found in organisational theory?

First, this choice can be driven by desire for the proponents and supporters of the CDE to extract it from the direct authority of a usually unsympathetic Chief of Defense Staff, to place it under the responsibility of a forward-driven Air Force leadership. It indeed fits the traditional sociological understanding of each service branch, the Air Force having a tendency to "worship at the altar of technology" in the words of Carl Builder,[92] while the Army is primarily concerned with conventional ground combat and "less interested in those functions that they view as peripheral",[93] among which can be found space support and surveillance.

Secondly, from the perspective of the Air Force, getting control over all national military space activities can fulfil two goals: another achievement in its quest for legitimacy and the opportunity to benefit from important budget increases. Although it has a longer history than its American counterpart (the French Air Force was separated from the Army in 1934 while the USAF became independent in 1947) all air forces around the world share a need for legitimacy, intrinsically related to their nature. Having been separated from their respective armies, it was key in air forces development to find a relevance beyond mere air support to ground troops – the Navy having retained its own naval aviation for the maritime domain. Their relevance was found in strategic air operations.[94] Nowadays, space constitutes, at least in the case of a more concentrated military as the French one, a defining feature of the Air Force. As such, keeping a direct control over military space activities allowed the Air Force to benefit from significant budget and personnel increases, and progressively catching up on the Army's clear domination of the French Armed Forces.

The final explanation proposed here of the apparent downgrading of the CIE in the CDE is directly related to the usual functioning of the French military as a whole. Analyst of strategic and military affairs and former director of the Security Studies Centre at the French Institute of International Relations (Ifri), Etienne de Durand has expressed doubts about the use of joint structures in the French military. In fact, while acknowledging that specific capabilities – he

[92] Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, 19.
[93] Halperin and Clapp, *Bureaucratic Politics and Foreign Policy*, 32.
[94] Builder, *The Masks of War: American Military Styles in Strategy and Analysis*, 27–28; Halperin and Clapp, *Bureaucratic Politics and Foreign Policy*, 27.

mentions space among others – are "rightfully joint",[95] excessive jointness bears the risk to "neglect each service's know-how".[96] Specifically in the case of France, he warns that:

> "Militarily dangerous, widespread jointness is moreover unwelcomed politically, as it is true that in France, 'rationalisations' are usually the disguise of budget reductions ordered in a context of urgency and which, without strategic or operational considerations, are limited to budgetary expedients".[97]

It is indeed clear when looking at the case of the CIE which had been reluctantly established by General Georgelin as an empty and spineless joint structure.

6.3. Limited impact on MINARM's influence in inter-ministerial decision-making processes

The creation of the CDE, while it will surely lead to an increase of the MINARM's technical capabilities, will probably not have any impact on its traditional posture of discretion with regards to political affairs. In fact, even when reaching its apogee with around 500 staff, which would be the largest ever number of space-related staff in MINARM history, the CDE would still account only for less than 0.2%[98] of all MINARM staff and probably even less if considering budget allocation. Moreover, while both the US Space Force and US Space Command are headed – by design – by a four-star general (OF-9), highest rank in the US military, the CDE is headed by a three-star general, third highest rank in the French Air Force, equivalent to a Major-General in the US (OF-7). The CIE has previously been headed either by two- (OF-6) or three-star generals (OF-7). It is therefore clear that, without presuming of the degree of his competency and motivation, his ability to influence the decisions taken at the Defence Staff by primarily five-star (OF-9) Army generals would be limited. It is however in line with French military practices as other major Air Force (e.g. Air Defense Command) or Joint Commands (e.g. Pacific forces) are usually headed by three-star generals or admirals (OF-7).

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[95] In French: 'relèvent de plein droit du domaine interarmées', in : Etienne de Durand, 'L'interarmées Aux États-Unis: Rivalités Bureaucratiques, Enjeux Opérationnels et Idéologie de La Jointness', Focus stratégique n°3 (Paris, France: Institut Français des Relations Internationales, November 2007), 29, https://www.ifri.org/sites/default/files/atoms/files/Focus_strategique_3_deDurand_interarmees.pdf.
[96] In French: 'négliger les savoir-faire propres à chaque armée', in : de Durand, 29.
[97] In French: 'Militairement dangereuse, l'interarmisation tous azimuts est en outre mal venue politiquement, tant il est vrai qu'en France les « rationalisations » ne sont le plus souvent que le faux nez de réductions de crédits opérées dans l'urgence et qui, sans souci de cohérence stratégique et opérationnelle, se réduisent à de simples expédients budgétaires', in : de Durand, 29.
[98] In 2018, the MINARM had a total of 266,792 staff (206,409 soldiers and 60,383 civilians), according to 'Defense 2018: Key Figures', 18.

6.4. Impact of the CDE on MINARM internal dynamics

Space-related experts at the MINARM, only a handful, being working so closely together, there is no real process than can be analysed from an organisational perspective [FR-8]. Will the progressive staffing of the CDE to 500 staff by 2025 initiate a change in internal MINARM dynamics?

It is very unlikely as the CDE's purpose is specifically to further integrate all space-related actors in the ministry. Therefore, another question, not answered in this dissertation, is whether the concentration of knowledge in a single organisation – the CDE – and the elimination of a healthy internal contradictory debate will be an improvement for the French Armed Forces.

7. Conclusion: partial validation of the hypotheses by the French case study

Although it possesses the SSA infrastructure – mostly radars, the French military has always chosen not to directly involve in space safety and sustainability like its American counterparts and therefore did not build related internal capabilities. Even its involvement in data collection was fortuitous. As explained at the beginning of this chapter, the development of GRAVES, the backbone of French and European SSA systems, was not part of usual military programming but was instead based on an experimental research budget line. Seeing the exceptional cost-performance ratio of the experimental radar developed by the ONERA, the French military believed the opportunity should not be missed, and that, being the only administrative supervisor of the ONERA with enough budget and manpower, it was its responsibility for the benefits of France to take over and develop the mission. However, the decision made from the start to focus on threats analysis (via the COSMOS) and to transfer the data to CNES for all risk analysis responsibilities – in other words space safety services, clearly demonstrates that it has never been the military's intention to be a space safety services provider.

Beyond the technical aspect of space safety services, the same can be said about STM-related policymaking, both nationally and at European level. The MINARM is only indirectly involving in these issues through the CNES but tends to have a relatively passive attitude towards the information and initiatives proposed by the CNES and the MEAE. As such, the French case study tilts in favour of the validity of Hypothesis 1, reminded below. While H1.1 has never been applicable in France, due to the clear technical superiority of the CNES over the military in terms of space operations, H1.2 is representative of the current behaviour of the government with regards to space safety, with the CNES providing services to any contracting entity with its CAESAR tool, with data from the Air Force's GRAVES radar.

Hypothesis 1: the military as reluctant leader in space safety and sustainability

[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).

[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

The current reorganisation of French military space capabilities, initiated by the SDS 2019, is a major step towards the development of a distinct body of space experts in the French armed forces. The requirement of the SDS 2019 to "create and sustain a pool of experts and specialists" is the best way to initiate a cultural change inside the MINARM, necessary condition for the upholding of the current reorganisation, in order to avoid reproducing President Sarkozy's failure to reform an Army-oriented institution. In fact, the process following which this talent pool is to be created reminds us of Morris Janowitz's recommendations: the establishment of a "space major" at the French Air Force Academy, the recruitment of external experts and finally the creation of a dedicated Space Academy.[99] In addition, every year, officers from the French Air Force are enrolling at mid-career graduate programs at the French Higher Institute of Aeronautics and Space (ISAE-SUPAERO), leading European aerospace university and oldest graduate school in the world for aeronautics. Although it is too early to conclude on Hypothesis 2 (reminded below), it seems clear that French decision-makers are betting on its validity, to ensure that the effects of their current reform of the French space military infrastructure will be long-lasting.

Hypothesis 2: the need for specialised space officers

The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

[99] 'Stratégie Spatiale de Défense 2019', 56–57.

For what concerns the third hypothesis analysed in this dissertation, the French case tends to disprove it. In fact, this chapter has shown that for numerous cultural, technical and institutional reasons, the French military has a limited direct influence on space safety and sustainability policymaking, instead choosing to focus on the development of technical capabilities (e.g. radar) and the analysis of threats, rather than larger space safety issues that would fall under the purview of the CNES's other supervisory authority, the MESRI.

Hypothesis 3: military as most influential actor in STM policymaking
[H3.1] If the military opposes a position on space safety and sustainability, then this position is perceived as inacceptable by other agencies involved in domestic decision-making (*absolute proscriptive influence*).
[H3.2] Conversely, if the military supports a position on space safety and sustainability, then this position is perceived very favourably by other agencies involved in domestic decision-making (*strong prescriptive influence*).

More generally, while France has been deeply involved in specific issues of space safety and sustainability, such as the mitigation of space debris, there was no concrete governmental interest for the concept of STM itself. On the contrary, French leading space authorities refrain from entering the debate on an unclear and potentially risky issue, without first discussing it with their European partners. Will the situation change in the short-term?

STM as a governmental topic of discussion may make its debut, for two reasons. First, it was hinted in interviews that internal discussions were undergoing on the establishment of an inter-ministerial working group on the issue [FR-2,3,4]. What would be the level of this working group? Does it presuppose the definition of clear positions in each responsible ministry? What would be its exact role and expected output? It is too early to answer these questions. The second reason would be exogenous as the initiative for STM discussions will probably come from EU-level. In fact, Germany has already initiated informal talks with EU member countries in order to gather opinions on STM and is now planning to put STM at the agenda of the its presidency of the Council of the European Union from July to December 2020 [FR-2,3,4]. This is probably the most promising and concrete initiative to follow.

Chapter 8. The Japanese military's approach to SSA and STM

Space development should be a source of national pride,
but Japan doesn't have a diplomatic strategy to take advantage of it
Kenichi Kawamura, aide to Representative Takeo Kawamura (28 March 2006)[1]

Ranking fourth in the world both for the number of satellites registered at the United Nations (4.5%)[2] and for national security space budgets (3.8%),[3] and having independent launching capabilities in all orbital regimes, Japan is the most advanced middle space power, second only to the United States, China and Russia. Due however to its unique recent history, Japan has a complicated relationship with the uses of outer space for military purposes. In fact, after a 1969 National Diet Resolution interpreting the peaceful uses of outer space as 'non-military', the Japanese Self-Defense Forces (SDF) had to wait until 2008 to be allowed to fully benefit from what is the backbone of all advanced militaries. This chapter analyses the evolution of the Japanese government's posture on the military uses of space and its impact on the development of space situational awareness (SSA) capabilities. In fact, due to the restrictions induced by the 1969 Resolution, the Japanese Aerospace Exploration Agency (JAXA) and its predecessors have taken a quasi-monopolistic role in the development of the national space program, including for SSA. What is then the role that the Japanese Ministry of Defense (MOD) can play in SSA and space traffic management (STM) policymaking?

The chapter is organised as follows. After sections 1 and 2 present respectively the consequences of the 1969 Diet Resolution on the 'exclusively' peaceful uses of space on the Japanese ecosystem and the upheaval constituted by the 2008 Basic Space Law, extending the

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[1] Ichiko Fuyuno, 'Japan Revises Its Military Plans for Space', *Nature* 440 (13 April 2006): 857.
[2] Extracted from: 'Union of Concerned Scientists Satellite Database'.
[3] Calculated from: Simon Seminari, 'Op-Ed | Global Government Space Budgets Continues Multiyear Rebound', SpaceNews.com, 24 November 2019, https://spacenews.com/op-ed-global-government-space-budgets-continues-multiyear-rebound/.

work done by prominent Japanese scholars,[4] section 3 is a comprehensive overview of Japanese efforts to develop strong SSA capabilities, both at JAXA and then at the MOD. Then, section 4 investigates the possibilities offered to the MOD to influence domestic policymaking with regards to SSA, STM and the military uses of space. Finally, section 5 concludes the chapter by a short opinion piece on the long-lasting consequences of the 1969 Resolution for Japan and evaluate the validity of the hypotheses against the Japanese case study.

1. Japanese non-military interpretation of the peaceful uses of outer space (1969-2008)

From 1969 to 2008, the use of space technology by the Japanese military was very limited, based on a strict non-military interpretation of the principle of peaceful uses of outer space. This section analyses from a security perspective the impact of the 1969 Diet Resolution on the peaceful uses of outer space on Japanese domestic space activities, and how it shaped power relations among Japanese government agencies.

1.1. The 1969 Diet Resolution on the peaceful uses of space

A strict interpretation of Japan's pacifist constitution, seen as "prohibit[ing] using space for security purposes" has led the Japanese Diet to pass a resolution which title can be translated by "Concerning the Principle of the Development and Utilization of Space".[5] This resolution, nicknamed the "exclusively peaceful purposes resolution"[6] barred the military from

[4] In particular Professor Kazuto Suzuki and Professor Setsuko Aoki, in: Kazuto Suzuki, 'Administrative Reforms and the Policy Logics of Japanese Space Policy', *Space Policy* 21 (2005): 11–19; Kazuto Suzuki, 'Transforming Japan's Space Policy-Making', *Space Policy* 23 (2007): 73–80; Kazuto Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5' (Tokyo, Japan: Research Institute for Peace and Security, October 2007); Kazuto Suzuki, 'A Brand New Space Policy or Just Papering over a Political Glitch? Japan's New Space Law in the Making', *Space Policy* 24 (2008): 171–74; Aoki, 'Introduction to the Basic Space Law of 2008'; Setsuko Aoki, 'Challenges for Japan's Space Strategy, AJISS Commentary No. 34 of 26 June 2008' (Tokyo, Japan: Association of Japanese Institutes of Strategic Studies, 26 June 2008); Setsuko Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', *Journal of Space Law* 35, no. 2 (Winter 2009): 363–438; Yasuhito Fukushima, 'Japan's Use of Space for Defense Purposes: Continuity and Change Before and After the Enactment of the Basic Space Law', Briefing Memo (Tokyo, Japan: National Institute of Defense Studies, March 2017), http://www.nids.mod.go.jp/english/publication/briefing/pdf/2017/briefing_e201703.pdf.

[5] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 2.

[6] The expression used in Japanese for 'exclusively peaceful purposes' is 平和の目的に限り (literally "restricted to the peaceful uses"). See '衆議院会議録 第三十五号 [Minutes of the Plenary Session, Vol. 35]', Japanese original transcript (Tokyo, Japan: House of Representatives, 9 May 1969), http://kokkai.ndl.go.jp/cgi-bin/KENSAKU/swk_list.cgi?SESSION=32866&SAVED_RID=2&MODE=1&DTOTAL=17&DMY=2 http://kokkai.ndl.go.jp/SENTAKU/syugiin/061/0001/06105090001035.pdf.

participating in Japan's national space program, restricting the latter's purpose to the development of space science and space technology for purely civilian uses.[7] The Japanese Diet's interpretation of peaceful as non-military is unique among other space powers: as it is commonly interpreted in space law circles, "all military uses are permitted and lawful as long as they remain 'non-aggressive' as per Article 2(4) of the U.N. Charter, which prohibits 'the threat or use of force'".[8] Setsuko Aoki pointed out that Japanese lawmakers were aware of the uniqueness of their interpretation during the debates, and that the unanimous adoption of the resolution in both chambers (House of Representatives and House of Councillors) is the proof of Japan's strong commitment to exclusively peaceful purposes.[9] The English full text of the resolution can be found on figure 8-1 below.

The 1969 Resolution Concerning the Principle of the Development and Utilization of Space

Our nation's development and utilization of satellites and rockets to be launched beyond the earth's atmosphere shall be confined to exclusively peaceful purposes. They shall be undertaken to promote the advancement of science, the enhancement of national living, and the welfare of human society. They also shall contribute to the development of industrial technology and the promotion of international cooperation.

Figure 8-1. English translation of the 1969 Diet Resolution on the peaceful uses of outer space[10]

Kazuto Suzuki argued that the choice of exclusively peaceful purposes was also driven by an analogy with another dual-use field: nuclear technologies. In fact, both space and nuclear technologies were under the supervision of the Science and Technology Agency (STA) and it

[7] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5'.
[8] Ivan A Vlasic, 'The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space', in *Peaceful and Non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race*, ed. Bhupendra Jasani, UNIDIR United Nations Institute for Disarmament Research (New York: Taylor & Francis, 1991), 179; Cited in: Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities'.
[9] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 380–81.
[10] Private translation of Professor Kazuto Suzuki, published in Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 16.

was decided to follow the same approach for space as was previously decided for nuclear research.[11]

1.2. Consequences of the 1969 Resolution

The Exclusively Peaceful Purposes Resolution had deep direct and indirect consequences on the Japanese space sector. In fact, the limitations imposed on the military led to the concentration of powers at the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the establishment of a civilian satellite intelligence structure at the Cabinet Secretariat.

1.2.1. Exclusively peaceful purposes

The 1969 Resolution had deep and lasting consequences on the Japanese space sector. In fact, a few weeks after the resolution was enacted, the law establishing the National Space Development Agency (NASDA) mandated, in its first article, the agency to develop technologies for "exclusively for peaceful purposes".[12] In the 2002 law creating of Japan Aerospace Exploration Agency (JAXA) by merging NASDA with the Institute of Space and Astronautical Science (ISAS) and the National Aerospace Laboratory of Japan (NAL), Article 4 maintained the same "exclusively peaceful purposes" (平和の目的に限り) requirement for aerospace research, development and utilisation,[13] while excluding aeronautics.[14]

For a modern military like the Japanese Self-Defense Forces (SDF), being limited in its use of space technology was a very heavy limitation. Particularly, the inability to use satellite communication was extremely incapacitating from an operational standpoint. In fact, even during joint military exercises with the US, Japanese vessels were not carrying equipment to receive radio-signal from American satellites, due to the unclear legality of such practices at

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[11] Suzuki, 2.

[12] 'Law No. 50 of 23 June 1969 Concerning the National Space Development Agency of Japan (Unofficial English Translation)', UN Office for Outer Space Affairs, accessed 30 March 2020, http://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/japan/nasda_1969E.html; Paul Kallender-Umezu, 'Enacting Japan's Basic Law for Space Activities: Revolution or Evolution?', *Space Policy* 29 (2013): 28–34.

[13] '法律第百六十一号 [Law No. 161] 独立行政法人宇宙航空研究開発機構法 [Japan Aerospace Exploration Agency Law]', House of Representatives of Japan, 13 December 2002, http://www.shugiin.go.jp/internet/itdb_housei.nsf/html/housei/15520021213161.htm.

[14] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 376.

the time.[15] The absurdity of this situation led to a reasonable compromise: the "governmental unified view" of February 1985.[16] This view authorised the use of satellite technology by the SDF as long as it was primarily designed and already commonly used for civil applications. Space security expert Yasuhito Fukushima however mentions that the Japan Defense Agency (JDA)[17] used satellite imagery from US Landsat satellites before 1982 through NASDA, commercial satellite communication services since 1977, and meteorological data from Himawari since 1982, although the legality of such practices seems unclear.[18]

1.2.2. The Cabinet Secretariat's information-gathering satellite program

The third global economic power, one of the world's largest military spenders and surrounded by hostile nations, the voluntary rejection of the military uses of space was untenable for Japan. As Aoki wrote: "Sooner or later, Japan's 'non-military' principle was doomed to be circumvented in order to adjust to reality".[19] The reality described by Aoki materialised in the form of experimental medium-range ballistic missile Nodong-1, launched in 1993 towards the Sea of Japan by the Democratic People's Republic of Korea (DPRK).[20] However, it was only five years later, with the launch of Taepodong-1 on 31 August 1998 (the 'Taepodong Shock') that the Government of Japan (GoJ) initiated the Intelligence-Gathering Satellite (IGS) program, which saw its first satellite launched in 2003.[21] But how was the Japanese government able to initiate the IGS program without violating the 1969 Resolution? Taking into consideration the subtleties of existing legal restrictions, the program was made possible by a careful justification of the purposes of the satellites and by a wise choice of institutional responsibilities.

The first challenge of the GoJ was to justify the development and deployment of a satellite designed to serve national security purposes. As it was illegal to label IGS satellites as such, they were described in a Cabinet Order cited and translated by Aoki as "artificial satellites in

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[15] Fukushima identifies this as the 'multinational maritime exercise RIMPAC in 1980': Fukushima, 'Japan's Use of Space for Defense Purposes: Continuity and Change Before and After the Enactment of the Basic Space Law', 3–4.
[16] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 381.
[17] Precursor of the Ministry of Defense (MoD) of Japan, which was set up only in 9 January 2007.
[18] Fukushima, 'Japan's Use of Space for Defense Purposes: Continuity and Change Before and After the Enactment of the Basic Space Law', 2–4.
[19] Aoki, 'Introduction to the Basic Space Law of 2008', 586.
[20] Aoki, 586.
[21] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 380; Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 5.

order to collect imaging information useful for assuring Japan's security, addressing largescale disasters, and other important policy matters of the Cabinet".[22] Going even further, Suzuki wrote: "Although it was clear that the purpose of the IGS program was to monitor the military activities of its neighbours, including North Korea, this was concealed under the guise of a 'multipurpose' satellite program".[23]

The second challenge faced by the government was the choice of an appropriate institution to operate the satellites. The JDA and the SDF being inconceivable choices, per the 1969 Resolution, a civilian agency had to be selected. The natural one, NASDA, was however forbidden to engage in non-peaceful uses of space, as defined in its establishment law. It was then decided to set up what is now called the Cabinet Satellite Intelligence Centre (CSICE), under the Cabinet Secretariat's Cabinet Intelligence and Research Office (CIRO). The CIRO is a civilian intelligence agency reporting directly to the Prime Minister of Japan, as shown on figure 8-2. IGS operations at the CSICE started in March 2003. This compromise allowed the JDA/SDF to use the data from the satellites operated by the CSICE, in accordance with the 1969 Resolution which strict conditions were relaxed by the 1985 unified government view. The latter was however applicable under the limitation that "the resolution of IGS images should not be better than the resolution available from other satellites in the market", hence banning the use of very advanced military satellites.[24]

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[22] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 380.

[23] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 5–6; Suzuki also cites: Tsuyoshi Sunohara, *誕生国産スパイ衛星 独自情報網と日米同盟 [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance]* (Tokyo, Japan: 日本経済新聞社 [Nihon Keizai Shimbunsha], 2005).

[24] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 380–82.

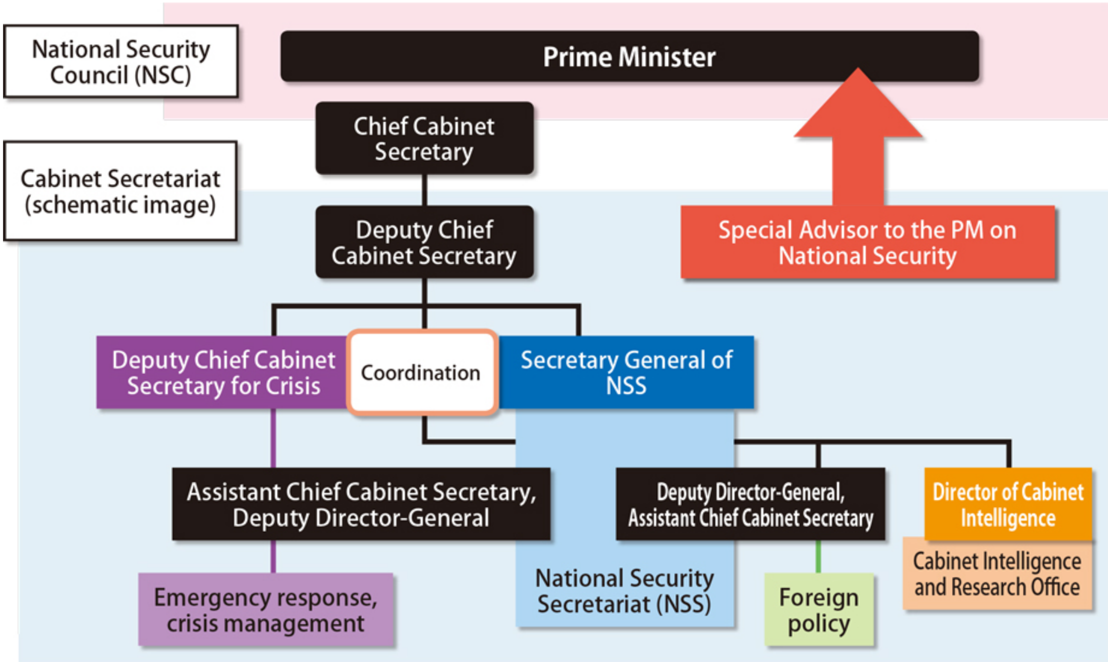

Figure 8-2. Organisational structure of Japanese national security[25]

Apart from two pressing domestic legal challenges, the GoJ also needed to take into account the country's trade relations with the US. In fact, around ten years before the initiation of the IGS program, the US government, using the threat of imposing tariffs on Japanese exports to the US, forced Japan to procure its civilian satellites through an open and international competitive process.[26] Specifically, the 1990 US-Japan Agreement on Satellite Procurement requires Japan "to procure non-R&D satellites on an open, transparent and non-discriminatory basis", therefore excluding NASDA's "R&D satellites" and potential security-oriented satellites.[27] Choosing to define the IGS as "multipurpose" satellites for both civilian and military uses was then a way for the GoJ not only to avoid violating the 1969 Resolution, but also the 1990 Agreement of Satellite Procurement when attributing the IGS contracts to Mitsubishi Electric Corporation (MELCO).[28]

From 2003 until the recent launch of IGS Optical 7 on 9 February 2020, the GoJ has purchased eighteen IGS from MELCO. Due to launch incidents and natural decommissioning,

[25] 'Chapter 3 - Japan's Foreign Policy to Promote National and Worldwide Interests', in *Diplomatic Bluebook 2014 Summary* (Tokyo, Japan: Ministry of Foreign Affairs, 2014), https://www.mofa.go.jp/policy/other/bluebook/2014/html/chapter3/efforts.html.
[26] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 5.
[27] 'Agreement on Satellite Procurement (June 15, 1990)' (Tokyo, Japan: Japan Aerospace Exploration Agency), accessed 31 March 2020, http://stage.tksc.jaxa.jp/spacelaw/world/1_05/05.E-4.pdf.
[28] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 6; Melissa Maday, 'Japan Successfully Launches Latest IGS Reconnaissance Satellite', SpaceWatch.Global, 10 February 2020, https://spacewatch.global/2020/02/japan-successfully-launches-latest-igs-reconnaissance-satellite/.

the CIRO/CSICE is currently operating eight IGS, including five high-resolution synthetic aperture radar (SAR) and three electro-optical IGS satellites.[29]

1.2.3. Concentration of powers at the MEXT

Both the restriction of the Japanese space program to "exclusively peaceful uses" in the 1969 Resolution and the exclusion of open bidding procedures for R&D satellites since 1990 have indirectly led to the concentration of space policy-making powers at the STA, administrative authority supervising NASDA.

Later, successive administrative reforms have further concentrated powers. First in 2001, the STA was merged with the Ministry of Education, supervising the ISAS, to form the MEXT mastodon. Then in 2003, the NASDA, the ISAS and the NAL were consolidated into JAXA.[30] Moreover, as pointed out by Suzuki, the Space Activities Committee (SAC), then-inter-ministerial decision-making body for space, was placed under the full authority of the MEXT.[31]

At the time of redaction of this dissertation, the MEXT is still the most important ministry with regards to space activities in Japan as main supervising authority for JAXA. The administrative reform of 2012, that established the National Space Policy Office (now Secretariat) at the Cabinet Office, as main space policy coordinating structure in the GoJ, has however created a counterweight to the MEXT. It was moreover reinforced by the concurrent establishment of the Cabinet Office's National Space Policy Committee as central space policy advisory body of the GoJ, reporting directly to the Prime Minister.[32]

1.3. Turning point: the Ballistic Missile Defense program

Suzuki saw in the early 2000s the turning point of Japanese space policy with issues concerning national security.[33] The complexity surrounding the procurement of IGS, necessary tools to ensure the security of the Japanese people in the midst of increased tensions in East Asia, showed the absurdity of the extreme Japanese posture of "exclusively peaceful" use of outer space. To this, Suzuki added constitutional concerns raised by Prime Minister Junichiro Koizumi's decision to participate in the US Ballistic Missile Defence (BMD) program, highly

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[29] Maday, 'Japan Successfully Launches Latest IGS Reconnaissance Satellite'.
[30] Suzuki, 'Administrative Reforms and the Policy Logics of Japanese Space Policy', 11.
[31] Suzuki, 11; Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 371–72.
[32] 'Committee on the National Space Policy (The Prime Minister in Action)', 31 July 2012, https://japan.kantei.go.jp/noda/actions/201207/31space_e.html.
[33] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 6–7.

justified in the geopolitical context of Japan. In fact, in December 2003, the Cabinet officially included BMD in the national defence posture.[34]

Suzuki's argument is the following: under the existing legal framework at the time, Japan was not allowed to own and operate early warning satellites and therefore had to rely on US intelligence. However, if based on US intelligence, Japan was to shoot down a missile directed to the US and only coincidentally flying over its territory (e.g. launched by DPRK), then Japan would have exercised its right of collective self-defence in accordance with the UN Charter but in violation with its own pacifist constitution. Having to choose between, on the one hand, upholding an excessively restrictive Diet resolution and taking the risk of violating the most fundamental law of the land, or on the other hand, providing Japan with the flexibility it vitally needs with regards to the security uses of outer space, Koizumi's party, the Liberal Democratic Party (LDP) decided that it was time to act.[35]

2. The Basic Space Law of 2008

The desire of the LDP to reconsider the limitations of the 1969 Peaceful Uses Diet Resolution culminated with the *Law No. 43 of 2008*, also called the *Basic Space Law of 2008,*[36] most prominent, although quite short, piece of Japanese space legislation since the beginnings of the national space program. This section investigates the origins of the Basic Space Law, in particular what was came to be known as the *Kawamura Initiative*, and its implications on the Japanese interpretation of the peaceful uses of outer space.

2.1. The drafting of the Basic Space Bill

After understanding and acknowledging the need for change in 2003, it took more than a year for LDP decision-makers to initiate discussions on the revision of the 1969 Resolution and the drafting of Japan's first national space law.

2.1.1. The Kawamura Initiative (2005-2007)

The Kawamura Initiative is a term coined to characterise the worked carried out mostly by lawmakers of the LDP from early 2005, having led to the bipartisan adoption of the Basic

[34] Norifumi Namatame, 'Japan and Ballistic Missile Defence: Debates and Difficulties', *Security Challenges* 8, no. 3 (Spring 2012): 4.
[35] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 6–7.
[36] In Japanese: 平成二十年法律第四十三号、宇宙基本法

Space Law of 2008. It takes its name from Takeo Kawamura[37], senior and powerful member of the House of Representatives of Japan. Having had to face the loss of two IGS satellites in a H-IIA launch failure in November 2003,[38] during his tenure as Minister of Education, Culture, Sports, Science and Technology, Takeo Kawamura became really critical of the management of national security space programs in Japan. For him, this failure was intrinsically systemic: the final user of the IGS, the JDA, was not allowed to involve; the Cabinet Secretariat, housing the CIRO/CSICE, had not enough staff devoted to overseeing the ISG program; and finally, the MEXT was only responsible for the launch.[39] He then gathered around him other LDP lawmakers, in particular Hiroshi Imazu and Minoru Terada [JP-1], as well as numerous high-ranking civil servants from the MEXT and the JDA but also from the Ministry of Economy, Trade and Industry (METI) and the Ministry of Foreign Affairs (MOFA), to form the Consultation Group for National Strategy for Space, or "Kawamura Consultation Group".[40] According to Suzuki, the group met ten times and produced an extensive report for use by the LDP that included revising the 1969 Resolution. Blaming the lack of coherent national strategy due to the concentration of power at the MEXT, the report argued for the designation of a coordinating minister for space,[41] paving the way for the current institutional arrangement at the Cabinet Office, with a National Space Policy Secretariat headed by Director-General (career civil-servant) reporting to a Minister of State for Space Policy. The full structure of space policymaking in Japan can be found on figure 8-3 below.

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[37] Takeo Kawamura (河村建夫, *Kawamura Takeo*) was continuously elected member of the House of Representatives of Japan since 1990. He held ministerial positions during his career, such as Minister of Education, Culture, Sports, Science and Technology from 22 September 2003 and 27 September 2004, before reaching the position of Chief Cabinet Secretary from 24 September 2008 to 16 September 2009, *de facto* deputy head of the executive branch, after the Prime Minister himself, Taro Aso at the time.
[38] Maday, 'Japan Successfully Launches Latest IGS Reconnaissance Satellite'.
[39] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 7.
[40] Suzuki, 7–8.
[41] Suzuki, 8–9.

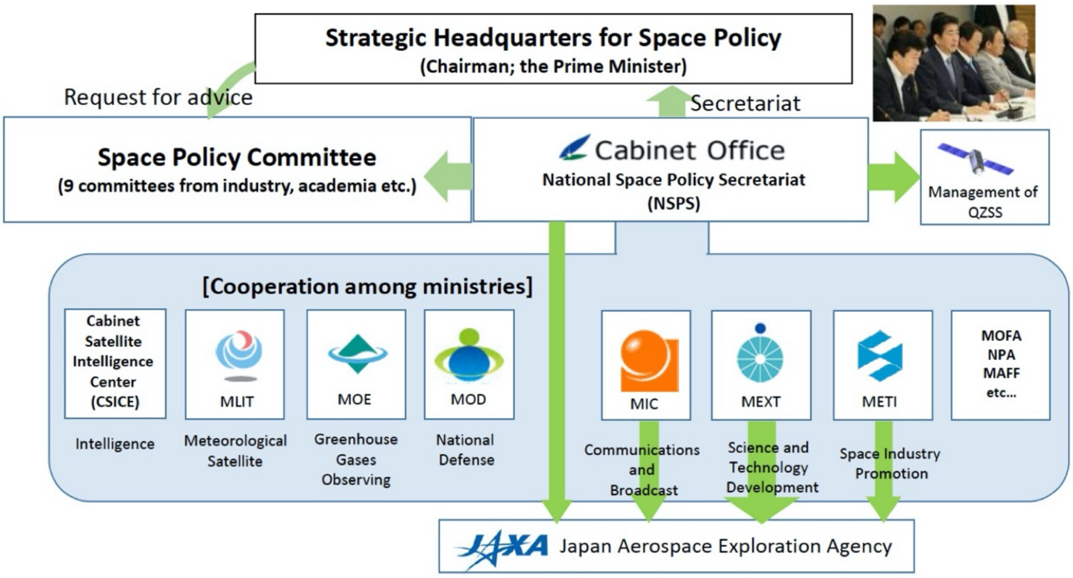

Figure 8-3. Structure of space governance at the Government of Japan[42]

The success of the informal Kawamura Consultation Group led the LDP's Policy Research Council to establish an official Special Committee on Space Development (SCSD). This strongly helped to promote the idea of space reform, both to the public through more media attention, and within the LPD. The Basic Space Bill was then submitted to the Diet on 20 June 2007.[43]

2.1.2. The SJAC working group

In parallel to the work initiated by Kawamura, another working group was established in 2006 at the Society of Japanese Aerospace Companies (SJAC), having led to a draft law said to have been instrumental in the overall drafting of the Basic Space Bill.

The SJAC characterises itself as "the sole public entity representing the interests of the Japanese aerospace industry". Established in 1952 as a forum of discussion for the aeronautical industry, it now includes also the space industry, having a membership of around 140 companies nationwide.[44] In 2006, seeing the growing interest of the Japanese political class in space policy, then-SJAC Director Norihiro Sakamoto decided to establish a working group at SJAC in order to draft a national space law proposal [JP-1]. Himself former rocket motor

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[42] Yasuhiro Yukimatsu, 'Space Policy Overview: Japan' (Country Report, 26th Session of the Asia-Pacific Regional Space Agency Forum, Nagoya, Japan, 28 November 2019), https://www.aprsaf.org/annual_meetings/aprsaf26/data/1128_CountryReports/JAPAN_AP-26_Country_Report.pdf.
[43] Suzuki, 'Space: Japan's New Security Agenda - RIPS Policy Perspectives No.5', 10.
[44] 'About SJAC', The Society of Japanese Aerospace Companies, accessed 30 March 2020, https://www.sjac.or.jp/en_index.html.

engineer at Nissan Motor Company and global commons policy expert, Sakamoto gathered around him a team of space law academics from prominent Japanese universities as well as representatives from the major Japanese space companies: MELCO, Mitsubishi Heavy Industries Corporation (MHI), IHI Corporation and NEC. After completing their work on 13 February 2007, the space law draft was transmitted to the office of Takeo Kawamura by two retired senior executives of MELCO and IHI [JP-1]. This draft is the first document clearly outlining lifting the ban of space technology utilisation by the Japanese SDF and was used by aides of Kawamura to compile the final draft of the Basic Space Bill submitted to the Diet. While the reference to space security is quite light in both documents, it shows a major shift with the previous exclusively peaceful purposes considerations. The author of this dissertation having been given access to the final SJAC draft completed on 13 February 2007, its mention of national security (国家安全保障) is reproduced below:

> Article 2 (Definition of Terms)
>
> 4. […] In addition, "use of outer space" refers to the use of "space objects" for a wide range of applications including communications, broadcasting and positioning, space environment utilisation, meteorological observation, Earth environment monitoring, disaster prevention and national security, unless otherwise specified.[45]

In the final Basic Space Bill, the inclusion of national security in the array of Japanese space activities was formulated in Articles 2 and 14. First of all, Article 2 repeals Japan's unique interpretation of the peaceful uses of outer space in favour of the laxer interpretation of peaceful uses of the Outer Space Treaty.

> Article 2 (Peaceful Use of Outer Space)
>
> Space Development and Use shall be carried out in accordance with treaties and other international agreements with regard to Space Development and Use including the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, in accordance with the pacifism of the Constitution of Japan.[46]

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[45] Unofficial translation by the author from the original Japanese: 第 2 条(用語の定義) 4 [...] また、「宇宙の利用」とは、別段の規定がある場合を除くほか、通信・放送及び測位、宇宙環境利用、気象観測、地球環境の監視、防災並びに国家安全保障を含めた幅広い用途に「宇宙物体」を利用することをいう。

[46] 'Basic Space Law (Law No. 43 of 2008)', Unofficial provisional translation (Tokyo, Japan: Japan Aerospace Exploration Agency), accessed 30 March 2020, http://stage.tksc.jaxa.jp/spacelaw/country/japan/27A-1.E.pdf.

Then, Article 14 clearly requires the state of Japan to engage in national security applications of space technology:

> <u>Article 14 (Ensuring International Peace and Security as well as the National Security of Japan)</u>
> The State shall take necessary measures to promote Space Development and Use to ensure international peace and security as well as to contribute to the national security of Japan.[47]

2.1.3. Position of the Japanese industry

Both Aoki and Suzuki agree on the Japanese space industry's support to the reform, *a fortiori* satellite manufacturers. In particular, their views converge on the impact of the 1990 US-Japan Satellite Procurement Agreement. This agreement, going further than the WTO's conditions for government procurement,[48] is not applicable to R&D and national security satellites, as already mentioned with regards to the attribution of IGS contracts to MELCO. Authorising the use – and therefore procurement – of satellites for national security would provide new governmental market opportunities for Japanese satellite manufacturers such as MELCO and NEC.

While agreeing on the overall argument, an expert familiar with the matter told the author that most of the representatives of the Japanese space industry in the SJAC working group were initially against the idea to include national security applications in the draft. In fact, they considered having already a sufficient amount of governmental contract and were not willing to risk antagonising the government on such a sensitive issue [JP-1].

2.2. Adoption of the basic space law

After the submission of the first bill to the House of Representatives on 20 June 2007 by the LDP and its ruling-coalition partner the Komeito, it took ten months for the bill to be discussed, in particular due to the fact that the Upper House, the House of Councillors, was under the control of the LDP's primary opponent, the Democratic Party of Japan (DPJ). In April 2008 however, the DPJ announced its support to the bill, which led to the joint submission on 9 May 2008 of a new bill by the LPD, the Komeito and the DPJ. It passed the House of Representatives on 13 May, the House of Councillors on 21 May, was promulgated on 28 May and finally entered into force on 27 August 2008.[49]

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[47] 'Basic Space Law (Law No. 43 of 2008)'.
[48] Aoki, 'Challenges for Japan's Space Strategy, AJISS Commentary No. 34 of 26 June 2008', 3.
[49] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 383–84.

Suzuki provided a thorough accounting of the background negotiations having led to the submission of the bipartisan bill. He argued that there were no major opposition among the three parties on the substance of the bill, and that disagreement were revolving around purely institutional matters. According to him, although both the LDP and the DPJ agreed on the need for an organisation to take the coordination and space policymaking power away from the MEXT which has been responsible for the lack of comprehensive vision of the Japanese space program, the former favoured the Cabinet Secretariat (hence control by politicians) while the latter wanted to creation of large and powerful ministry of space. The compromise they found was the current institutional arrangement at the Cabinet Office.[50]

2.3. Space security repercussions of the 2008 Basic Space Law

After its entry into force on 27 August 2008, the Basic Space Law led to deep modifications of the Japanese government use of space technology for national security purposes. This section analyses the implementation of the Basic Law through the multiple plans and policies developed by the National Security Council (NSC) and the MOD.

2.3.1. Immediate reaction of the MOD

In reaction to the enactment of the Basic Space Law, the MOD established on August 2008 the Committee for the Promotion of Outer Space Development and Use, chaired by the Senior Vice-Minister. The Committee then released on 15 January 2009 its *Basic Guidelines for Space Development and Use of Outer Space*. It confirmed the desire of the MOD to build up its space capabilities, although without providing clear directions.[51] The first comprehensive space strategies of the MOD were not developed until 2014, but most importantly 2018, as described in 3.2.1.

In addition, the MOD seconded an officer, Lieutenant Colonel Yasuo Otani, to work at the Secretariat of the Strategic Headquarters for Space Policy, council of ministers in charge of providing high-level directions for the domestic space program.[52]

[50] Suzuki, 'A Brand New Space Policy or Just Papering over a Political Glitch? Japan's New Space Law in the Making', 171–72.
[51] 'Defense of Japan 2009', Defense of Japan (Annual White Paper) (Tokyo, Japan: Ministry of Defense, 2009), 123.
[52] 'Defense of Japan 2009', 124.

2.3.2. The defence strategies of 2010

After the enactment of the MOD Basic Policy on space in January 2009, the first official shift in defence strategy with regards to space occurred when the NSC and the Cabinet approved and released, on 17 December 2010, the National Defense Program Guidelines for FY 2011 and Beyond,[53] and the lower-level implementation document Mid-Term Defense Program (FY2011-FY2015).[54] While their content is quite light and mostly mentions the use of outer space for intelligence gathering, it should be noted that it was the first time that the word "space" was used in a Japanese defence strategy. In fact, the previous National Defense Program Guidelines (NDPG) FY 2005-[55] and Beyond, and the lower-level implementation document Mid-Term Defense Program (MTDP) (FY2005-FY2009), did not even contain the word "space", in accordance with the 1969 Resolution.[56] Details on the hierarchy of Japanese defence strategy documents is provided on figure 8-4 in the next section.

2.3.3. The National Security Strategy of 2013

The National Security Strategy (NSS) of 2013 is the first-ever document outlining the GoJ's approach to national security, released by the Cabinet Secretariat on 17 December 2013.[57] Figure 8-4 shows the hierarchy of Japanese defence strategy documents, with the NSS at the highest level.

[53] 'National Defense Program Guidelines for FY 2011 and Beyond', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 17 December 2010), https://www.mod.go.jp/e/d_act/d_policy/pdf/guidelinesFY2011.pdf.

[54] 'Mid-Term Defense Program (FY2011-FY2015)', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 17 December 2010), https://www.mod.go.jp/e/d_act/d_policy/pdf/mid_termFY2011-15.pdf.

[55] 'National Defense Program Guidelines, FY 2005-', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 10 December 2004), https://www.mod.go.jp/e/d_act/d_policy/pdf/national_guidelines.pdf.

[56] 'Mid-Term Defense Program (FY2005-FY2009)', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 10 December 2004), https://www.mod.go.jp/e/d_act/d_policy/pdf/mid-term_defense_program.pdf.

[57] 'National Security Strategy', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 17 December 2013), https://www.cas.go.jp/jp/siryou/131217anzenhoshou/nss-e.pdf; 'Defense of Japan 2014', Defense of Japan (Annual White Paper) (Tokyo, Japan: Ministry of Defense, 2014), 132.

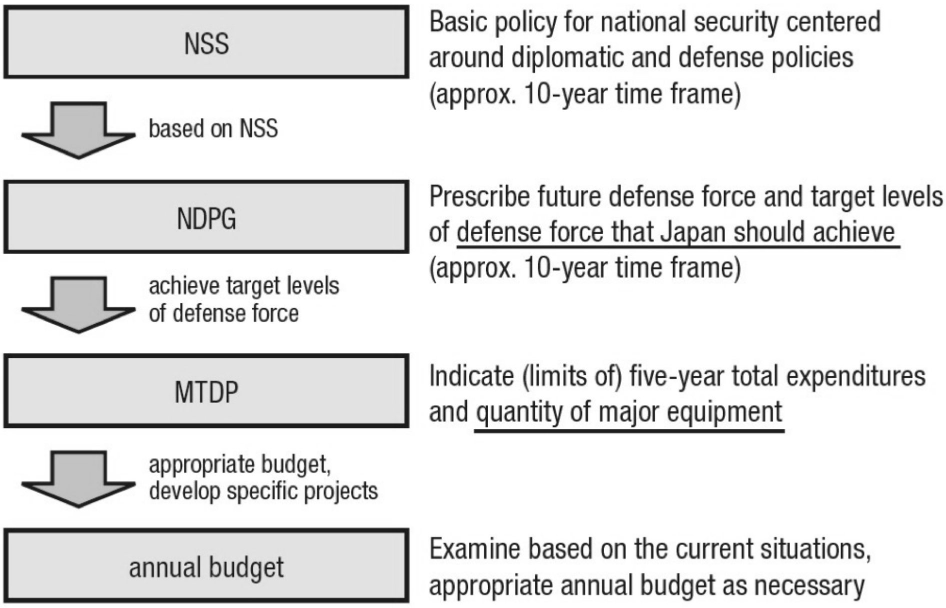

Figure 8-4. Hierarchy of Japanese defence strategy documents.[58]

Continuing on the groundwork laid by the 2008 Basic Space Law, the NSS contains an entire section emphasising the importance of the security uses of space. It is fully reproduced below:

> (9) Ensuring the Stable Use of Outer Space and Promoting Its Use for Security Purposes
>
> The stable use of outer space is not only fundamental to the lives of the people and the economy, but is also crucial for national security. Japan will therefore maintain and improve the foundation of science, technology and industry that supports the development and utilization of outer space, and promote the utilization of outer space from a security perspective.
>
> In particular, Japan will engage itself in enhancing the functions of information-gathering satellites and in making effective use of satellites, including ones Japan possesses for the operation of the SDF units, information-gathering and analysis, maritime domain awareness, telecommunication, positioning, navigation and timing. In addition, Japan will enhance a system for space situational awareness.
>
> Furthermore, Japan will promote the development and utilization of outer space in a manner that contributes to national security in the medium- to long-term, including the development of technologies such as satellite manufacturing.[59]

Most importantly for the topic of this dissertation, the NSS requested the enhancement of Japanese SSA capabilities. Further analysis is provided in section 3 below.

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[58] Taken from: 'Defense of Japan 2014', 132. Abbreviations: NSS = National Security Strategy, NDPG = National Defense Program Guidelines, and MTDP = Mid (or Medium) Term Defense Program.
[59] 'National Security Strategy', 19–20.

3. Evolution of space situational awareness in Japan

After general considerations on the impact of the 2008 Basic Space Law on Japanese approach to space security, this section focusses on the evolution of Japanese SSA capabilities over the years.

3.1. JAXA's monopoly on national SSA capabilities

Until 2008, the MOD being heavily constrained from engaging in space-related activity, JAXA had a monopolistic role on SSA. Due to the complexity of planning, budgeting and setting up SSA capabilities, JAXA is still the only agency in Japan with an SSA infrastructure. This section presents it and comments on its future evolution.

3.1.1. Current JAXA capabilities: the Bisei and Kamisaibara Space Guard Centres

The Government of Japan's SSA capabilities are currently limited to JAXA's Bisei (BSGC) and Kamisaibara Space Guard Centres (KSGC), established respectively in 2001 and 2004 in Okayama Prefecture, as shown on figure 8-5 below.

Figure 8-5. JAXA SSA infrastructure[60]

The BSGC houses two optical telescopes (of respectively 0.5m and 1m of diameter) primarily devoted to debris and satellite observation in high orbits, in particular the GEO belt.

[60] 'Space Situational Awareness (SSA) System', Japan Aerospace Exploration Agency, accessed 1 April 2020, https://global.jaxa.jp/projects/ssa/.

The KSGC on the other hand is a radar facility for LEO observation but with very limited capabilities. It can follow simultaneously 10 objects of 1.6m-size at an altitude of 650 km.[61] The BSGC and KSGC were operated by the non-profit foundation Japan Space Forum, on behalf of JAXA, until 2017.[62]

3.1.2. Upgrade of existing JAXA capabilities

As part of a government-wide strategy to enhance national SSA capabilities, defined in the Basic Plan for Space Policy, JAXA's own SSA capabilities are being upgraded, for a first trial in 2022. The details of the upgrade are shown on table 8-1 below.

Table 8-1. Details of JAXA SSA capabilities' upgrade[63]

System	Evaluation criteria	Current performances	Future performances
Radar (KSGC)	Object size detected at 650 km altitude	1.6 m	10 cm
	Maximum number of simultaneous observations	10	30
1 m telescope (BSGC)	Limiting magnitude	18th	18th
50 cm telescope (BSGC)		16.5th	16.5th
Data analysis centre (Tsukuba Space Centre)	Maximum number of objects managed	30,000	100,000
	Number of observation paths per day (radar)	200	10,000
	Observation planning	Manual	Automatic

The main improvement will consist in an ambitious upgrade of the KSGC radar, which will become able to detect object of around 10 cm in LEO, on par with the best world capabilities (before the Space Fence though). The data analysis capabilities of the Tsukuba Space Centre will also undergo a major enhancement, in order to be able to cope with the increased quantity of data collected by the KSGC radar and through SSA data sharing

[61] Susumu Yoshitomi, 'SSA Capabilities and Policies in Japan' (Workshop presentation, Space Situational Awareness Workshop: Perspectives on the Future Directions for Korea, Seoul, Republic of Korea, 24 January 2019), 10, https://swfound.org/media/206349/susumu-yoshitomi-ssa-workshop-in-seoul-20190124.pdf.
[62] Yoshitomi, 9.
[63] Adapted from: Yoshitomi, 10.

partnership with foreign partners, currently only the US and France. As for the BSGC, its old facilities and telescopes will simply be refurbished without any increase of performance.

3.1.3. Evolution of JAXA's policy on security applications

Although the 2008 Basic Space Law lifted the limitations on the use of space technology for national security, it did not automatically authorise JAXA to engage in such activities. In fact, it required an amendment of the JAXA Law.[64]

The amendment of JAXA Law was done in 27 June 2012 in accordance with the Basic Space Law.[65] It consisted in amending the contents of Article 4 (Purpose of the Agency) by replacing the reference to "exclusively peaceful purposes" (in Japanese: 平和の目的に限り) by "in accordance with the basic principle of the peaceful use of space as referred to in Article 2 of the Aerospace Basic Act (Act No. 43 of 2008)" (in Japanese: 宇宙基本法（平成二十年法律第四十三号）第二条の宇宙の平和的利用).[66]

JAXA's programmatic guidelines being revised every 7 years, it was only on 1 March 2018 that the agency's new role in space security was officially defined by its supervising ministries in its Medium- to Long-Term Goals (FY2018-FY2024). It includes, in particular, the requirement for JAXA to work in collaboration with the MOD.[67]

3.2. The development of SSA capabilities at the MOD

The lift of the limitations on the development and use of space technology by the MOD/SDF led to a sharp evolution of the ministry's policy and strategy. This evolution materialised with the attribution of space budgets, with the development of SSA capabilities at the SDF, and with new partnerships with JAXA and foreign partners.

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[64] Aoki, 'Current Status and Recent Developments in Japan's National Space Law and Its Relevance to Pacific Rim Space Law and Activities', 382.

[65] Yasuo Otani and Naohiko Kohtake, 'Applicability of Civil and Defense Dual Use to Space Situational Awareness System in Japan', *Space Policy* 47 (2019): 141.

[66] 'Act on the Japan Aerospace Exploration Agency, National Research and Development Agency (Act No. 161 of December 13, 2002)', Japanese Law Translation, 9 February 2018, http://www.japaneselawtranslation.go.jp/law/detail/?vm=04&re=01&id=3194.

[67] '国立研究開発法人宇宙航空研究開発機構が 達成すべき業務運営に関する目標（中長期目標） [Goals Related to Business Operations to Be Achieved by the Japan Aerospace Exploration Agency (Medium- to Long-Term Goals)]' (Tokyo, Japan: Cabinet Office; Ministry of Internal Affairs and Communications; Ministry of Education, Culture, Sports, Science and Technology; and Ministry of Economy, Trade and Industry, 1 March 2018), 6–7, https://www.jaxa.jp/about/plan/pdf/goal04.pdf.

3.2.1. Post-2008 policy and strategic shifts

Apart from the immediate release of a Basic Policy on space development and utilisation after the enactment of the Basic Space Law, the MOD's posture on space security has progressively shifted with successive strategic documents,[68] listed below:

- The NDPG for FY 2014 and Beyond, published on the same day as the NSS, 17 December 2013, goes further in the requirements to the SDF to develop appropriate SSA capabilities in order to "secure effective, stable use of outer space", through "organic partnerships with research and development institutions in Japan, as well as with the US."[69]
- The MTDP (FY2014-FY2018) reaffirms the directions given in the NDPG by specifying that collaboration with the domestic institutions and the US should focus on "personnel development", for the goals of "actively promot[ing] space situational awareness efforts, and research on satellite protection, and work[ing] to enhance the resiliency of its [SDF] satellites".[70]
- Based on the two previous documents and on the NSS, the MOD released in August 2014 a revised Basic Policy on Space Development and Utilisation, including the requirement for the "MOD and JSDF [to] conduct specific studies in collaboration with the Cabinet Office and the MEXT aiming for the development of sensors and analysis systems necessary for tracking space objects," as well as to "share gathered information etc. with allied countries".[71]
- Finally, the NDPG for FY 2019 and Beyond and the MTDP (FY2019-FY2023) are the most ambitious strategy documents to-date on the development of space security capabilities at the SDF. Regarding SSA particularly, they announced the following changes at the MOD/SDF:[72]

[68] Otani and Kohtake, 'Applicability of Civil and Defense Dual Use to Space Situational Awareness System in Japan'.
[69] 'National Defense Program Guidelines for FY 2014 and Beyond', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 17 December 2013), 20, https://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/Defense_Program.pdf.
[70] 'Medium Term Defense Program (FY2014-FY2018)', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 17 December 2013), 12–13, https://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/20131217_e2.pdf.
[71] Translated and cited in: Otani and Kohtake, 'Applicability of Civil and Defense Dual Use to Space Situational Awareness System in Japan', 141.
[72] 'Medium Term Defense Program (FY2019-FY2023)', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 18 December 2018), https://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/20131217_e2.pdf.

- The establishment of a "space domain mission unit" at the Air SDF, primarily to conduct SSA missions. It is budgeted for the first time in FY2020, under the name "space operations squadron".[73]
- The development of a "space situational awareness (SSA) system" in order to connect all SSA-related government capabilities in Japan.
- The development of advanced SSA technologies such as "space-based optical telescopes" and "SSA laser ranging devices".
- The enhancement of cooperation with JAXA, the US and other countries (e.g. France), in particular for human resource development. In fact, a month before the publication of these documents, in October 2018, the SDF participated for the first time in the US Air Force Space Command's Schriever Wargame, most famous international space warfare simulation game.[74]

The latest strategies are showing a very clear desire for the GoJ to engage fully in the military uses of space. The question now, still open, is whether the Cabinet and Diet will allow the concrete realisation of the strategies through important budget increases. When looking at the decrease of space-related budget for FY2020 shown on figure 8-6 below, some experts have shown serious doubt about the actual commitment of decision-makers [JP-1].

[73] 'Defense Programs and Budget of Japan: Overview of FY2020 Budget' (Tokyo, Japan: Ministry of Defense, 2020), 4, https://www.mod.go.jp/e/d_act/d_budget/pdf/200330a.pdf.
[74] Takeshi Iwaya, 'Speech by Minister of Defense Iwaya at Center for Strategic and International Studies (CSIS)', Ministry of Defense, 17 January 2019, https://www.mod.go.jp/j/approach/anpo/kyougi/2019/01/17_speech-en.html.

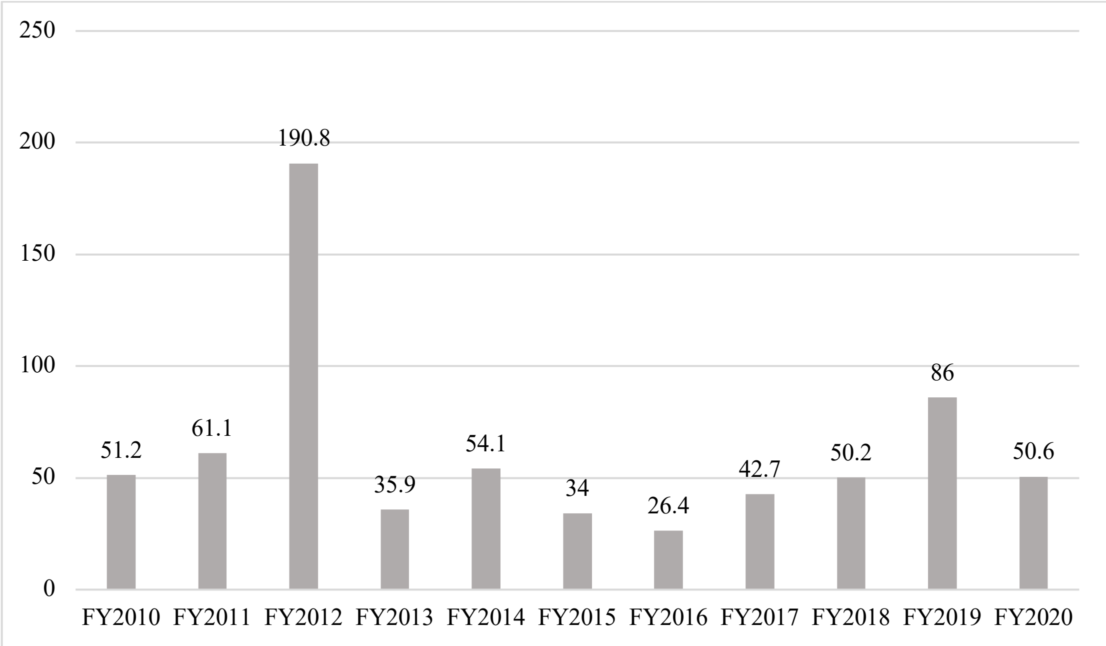

Figure 8-6. Space-related MOD budget (JPY, FY2010-FY2020)[75]

3.2.2. Development of new MOD sensors and synergies with JAXA

While the MOD does not possess its own SSA technical capabilities, it is currently in the process of developing a deep space radar for the monitoring of objects around the geostationary orbit, initiated in FY2016 and to be completed in FY2022 as defined in the Basic Plan for Space Policy.[76] In fact, the MOD has been receiving technical support through the US government Foreign Military Sales (FMS) program since FY2018.[77]

The development of these capabilities at the MOD aims to complement existing JAXA capabilities. The integration of Japanese SSA capabilities following a whole-of-government approach, combined with agreements with foreign partners (cf. 3.2.3) is expected to provide a fine monitoring of both the LEO (with JAXA's KSGC radar) and the GEO regions (with JAXA's BSGC telescopes and the future MOD radar).[78] Figure 8-7 provides a visual of such collaboration framework.

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[75] 'Defense Budget', Ministry of Defense, accessed 2 April 2020, https://www.mod.go.jp/e/d_act/d_budget/.
[76] 'Implementation Plan of the Basic Plan on Space Policy (Revised FY2017)', Tentative translation (Tokyo, Japan: National Space Policy Secretariat, Cabinet Office, 12 December 2017), 45–46, https://www8.cao.go.jp/space/english/basicplan/2017/basicplan.pdf; 'Defense of Japan 2018', Defense of Japan (Annual White Paper) (Tokyo, Japan: Ministry of Defense, 2018), 331, https://www.mod.go.jp/e/publ/w_paper/pdf/2018/DOJ2018_Full_1130.pdf.
[77] Shinichi Akiyama, 'Japan, US to Collaborate on Space Surveillance', Mainichi Daily News, 30 March 2019, https://mainichi.jp/english/articles/20190330/p2a/00m/0na/002000c.
[78] Yoshitomi, 'SSA Capabilities and Policies in Japan', 18.

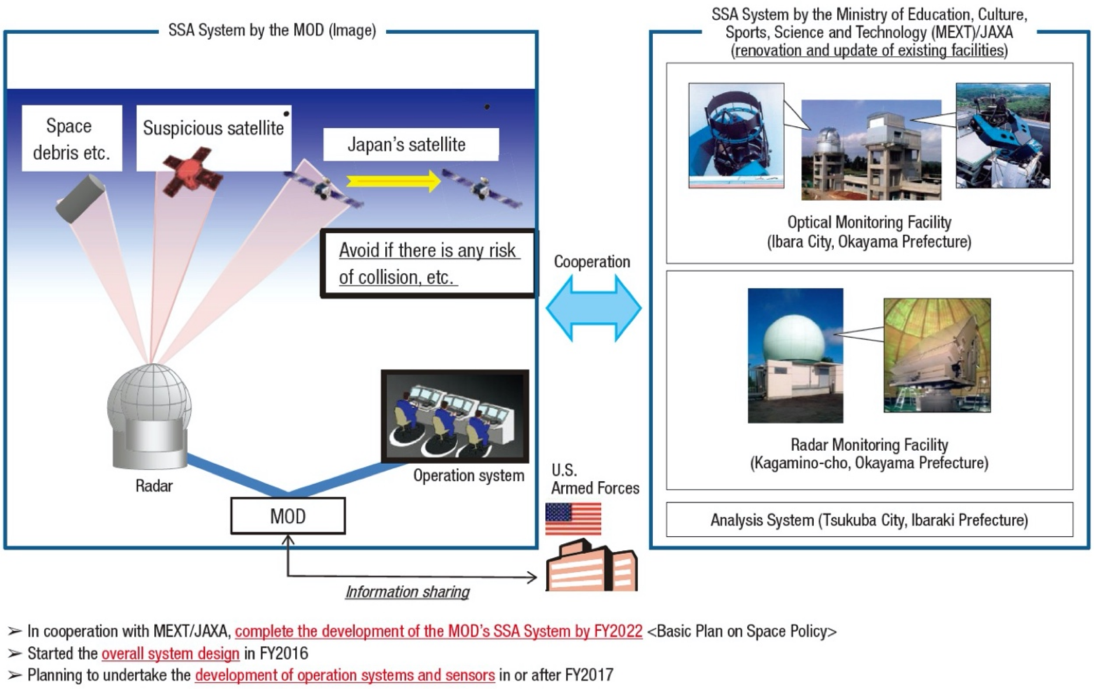

Figure 8-7. Cooperation structure between the MOD and JAXA (MEXT) for SSA[79]

As part of its cooperation with JAXA, the MOD dispatched an officer from the Air Staff Office to JAXA's Tsukuba Space Centre as the first step of the development of SSA-related capacity at the SDF.[80]

3.2.3. Partnership with the US and 'gaiatsu'

An important element of the GoJ's progressive increase of SSA capabilities is an SSA data sharing partnership with the US – for unclassified data only.[81] Along with many other countries in the world, Japan has entered into an agreement with the Strategic Command of the US military (USSTRATCOM) both to benefit from US data and to fuel its own data into the US Space Surveillance Network (SSN). The memorandum of understanding (MoU), negotiated by the MOFA with the US Government, was then signed by multiple GoJ agencies, namely those actually operating satellites: the Cabinet Secretariat (via the Director of Cabinet

[79] Taken from: 'Defense of Japan 2018', 331.
[80] Yoshitomi, 'SSA Capabilities and Policies in Japan', 16.
[81] 'Space Cooperation, Space Situational Awareness: Agreement Between the United States of America and Japan Effected by Exchange of Notes at Tokyo, May 28, 2013, with Memorandum of Understanding', Treaties and Other International Acts Series 13-528 (Washington, DC: Department of State, 28 May 2013), https://www.state.gov/wp-content/uploads/2019/02/13-528-Japan-Space-Cooperation-SSA-Safety-of-Space-w-MOU.pdf.

Intelligence), the MEXT, the METI, the MLIT and JAXA on 28 May 2013.[82] The reason for the multiple signatories on the Japanese side is that the each entity receiving SSA services should have a direct agreement with the US Secretary of Defense, through the USSTRATCOM [JP-9]. To simplify overall discussions between the US and Japan, the MOFA negotiated the MoU on behalf of all GoJ agencies. This "umbrella agreement between the two governments established the basic terms and conditions, and being delegated by that document, each ministry concluded a detailed agreement with the DoD" [JP-9]. Another benefit of having an umbrella agreement is that it makes it easy for new GoJ entities to enter into an agreement with the USSTRATCOM [JP-9]. The MOD/SDF benefited from such agreement through other entities, in particular JAXA and the CSICE.

Interestingly, the Japan-US SSA agreement can be seen as both a cause and consequence of the enhancement of Japanese SSA capabilities. A consequence because it is not appropriate for a powerful nation like Japan to solely rely on an external source of data and because the Japanese government prides itself in explaining that the data exchange is bidirectional. But it is also a cause of Japanese enhancement as the US Government is willing to extend the coverage of its SSN to a still "under-covered" region.[83] Such motivation of Japan to increase its capabilities in reaction to the direct or indirect pressure exerted by a foreign country is emblematic of the concept of *gaiatsu*, (外圧, literally "foreign pressure"), a common but debated interpretation of Japanese political motivations.[84] An interviewee strongly supported the idea that developing SSA capabilities at the MOD was primarily motivated by *gaiatsu*, the MOD having very limited need for it – except for minor checks on China and DPRK – due to its lack of own satellites to monitor and protect [JP-6], while another opposed the idea by saying that the MOD's monitoring role would go beyond its own capabilities to cover the very extensive GoJ civilian space infrastructure [JP-1].

Another step of the Japan-US collaboration on SSA was taken with the *2015 Guidelines for Japan-U.S. Defense Cooperation*, urging the two partners "to maintain and strengthen their partnership to secure the responsible, peaceful, and safe use of space".[85] In order to pursue this

[82] 'Space Cooperation, Space Situational Awareness: Agreement Between the United States of America and Japan Effected by Exchange of Notes at Tokyo, May 28, 2013, with Memorandum of Understanding'.
[83] Paul McLeary and Theresa Hitchens, 'US, Japan To Ink Hosted Payload Pact to Monitor Sats', Breaking Defense, accessed 5 April 2020, https://breakingdefense.com/2019/08/us-japan-to-ink-hosted-payload-pact-to-monitor-sats/.
[84] Paul Nadeau, 'The End of Gaiatsu?', Center for Strategic and International Studies, 29 October 2018, https://www.csis.org/analysis/end-gaiatsu.
[85] 'The Guidelines for Japan-U.S. Defense Cooperation' (Tokyo, Japan: Ministry of Foreign Affairs, 27 April 2015), 21, https://www.mofa.go.jp/files/000078188.pdf.

goal, the guidelines namely mentioned SSA and called for the two governments to "pursue opportunities for cooperation […] in space-related equipment and technology that will strengthen capabilities and resiliency of the space systems, including hosted payloads".[86] The announcement in mid-2019 of a Japanese-US agreement on the installation of American satellite-based SSA sensors onboard Japanese QZSS satellites, to increase the American coverage of the East Asian area, is the materialisation of this latter point.[87]

Finally, the Japan-US collaboration on SSA materialises through staff exchange. In fact, the Japanese annual defence budget includes credits for the MOD to dispatch SDF officers for space-related trainings with the US military.[88]

4. Promoting Japanese military equities in STM

This section analyses the views on STM in the Japanese MOD/SDF and questions the ability of the MOD/SDF to influence space and in particular STM policymaking efforts at the GoJ. In order to facilitate the reader's understanding of the different components of the MOD, a detailed organisational chart is shown on figure 8-8.

86 'The Guidelines for Japan-U.S. Defense Cooperation', 21.
87 McLeary and Hitchens, 'US, Japan To Ink Hosted Payload Pact to Monitor Sats'.
88 'Defense Programs and Budget of Japan: Overview of FY2020 Budget', 5.

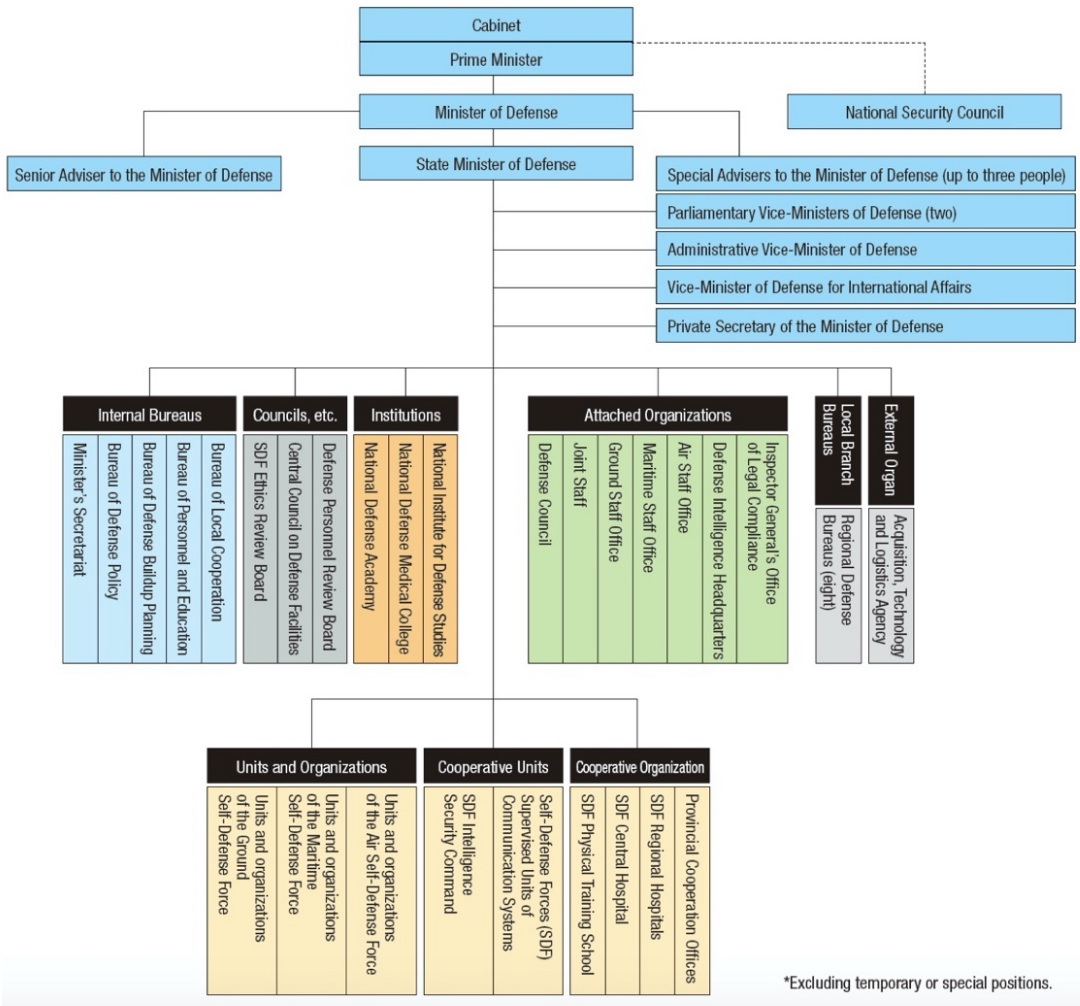

Figure 8-8. Japanese MOD organisational chart[89]

4.1. Views of the Japanese military on STM

Being a newcomer in the military uses of space and in even space surveillance, needless to say that the MoD/SDF do not have any official view on STM. Even concerning civilian and military officials, only a very few have been working on space policy and *a fortiori* STM. For example, at a given time, there are only three or four people working on space policy at the Strategic Planning Division of the Bureau of Defense Policy, civilian heart of the MOD, most staff of the division focussing on cybersecurity and ballistic missile defence [JP-4]. As for the SDF, being in the process of capacity building, there are still very limited knowledge to be found on STM, with the exception of senior officers having acquired it in contact with the US military.

[89] 'Defense of Japan 2018', 310.

This section presents the views on STM of current or retired MOD officials interviewed by the author. Interestingly, thanks to the very small number of MOD staff with knowledge on space issues, there is no real internal debate, everyone – both at the Internal Bureaus (civilian) and the ASO – agreeing on few elements detailed in the following subsections. It has however not always been the case. In fact, the use of space technology in general and of SSA in particular was not seen as a priority at the MOD: the Air SDF doubted its real benefits while the Internal Bureaus were concerned that an increase of space budget would lead to a decrease in other key budgets [JP-5,6]. It required the influence of senior military leaders, such as former ASDF Chief of Staff General Haruhiko Kataoka (now member of the NSPC's subcommittee on space security), to progressively change the conservative mindset of the ASO [JP-5]. US Air Force General Raymond, while he was still Commander of the Air Force Space Command, is said to have been instrumental in supporting a change in the SDF's appreciation of the importance of space technology [JP-5]. This is due to the fact that General Raymond has developed close ties with the SDF leadership while serving as Vice Commander of the 5th Air Force and Deputy Commander of the 13th Air Force, housed at the Yokota Air Base in Japan, from late 2010 to mid-2012 [JP-5].[90]

4.1.1. STM should be under civilian authority

In line with their American and French counterparts on this issue, Japanese MOD officials all agree on the fact that the MOD could "support" STM through data and information sharing but should not involve in regulatory affairs [JP-4,5]. They strongly believe that both JAXA and the MOD should complement each other's capabilities in LEO and GEO in order to provide a civilian agency responsible for STM with high-quality actionable data [JP-4].

The choice of the civilian agency is however a point of disagreement among MOD experts, mirroring the US situation. On the one hand, some believe that the MLIT would be the most appropriate and natural structure as the agency already responsible for other forms of traffic management (land, air or maritime) [JP-5]. In particular, the MLIT is the supervisory authority of the Japanese Coast Guard (JCG), now in charge of building the Japanese national operational picture for maritime domain awareness (MDA), that includes receiving and integrating data from the MSDF.[91] This experience supports the designation of the MLIT as

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[90] 'Biography: General John W. "Jay" Raymond', U.S. Air Force, December 2019, https://www.af.mil/About-Us/Biographies/Display/Article/108479/general-john-w-jay-raymond/.
[91] 'MDA Situational Indication Linkages' (Tokyo, Japan: Japan Coast Guard, 21 January 2020), https://www8.cao.go.jp/ocean/policies/mda/pdf/msil_leaflet.pdf.

natural candidate for the responsibility and can prove useful in building a civilian system integrating the ASDF's SSA data.

On the other hand, others believe that in order to facilitate cooperation with the US on SSA/STM, the METI should step up as the lead civilian agency, as it can rely on its longstanding relationship with the US Department of Commerce, designated by President Trump as responsible for STM in the US Government.[92] This is in line with the typical interpretation of Japanese governmental practice of *gaiatsu*, already mentioned above.

Finally, as presented in 3.2.3, both the METI and the MLIT were among the agencies having signed the SSA sharing agreement with the USSTRATCOM and therefore have experience in dealing with practical international cooperation for space surveillance.

4.1.2. In favour of national and international rulemaking

Another common understanding of the MOD officials interviewed by the author is the importance of establishing a certain level of national STM rules to preserve the outer space operational environment. When asked if such rules should equally apply to all domestic actors, including the SDF, all answered that there is no reason for the SDF to have an exception in peacetime [JP-4,5]. Moreover, the strong Japanese belief in civilian control of the military prompted some to insist that the MOD should not participate in establishing those rules [JP-4].

With regards to international STM rules, there was much less consensus among MOD interviewees on the way forward. Although they all acknowledged the importance of international coordination for the long-term sustainability of the space environment, opinions were quite contrasted, with some willing to see the UNCOPUOS developing rules applicable to every space actor in the world [JP-4], while others favoured non-binding rules allowing operationally-motivated exceptions [JP-5]. None however, had a clear appreciation on the form that these rules can take. It was in that sense very different from the interviews that the author conducted in the US, where all interviewees had internalised the use of the cautious expression "norms of behaviour". It will be important for the MOD to develop its own understanding of rulemaking for STM as its "involvement in international effort to establish international rule regarding space domain" is included for the first time in its annual budget for FY2020.[93]

[92] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[93] 'Defense Programs and Budget of Japan: Overview of FY2020 Budget', 5.

4.2. Influence of the MOD on space policymaking

This section analyses the actual influence of the MOD on Japanese space policymaking, with an emphasis on the lack of interaction between the space and national security policymaking communities.

4.2.1. Official structure of space policymaking[94]

As shown on figure 8-3, there are three main structures of space policymaking at the GoJ: the Strategic Headquarters for Space Policy (SHSP), the National Space Policy Committee (NSPC) and the National Space Policy Secretariat (NSPS), all three housed at the Cabinet Office.

The SHSP is a council chaired by the Prime Minister and composed of all space-related ministers. It is the highest-level decision-making body in charge of providing strategic directions for the Japanese space program while more concrete policymaking and implementation are debated at the NSPC.

The NSPC is a committee of seven members chosen among the most prominent national experts in space engineering, science, law and policy. It usually includes university professors, astronauts, industrials and retired general officers. The committee is responsible for advising the SHSP and is the primary source of information for policymaking. In order to provide recommendations on specific issues, the NSPC has eight subcommittees on various topics such as space security, space legislation, space industry, etc.

Finally, the NSPS serves both as secretariat for the NSPC and SHSP and as coordinating body for space activities across the GoJ. As there are no Cabinet Office career civil servants, most of NSPS officials are seconded from the MEXT and METI, completed by other relevant ministries and agencies (MOFA, MIC, MOD, JAXA, etc.). Moreover, the NSPS Director General is always from the METI while his deputy is chosen from the MEXT, which seems to be related to internal tradition rather than strict legal design.

4.2.2. Structure of national security policymaking for the 2018 defence strategies

National security policymaking in Japan has roughly the same structure as space policymaking, except it is housed at the Cabinet Secretariat rather than at the Cabinet Office.

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[94] A very comprehensive introduction to space policymaking in Japan can be found in: Takuya Wakimoto, 'A Guide to Japan's Space Policy Formulation: Structures, Roles and Strategies of Ministries and Agencies for Space', *Pacific Forum: Issues & Insights* 19 (April 2019), https://pacforum.org/wp-content/uploads/2019/04/issuesinsights_Vol19WP3_0.pdf.

This subsection briefly outlines the drafting process of latest NDPG and MTDP, released in December 2018, as shown on figure 8-9.

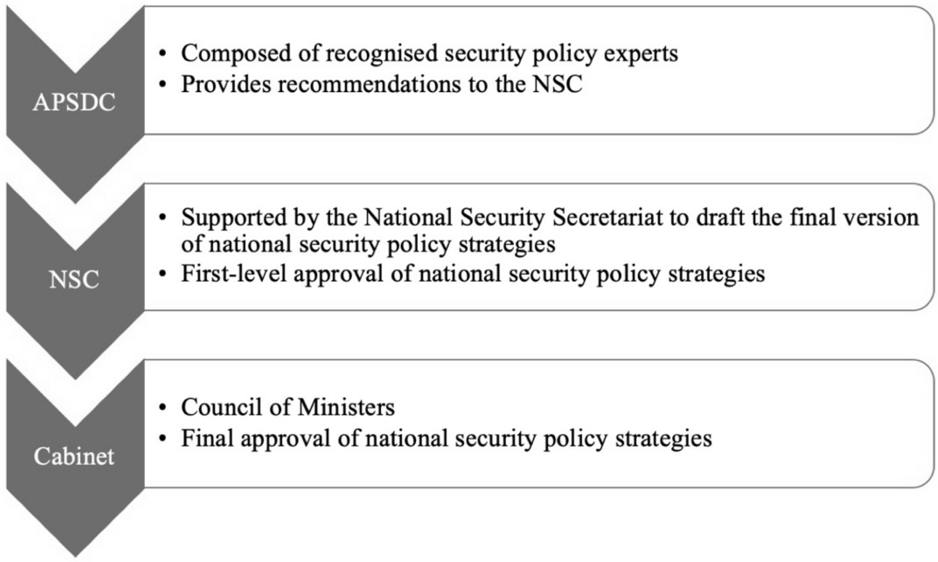

Figure 8-9. Simplified outline of national security policymaking in 2018 at the GoJ

The first layer of security policymaking is the Advisory Panel on Security and Defense Capabilities (APSDC). Its members, appointed by the Prime Minister, are, as for the NSPC, widely recognised experts in all facets of national and international security. The APSDC is the main security discussion body where key recommendations are drafted, before being handed over to the National Security Council (NSC). By deciding to follow such process, Prime Minister Abe was following a long tradition of national space policymaking relying on a private advisory council.[95]

The NSC, subset of the Cabinet, is a high-level council chaired by the Prime Minister and composed of the Minister of Internal Affairs and Communications, the Minister of Foreign Affairs, the Minister of Finance, the Minister of Economy, Trade and Industry, the Minister of Land, Infrastructure, Transport and Tourism, the Minister of Defense, the Chief Cabinet Secretary and the Chairman of the National Public Safety Commission. Apart from plenary sessions with all nine members, the NSC often meets under the "4-Minister Meeting" format, with the Prime Minister, the Chief Cabinet Secretary and the Ministers of Foreign Affairs and Defense.[96] The work of the NSC is supported by the National Security Secretariat. It is

[95] Takao Sebata, *Japan's Defense Policy and Bureaucratic Politics, 1976-2007* (Lanham, Maryland: University Press of America, 2010), 326.
[96] 'Defense of Japan 2014', 125–26.

responsible for "the planning and coordination of basic direction and important matters of foreign and defence policies concerning Japan's national security, using its general coordination authority".[97] After coordination across the GoJ and the final drafting of the national security documents (e.g. NDPG and MTDP) the NSC provides the first level of approval before the final approval by the full Cabinet.

4.2.3. What about space security policymaking? The LDP: the missing link

The natural question rising from the succinct outlines of space and national security policymaking provided in the two previous sections is the following: what happens for space security policymaking, at the crossroads of both structures?

Space security policy being part of the broader category of national defence and security policy, it is the responsibility of the NSC and therefore relies on recommendations made by experts of the APSDC. However, a close analysis of the composition of the APSDC shows that it does not contain any expert in space security, information confirmed by a member of the panel interviewed by the author [JP-3]. In fact, apart from a short presentation made during an APSDC meeting by JAXA President Hiroshi Yamakawa, there was no actual space security expert input to the APSDC's work [JP-3]. Moreover, according to members of both the APSDC and the NSPC, there was no formal or informal interactions between the two committees [JP-2,3], even though the NSPC's space security subcommittee is composed of prominent experts from academia, industry and the military. The supervision of the two processes by two different organisations, the Cabinet Secretariat and the Cabinet Office, may explain the absence of interaction, in line with the traditional extreme verticality of the GoJ.

Therefore, how could the APSDC recommend a space security strategy as comprehensive as the one detailed in the latest MTDP without having neither internal knowledge nor external input? In fact, space-related items to be included in the NDPG and MTDP were provided to members of the APSDC directly from bureaucrats of the National Security Secretariat [JP-3], going against the spirit of the process. However, after learning this, it seemed surprising to the author of this dissertation that bureaucrats of the National Security Secretariat had enough specialised knowledge to develop the MTDP guidelines without themselves receiving external input. Thanks to a thorough investigation, the author was able to identify and confirm the real origin of the recommendations and uncover the hidden link allowing a certain consistency between Japanese space policy and national security policy: the LDP.

[97] 'Defense of Japan 2014', 125.

A senior advisor at the LDP interviewed by the author confirmed that the recommendations made by bureaucrats to the members of the APSDC originated from LDP internal space policy research, which was then transmitted to the Prime Minister by the LPD leadership, which in turns instructed Cabinet Secretariat officials [JP-1]. In fact, the space-related elements included in the MTDP are almost copy-paste of an internal document, consulted by the author, titled "Realisation of Defense Program Guidelines and the Expansion of the Use of Space in Industry and Scientific Domain (LDP 5th Policy Recommendations)"[98] released internally on 14 May 2019 by the LDP Policy Committee's Special Committee on Space and Ocean Development.[99] The author was also able to consult the four previous LDP space policy recommendations, which contents are correlated with the work done by the Cabinet Office's NSPC, although not copy-paste like for the MTDP. It is surely due to the fact that the NSPC has the necessary expertise to develop complex space policies based on the LDP's initial recommendations whereas the APSDC and NSC have to accept them at face value due to the lack of space expertise in their ranks.

4.2.4. Channels of MOD influence on space policymaking

Taking into consideration the structures of space and security policymaking at the GoJ, this section identifies the different channels that can be used by the MOD/SDF to defend their interests in space development and utilisation.

From a purely high-level organisational perspective, the Minister of Defense is one of the four core members of the NSC and therefore has a strong voice in the discussions. Moreover, the MOD is directly dispatching officers at the National Security Secretariat, in particular successive junior SDF general officers as concurrently Cabinet Councillor and Assistant Chief Cabinet Secretary, and at the Cabinet Office's NSPS. They therefore allow a direct MOD input in space and security policy policymaking. Wakimoto also mentions a certain level of coordination between the Bureau of Defense Policy's Strategic Planning Division and the NSPC on SSA policy.[100] However, while having MOD staff at the National Security Secretariat and at

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[98] In Japanese: 自民党＜第五次提言＞防衛大綱の具体化と産業・科学における宇宙利用の拡大.

[99] '自民党＜第五次提言＞ 防衛大綱の具体化と産業・科学における宇宙利用の拡大 [LDP 5th Policy Recommendations - Realization of Defense Program Guidelines and the Expansion of the Use of Space in Industry and Scientific Domain]' (Tokyo, Japan: 自由民主党政務調査会 宇宙・海洋開発特別委員会 [Special Committee on Space and Ocean Development, Policy Committee, Liberal Democratic Party of Japan], 14 May 2019), On File with Author.

[100] Wakimoto, 'A Guide to Japan's Space Policy Formulation: Structures, Roles and Strategies of Ministries and Agencies for Space', 18–19.

the NSPS can prove useful for traditional areas of SDF expertise (e.g. maritime security), it is very limited in the case of space policy due to the lack of internal knowledge on the issue, both at the ASO and the Bureau of Defense Policy. The SDF therefore have to rely not on direct defenders of its inexistent internal position on STM but rather on external promoters of its longstanding interests and spirit. Regarding space policy, this can be done at two levels: the LPD and the Cabinet Office's NSPC. Regarding the LPD, it is very common for lawmakers or researchers to hold policy research meetings with external experts [JP-2]. However, whether active or retired high-ranking officers were invited to such was not mentioned by any interviewee. As for the NSPC, two prominent retired SDF officers are officially participating in the debates, namely General Ryoichi Oriki, former Chief of Staff of the SDF, as member of the NSPC and General Kataoka as member of the NSPC's subcommittee on space security.

4.3. Developing a space expertise at the ASDF

In line with the strategies of the two other countries studied in this dissertation, the Japanese government is planning for the development of a body of space experts in the ASDF. With the goal of establishing a capacity for cross-domain operations, the NDPG for FY2019 and Beyond instructs:

> "(2) SDF will maintain an ASDF unit that specializes in space domain missions, and strengthen its posture for joint operations in order to conduct persistent monitoring of situations in space, and to ensure superiority in use of space at all stages from peacetime to armed contingencies through such means as mission assurance and disruption of opponent's command, control, communications and information".[101]

More fundamentally, this institutional reorganisation is to be accompanied by capacity building efforts, consisting in the development of a career track on space operations and increased cooperation with JAXA and other international partners, as explained in the same NDPG for FY2019 and Beyond:

> "SDF will actively leverage civilian technologies and work to enhance cooperation with relevant agencies including the Japan Aerospace Exploration Agency (JAXA) and with the United States and other relevant countries. SDF will also engage in organization building such as the creation

[101] 'National Defense Program Guidelines for FY 2019 and Beyond', Provisional translation (Tokyo, Japan: Cabinet Secretariat, 18 December 2018), 26–27, https://www.mod.go.jp/j/approach/agenda/guideline/2014/pdf/Defense_Program.pdf.

> of units specializing in space and dedicated career field, and develop human resources and accumulate knowledge and expertise in the space field".[102]

The details of the implementation of this capacity building policy are however not perfectly defined in the strategies themselves (NDPG and MTDP), the MTDP for FY2019 simply explaining that the SDF will "establish new job categories and enhance education dedicated to the space domain".[103] The MOD's annual key publication, *Defense of Japan*, shed more light on a possible implementation by mentioning staff exchanges with JAXA – including officers dispatched at the Tsukuba Space Centre, and most importantly close contacts with the US through the Japan-US Space Cooperation Working Group (SCWG), established in April 2015, to promote cooperation for the joint "training of space experts" and participation in tabletop exercises as described earlier in this chapter (Global Sentinel and Schriever Wargame). Finally, this publication also names "other relevant countries" as being currently France, India and the EU (*sic*).[104]

For what concerns the development of dedicated programs at the National Defense Academy or other forms of training organised by the Air Training Command, there was no official announcement of the MOD. The National Defense Academy has an aerospace engineering department but the ratio between aeronautics and astronautics is unclear. In addition, the National Institute for Defense Studies has been conducting seminars for senior officers, including lectures on space security.[105]

In addition to the official plans outlined above, a noticeable aspect of the development of an awareness on space issues among senior Japanese military leaders is the role played by senior US military officers. As mentioned earlier, General Raymond, first Chief of Space Operations in the history of the US, used to be posted in Japan and the close contact that the Japanese senior military establishment developed with this prominent "pure space officer" is said to have contributed significantly to the evolution of SDF mentalities [JP-5].

[102] 'National Defense Program Guidelines for FY 2019 and Beyond', 20.
[103] 'Medium Term Defense Program (FY2019-FY2023)', 7.
[104] 'Defense of Japan 2019', Defense of Japan (Annual White Paper) (Tokyo, Japan: Ministry of Defense, 2019), 292, https://www.mod.go.jp/e/publ/w_paper/pdf/2019/DOJ2019_Full.pdf.
[105] '教育状況 バックナンバー', National Institute for Defense Studies, accessed 27 June 2020, http://www.nids.mod.go.jp/topics/education/2018.html; 'Education', National Institute for Defense Studies, accessed 27 June 2020, http://www.nids.mod.go.jp/english/research/education/index.html.

4.4. Involvement in international rulemaking in space

There is currently no evidence of MOD's involvement in international rulemaking for the preservation of the space environment. However, this may change in the course of FY2020 (April 2020 – March 2021) as the national defence budget includes for the first time a budgetary line on the MOD's "involvement in international effort to establish international rule regarding space domain".[106]

5. Conclusions

In this concluding chapters, the author first provides his personal interpretation of the consequences of the 1969 Resolution before analysing the validity of this study's hypotheses with regards to the Japanese case study.

5.1. Overcoming the 1969 Resolution's disaster

The development of the Japanese space program has been heavily shaped by the strong limitations of space development and utilisation by the SDF, based on the 1969 Exclusively Peaceful Purposes Resolution's non-military interpretation of the peaceful uses of outer space. The author of this dissertation is convinced that this resolution was disastrous for Japan. Although it is one of the world's most advanced civil space powers, Japan is a military space dwarf. Faced with the rise of Chinese military space capabilities, that it will never be able to catch up with, Japan put itself in a situation of utter vulnerability towards potential enemies and heavy dependency on its allies. Without the US, Japan has limited abilities to detect hostile acts against its space infrastructure, providing the US with a strong leverage to push Japan to develop SSA capabilities and host American SSA payloads on its QZSS satellites. In short, after shooting itself in the foot in 1969, Japan cannot refuse US pressures to develop capabilities that are primarily in the interest of the US, by fear of losing American support in space safety and security. But are the current developments of military SSA in Japan adapted to the need of the country? It is far from being certain and MOD decision-makers should stop hiding behind the concept of *gaiatsu* and produce a real independent analysis of the benefits brought by the planned MOD radar and hosted American payloads. In fact, the SDF are intelligently trying to develop a space career field and therefore a body of space experts in their ranks: but it is only after this step that meaningful decisions can be made on a possible national defence space program. In the meantime, it may be preferable to commission an independent study to external

[106] 'Defense Programs and Budget of Japan: Overview of FY2020 Budget', 5.

experts. In addition, although the recent national defence strategy documents pushed for the development of counterspace capabilities, it is very doubtful that the Japanese industry will be able to develop such precise expertise before at least a decade. Foreign defence and space industrials met by the author expressed very positive expectations after the publication of the 2018 NDPG and MTDP, knowing that they would surely be awarded short-term contracts, waiting for the slow development of capabilities by the Japanese space and defence industrial sector.

The approval of the IGS program in late 1990s could be seen as a first step towards normality but was in fact limited by the excessively stringent Japanese non-military interpretation of the peaceful uses of outer space. As explained by Aoki, in order to be shared with the JDA in accordance with the 1985 unified government view, "the resolution of IGS images should not be better than the resolution available from other satellites in the market". What is then the point of spending so much money on an IGS program if simply purchasing commercial imagery would produce better results? Apart from this, it shows the inherent hypocrisy of the Japanese security space program, hiding itself behind beautiful anti-militaristic views but then spending decades – from 1985 to 2008 – finding all possible way to twist the law and its interpretations to have IGS and BMD.

The last major consequence of the 1969 Resolution is the heavy imbalance of the Japanese space program towards R&D and consequently the concentration of most of the power and influence in the hands of the MEXT. All the complexities and hurdles of recent Japanese space reform – in particular the creation of the National Space Policy Secretariat at the Cabinet Office – converge around the idea of reducing the MEXT's monopolistic influence on Japanese space policy. All this trouble for a simple resolution, that was clearly, even at the time, going against any reasonable interpretation of international space law.

5.2. Post-2008 situation and implications on the study's hypotheses

The push of Prime Minister Koizumi for the Ballistic Missile Defence program in 2003 ignited a desire for change among LPD lawmakers than culminated in 2005 with the Kawamura Initiative. But it is only with the enactment of the 2008 Basic Space Law and the attribution of consequent space budgets to the MOD/SDF that Japan really initiated a major shift in its military uses of outer space. The mandate of the Basic Space Law to pursue the use of space technology for the strengthening of the national security of Japan led to the development of internal policies at the MOD but most importantly the drafting and approval by the National Security Council of ambitious national defence strategies prompting, in particular, the development of an SSA infrastructure at the MOD. Does it however mean that the Japanese military is willing to engage in space safety and sustainability? The answer to this question is clearly negative. Concretely, how does Hypothesis 1, reminded below, test against the Japanese case study?

Hypothesis 1: the military as reluctant leader in space safety and sustainability
[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).
[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

The independent variable of H1.1 was never applicable to the Japanese case as JAXA has always been the monopolistic player of the Japanese space program, combining both mandate and capabilities, primarily due to the 1969 Resolution. The question of a MOD lead on space safety and sustainability was therefore clearly ruled out from the start. However, even now that they are allowed to engage in space affairs, MOD experts are willing to support a potential civilian lead but firmly refuse to play any further role, following a strict tradition of self-effacement of the military in domestic policymaking. The development of an SSA radar at the MOD does not contradict this posture as it is primarily aiming at the monitoring of the GEO belt for security purposes. H1.2.1 and therefore H1.2 being validated and H1.1 being inapplicable, Hypothesis 1 is passing the evaluation of the Japanese case study.

Nevertheless, even if self-restrained to a support role, and wiling to develop its own SSA capabilities, the MOD first needs to be able to do so by building capacity on space operations. As described above, although this is a key element of the current space strategy of the MOD, there does not seem to be any clear vision like those laid out by the American and French armed forces. Hence, it is too early to evaluate Hypothesis 2, reminded below, with the Japanese case study.

Hypothesis 2: the need for specialised space officers
The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

Finally, Hypothesis 3 is the easiest to evaluate and is firmly invalidated by the Japanese case. The Japanese MOD, although it has a diffuse and indirect influence via seconded staff, retired officials and prominent politicians interested in security issues, is, partially by choice, quite weak in domestic policymaking processes, having neither an absolute proscriptive influence nor a strong prescriptive one.

Hypothesis 3: military as most influential actor in STM policymaking
[H3.1] If the military opposes a position on space safety and sustainability, then this position is perceived as inacceptable by other agencies involved in domestic decision-making (*absolute proscriptive influence*).
[H3.2] Conversely, if the military supports a position on space safety and sustainability, then this position is perceived very favourably by other agencies involved in domestic decision-making (*strong prescriptive influence*).

Overall, the case of Japan is extremely interesting as it represents a very unique historical approach to the military uses of outer space. The reforms initiated since the enactment of the 2008 Basic Space Law tend to indicate that Japan is on the path towards normalisation. Will it be able to catch up with other leading military space powers, having decades of advance? Will its industry be able to support ambitious governmental strategies? To what extent US pressures will continue to shape Japanese strategies? These are numerous very key interrogations that will become increasingly relevant in the years to come.

Appendix. English translations of Japanese terms

Government agencies and positions	
National Diet	国会
House of Councillors	参議院
House of Representatives	衆議院

Cabinet Secretariat	内閣官房
Cabinet Intelligence and Research Office	内閣情報調査室
Cabinet Satellite Intelligence Centre	内閣衛星情報センター
National Security Council	国家安全保障会議
National Security Secretariat	国家安全保障局
Cabinet Councillor	内閣審議官
Assistant Chief Cabinet Secretary	内閣官房副長官補
Advisory Panel on Security and Defense Capabilities	安全保障と防衛力に関する懇談会
Strategic Headquarters for Space Policy	宇宙開発戦略本部
Cabinet Office	内閣府
Minister of State for Space Policy	内閣府特命担当大臣(宇宙政策)
National Space Policy Secretariat	宇宙開発戦略推進事務局
National Space Policy Committee	宇宙政策委員会
Ministry of Education, Culture, Sports, Science and Technology	文部科学省
Japan Aerospace Exploration Agency	国立研究開発法人宇宙航空研究開発機構
Ministry of Defense	防衛省
Self-Defense Forces	自衛隊
Bureau of Defense Policy	防衛政策局
Strategic Planning Division	戦略企画課
Japan Defense Agency	防衛庁
Ministry of Economy, Trade and Industry	経済産業省
Ministry of Foreign Affairs	外務省
Ministry of Land, Infrastructure, Transport and Tourism	国土交通省
Ministry of Internal Affairs and Communication	総務省
Political parties	
Liberal Democratic Party	自由民主党

Democratic Party of Japan	民主党
Komeito	公明党
Documents	
Basic Space Law	宇宙基本法
Basic Plan on Space Policy	宇宙基本計画
JAXA mid- to long-term goals	中長期目標
National Security Strategy	国家安全保障戦略
National Defense Program Guidelines	防衛計画の大綱
Mid-Term Defense Program	中期防衛力整備計画

Part III

Concluding chapters

Chapter 9. Conclusions on the role of the military in domestic STM policymaking and conceptual implications

The United States of America will always be willing to work closely with like-minded, freedom-loving nations, as we lead mankind into the final frontier
Vice President Mike Pence (21 October 2019)

After detailed accounts of the approaches of the American (Chapters 4-6), French (Chapter 7) and Japanese armed forces (Chapter 8) to space situational awareness (SSA) and space traffic management (STM), this chapter presents a comparative analysis of their respective military postures. The underlying idea of this comparison is to identify common elements that could constitute a joint vision on how to ensure space safety and to preserve the outer space environment – main purposes of STM – while taking into account the vital interests of their military forces. In fact, as it appeared in previous chapters, the protection of the security uses of space is a non-negotiable item of most countries' policy with regards to rule-making in space.

This chapter is organised as follows. Section 1 details the current points of agreement among the American, French and Japanese militaries on SSA/STM, both on the role they would play and on their expectations on the scope and format of an international regime for STM. Then, section 2 provides the final analysis of the hypotheses and shows the conceptual implications of the study.

1. Common views on STM in US and allied militaries

France and Japan representing the two most unique and differentiable views in the 'US bloc' – as further justified in the next chapter, any element of clear agreement between them and the US on military equities in STM would easily be accepted by other members. These elements are presented below.

1.1. STM is not a core military function

The first and foremost point of agreement among the American, French and Japanese militaries with regards to STM is that it is not a core military function. In other words, while STM is undoubtably a topic of prominent importance for the military, its actual implementation and daily management should be attributed to a civilian entity. Such view is motivated by the need of the military to focus on its core mission at a time of heightening tensions in outer space and on the fact that STM is before all a regulatory issue outside the scope of the armed forces.

1.1.1. Need to focus on warfighting

The primary element mentioned by DoD officials publicly and during interviews with the author is their need to focus on warfighting. All three militaries, when comparing their resources with the threats they have to face, consider themselves understaffed. While it is obvious in the French and Japanese strategies, officially planning an increase of space-related resources and staff, senior military leaders in the US have been calling for the transfer of space safety responsibilities (conjunction assessment and notification to commercial and foreign entities) to a civilian entity. A typical example is General Hyten's request to "be able to free up those [hundred] airmen and to focus on warfighting missions that we [the US military] need to worry about".[1] In fact, the two main annual reports on counterspace capabilities, produced from open-source documents by the Center for Strategic and International Studies (CSIS) and the Secure World Foundation (SWF), show a continuous increase of countries having developed actionable counterspace capabilities and therefore an overall increase of threats on US space assets.[2] In particular, these reports show that China and Russia are the two single most advanced competitors of the US in outer space, having developed and continuing to develop numerous of forms of counterspace technology such as LEO and GEO direct-ascent and co-orbital anti-satellite (ASAT) weapons, as well as directed energy and electronic warfare capabilities.[3] Finally, contrary to environmentally dirty kinetic ASAT weapons that are the focus of the public's attention since the irresponsible direct-ascent Indian test of 2019, SWF experts explain that "only non-kinetic capabilities are actively being used in current military operations".[4]

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[1] Ross, Bridenstine, and Hyten, Space Situational Awareness: Whole of Government Perspectives on Roles and Responsibilities (Video of Hearing).
[2] Harrison et al., 'Space Threat Assessment 2020'; Weeden and Samson, 'Global Counterspace Capabilities: An Open Source Assessment 2020'.
[3] Weeden and Samson, 'Global Counterspace Capabilities: An Open Source Assessment 2020', ix–xiii.
[4] Weeden and Samson, ix.

1.1.2. STM: regulatory or promotional, but not a military issue

The second element of agreement among the three militaries is one of institutional responsibility. What are the purposes of armed forces, in particular in the US, France and Japan? A quick answer is provided by the homepage of the DoD: "The Department of Defense provides the military forces needed to deter war and ensure our nation's security".[5] This is indeed the main role of armed or military forces: national defence. The MINARM's homepage adds two other levels by including the conduct of operations pursuant to "international or regional agreements and treaties", and its "implication in missions of public service", in support to the actions of other ministries.[6]

Do these purposes fit with the role of ensuring the safety of activities in outer space and the preservation of the space environment, which is the *raison d'être* of STM? Partially. In fact, STM is considered to be at the crossroads of regulatory and promotional issues, as epitomised by the very interesting FAA-DoC debate in the US government. Therefore, while it is inappropriate for the military to be the lead on STM as it does not concern directly national defence or foreign operations, it could play the role of support to a civilian lead, which is the choice made in Space Policy Directive 3 (SDP-3) in June 2018.

1.1.3. Military support to a civilian STM lead

Although it wishes to stop serving as the direct interface with commercial and foreign entities involved in space operations, the military should keep a support function of a potential civilian STM lead. In most countries, the military still possess the most advanced space surveillance capabilities and therefore, it should continue to collect and provide data to the civilian agency in charge of STM. Even in the United States, where private SSA giants LeoLabs, ExoAnalytics and AGI are continuously pushing the boundaries of commercial SSA services, none of them can match the extensive collection capabilities of the DoD, *a fortiori* since the Space Fence entered into operations. Where they can have a strong impact, and are probably more advanced than the DoD, is the downstream use of the data, including conjunction assessments and all related services that they can provide to satellite operators (e.g. notification, recommendation of most appropriate manoeuvres, intelligence on another satellite).

Secondly, and also related to their technical capabilities, militaries can serve as the authoritative cataloguing authority for space objects. In the case of the US, SPD-3 left to the

[5] 'Our Story', Department of Defense, accessed 11 April 2020, https://www.defense.gov/Our-Story/.
[6] 'Le Rôle Du Ministère Des Armées', Ministère des Armées, accessed 11 April 2020, https://www.defense.gouv.fr/portail/ministere/le-role-du-ministere-des-armees.

DoD the responsibility to maintain the national authoritative catalogue. Having a clear and unified understanding of the situation in outer space being critical for both space safety and national security, the military needs to develop its own catalogue, at least for internal use. Relying on a third-party for what is inherently a national security issue is a risk that the military would not take. Therefore, instead of having costly redundancies in the parallel development of different national catalogues, it seems wiser to assign the military with the lead on an activity it would not accept to abandon anyway.

1.1.4. Explaining the military's support to the transfer space safety responsibilities to civilians

The overall support of the US military to the transfer of space safety responsibilities to the DoC can seem rather surprising, in opposition to the traditional imperialist views of governmental bureaucracy. It has been a common conception of bureaucratic analysis in the 1970s and 1980s – and persistent until now, that a bureaucrat's primary goal was the maximisation of the size of this agency, as summarised by Gordon Tullock in 1976:

> "As a general rule, a bureaucrat will find that his possibilities for promotion increase, his power, influence and public respect improve, and even the physical conditions of his office improve, if the bureaucracy in which he works expands. This proposition is fairly general. Almost any bureaucrat gains at least something if the *whole* bureaucracy expands".[7]

What 'expanding the bureaucracy' means has been a topic of debate, primarily between those focussing on workforce expansion and those focussing on budget increase.[8] However, apart from the rational explanations of high-ranking civil servants expressed publicly (e.g. General Hyten's) or during interviews with authors, how to explain the support of a military organisation to being stripped of one of its tasks? Organisational theory and bureaucratic politics provide some useful considerations.

One of the most interesting critique of Tullock's and Niskanen's imperialist views of bureaucracy can be found in Patrick Dunleavy's *bureau shaping model*.[9] Although it oversimplifies a complex model, one can summarise Dunleavy's core argument as relying on the differentiation of bureaucrats' intentions by their rank, leading to the understanding that

[7] Tullock, *The Vote Motive*, 29.
[8] Respectively in: Fiorina and Noll, 'Voters, Bureaucrats and Legislators'; and Niskanen, *Bureaucracy: Servant or Master?*, 8; Both cited in: Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*, 154.
[9] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*.

senior bureaucrats, those actually having the power and influence to pursue budget-maximisation strategies, have little incentive in doing so. He writes:

> "Instead, higher-ranked bureaucrats place more emphasis upon non-pecuniary utilities: such as status, prestige, patronage and influence, and most especially the interests and importance of their work tasks".[10]

More precisely, among the different elements constituting Dunleavy's bureau-shaping model, two are of particular importance here. The first, concerning "competition with other bureaus", indicates that although there is a natural tendency for interagency rivalry, "bureaus may want to export troublesome and costly low-grade tasks to rivals, especially when doing so carries no major implication for a reduced program budget".[11] The offloading of space safety responsibilities by the military clearly falls under this category: their transfer to a civilian agency is unlikely to cause budget cuts, as existing spending are devoted in their huge majority to data collection and processing, mission that will be maintained in its pure military form (called space domain awareness in the US, in opposition to SSA). Getting rid of space safety service is basically getting rid of a barely budgeted supplementary – non-military – mission. The second applicable element of the bureau-shaping model is what Dunleavy labelled "load-shedding, hiving-off and contracting out". It is described as "by far the most radical possibilities for top-tier agencies to reshape their functions" and consists in "export[ing] responsibility for functions inconsistent with senior officials' agency-type ideal". This directly resonates with the positions expressed in public and during interviews of senior officials, epitomised by General Hyten's testimony on a congressional hearing quoted above.[12] Concluding on the bureau-shaping model however requires a note of caution: Dunleavy insists on the differences of appreciation and motivation among bureaucrats depending on their rank. The author of this dissertation having primarily interviewed senior officials on this issue, the clear applicability of the bureau-shaping model is served by this bias. Interviews with low-ranking bureaucrats with moderate career perspective – by definition unlikely as they do not consider themselves legitimate to talk with outsiders – may have provided empirical data pointing towards a slightly different direction.

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[10] Dunleavy, 200; Dunleavy cites: Halperin, *Bureaucratic Politics and Foreign Policy*; and Kingdon, *Agendas, Alternatives, and Public Policies*.

[11] Dunleavy, *Democracy, Bureaucracy and Public Choice: Economic Explanations in Political Science*, 204.

[12] Ross, Bridenstine, and Hyten, Space Situational Awareness: Whole of Government Perspectives on Roles and Responsibilities (Video of Hearing).

The second main takeaway from organisational and bureaucratic theories is what Allison labelled as "uncertainty avoidance" in his model II.[13] For Allison, a bureaucracy will tend to prioritise uncertainty avoidance on budget maximisation. To justify his point, he quotes an argument advanced by Morton Halperin, and concerning the DoD bureaucracy. Halperin's full quote is the following:

> "In particular, priority is attached to maintaining control over budgets. Organizations are often prepared to accept less money with greater control rather than more money with less control. Even with fewer funds, they are able to protect the essence of their activities. The priority attached to autonomy is shown by the experiences of various secretaries of defense. Robert McNamara caused great consternation in the Pentagon in 1961 by instituting new decision procedures that reduced the autonomy of the armed services, despite the fact that he increased defense spending by $6 billion and did not directly seek to alter their roles and missions. Melvin P. Laird, in contrast, improved Pentagon morale in 1969 by increasing service autonomy in budget matters while reducing the defense budget by more than $4 billion".[14]

Allison extends the analysis to the relations between a bureaucracy and its immediate counterparts, with which overlaps in responsibility may hamper autonomy:

> "Where autonomy is not possible, the primary environment (relations with other organizations comprising the government) is stabilized by such arrangements as agreed budgetary splits, ***accepted areas of responsibility***, and established practices" (emphasis added).[15]

In the case of space safety responsibilities, a clear cut between pure military responsibilities (e.g. space domain awareness, cataloguing) and activities relying on regulatory and promotional aspects (space safety *stricto sensu*) that can be dealt with by relevant civilian agencies, will let the military focus and devote its resources to an area of absolute autonomy and control.

1.2. A civilian STM lead would be a better storefront of government STM activities

The second point of agreement among the three militaries is a consequence of the first one: if STM is not a core military mission, then the lead should be assumed by a civilian agency. Beyond the institutional argument evoked in the previous section (regulatory and promotional), the benefits of civilian agencies compared to the military are their experience and ability to leverage the resources and inventiveness of the private sector, as well as the more benevolent image their offer in international negotiations.

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[13] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 170–71.
[14] Halperin and Clapp, *Bureaucratic Politics and Foreign Policy*, 51; A portion of this quote is reproduced in: Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 170.
[15] Allison and Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 170.

1.2.1. Military not well-placed to engage the private sector in STM

With the increase of commercial space capabilities and their progressive surpassing – in numbers at least – of security assets in outer space, a key element of the success of a prospective STM regime, whether national or international, will be the ability to coordinate with the private sector, at two levels.

The first level consists in promoting self-regulation by owner-operators of satellites based on widely accepted best practices, standards and norms of behaviour. The close work between the DoC's Office of Space Commerce (OSC) and the National Institute of Standards and Technology (NIST; part of the DoC too) is a clear signal sent by the US in this direction.[16] Moreover, all three countries are participating in the development of international norms of behaviour and standards for space safety at the International Organisation for Standardisation (ISO)[17] and numerous other international and interagency entities.

The second level consists in leveraging the private sector's ability to contribute to the enhancement of SSA, through the development new technologies and through the integration of data from numerous commercial entities. Engaging private sector participation requires incentivising, subsidising, creating an appropriate regulatory environment, developing standards for smooth inter-operability, in sum many different approaches usually dealt with by civil government agencies. This is again part of the official mandate and strategy of the DoC, currently developing its Open Architecture Data Repository, system that can be inspired from what is the norm for weather forecast, in particular at the National Oceanic and Atmospheric Administration (NOAA; part of DoC).[18]

The importance to encourage and support private sector participation in SSA/STM is shared among the US, Japan and France. In fact, some Japanese MOD/SDF interviewees have clearly stated their desire to see the METI taking over STM leadership to be able to cooperate smoothly with its American counterpart. While sharing the same vision, French experts favour a European approach with the integration of commercial data in the EU SST framework rather

[16] Kevin M O'Connell, 'Remarks from Space Commerce Workshop at NIST Boulder', Office of Space Commerce, 12 September 2019, https://www.space.commerce.gov/remarks-from-space-commerce-workshop-at-nist-boulder/.
[17] 'Participation: ISO/TC 20/SC 14 - Space Systems and Operations'.
[18] See Mark Mulholland's opening remarks for the AMOS SSA Policy Forum on SSA Data Sharing and Open Data Repositories, in: 'Remarks from AMOS Conference 2019', Office of Space Commerce, 20 September 2019, https://www.space.commerce.gov/remarks-from-amos-conference-2019/.

than the involvement of the French Ministry of Economy, having no experience in dealing with space affairs.

1.2.2. A civilian lead for a more benevolent image in international negotiations

STM being an inherently international – if not global – topic, taking into consideration the need to carry out negotiations with foreign partners is key is selecting the most appropriate national lead agency. Far away is the time of gunpowder diplomacy as practiced by Navy officers like Commodore Perry in Japan; current times require the benevolence of civilian dress for international negotiations. *A fortiori* in a high-tension domain like outer space, the development of international rules and practices requires extreme care and a direct and visible military involvement would surely raise suspicions and threaten the whole negotiation process. Aware of this, none of the defence-affiliated interviewees met by the author would like their organisation to be in the driver's seat for international negotiations, but rather support domestic decision-making. As one interviewee puts it, a civilian organisation would be a "better international storefront" [US-1].

In fact, having a civilian lead for international negotiations, in particular at the UN, provides benefits without any negative side-effect. When conducting international negotiations on behalf of its country, any agency – civilian or not – would not defend its own views but the position of its government as a whole. Therefore, even if the military was the focal point, it would not change much in the position it would have to defend. It is then more beneficial for the military to infuse its ideas and interests as much as possible in the domestic whole-of-government position to see it defended internationally under a more benevolent civilian disguise.

1.3. An international STM regime? Yes, but in a very specific form

The benefits of establishing an international regime for STM are well shared among officials of the American, French and Japanese militaries interviewed by the author, but not without conditions. They expressed clear views regarding both the scope and the format of such regime.

1.3.1. 'Managing' space traffic is inappropriate

STM, as one of the most fashionable terms of contemporary space law and policy, is also one of the most misunderstood and lightly used. As discussed extensively in Chapter 2, there exist numerous definitions and understandings of what it encompasses. Moreover, there is a clear gap between law experts believing in the illusion of a comprehensive and binding regime, and practitioners rejecting the idea of management of space traffic all-together. *A fortiori* in the case of military and national security experts, there is a clear preference for the concept of 'space traffic coordination'. While 'management' implies an idea of limitation of the freedom of space activities and of enforcement of binding rules by an overarching authority, both undesirable for states willing to keep some strategic autonomy and unrealistic from a diplomatic standpoint, 'coordination' on the other hand evokes the vision of a world where responsible actors choose to work together for the preservation of a shared environment and therefore of their own interests, including secret ones.

The choice, most likely made by the National Space Council (NSpC), to title SPD-3 "National Space Traffic Management Policy",[19] therefore following the journalistic/academic doxa, makes the error of being misleading in its intentions. When reading the document in detail, its content is more about SSA and space safety coordination rather than about STM. In fact, in all recent public declarations of officials of the DoC/OSC, the term STM was largely abandoned in favour of "space safety" and "space sustainability".[20]

1.3.2. Norms of (safe) behaviour

After clarifying their understanding of STM as coordination and recommendation rather than management *per se*, comes the question of the format of the regime. As a reminder, Stephen Krasner defines a regime as a "[set] of implicit or explicit principles, norms and rules, and decision-making procedures around which actors' expectations converge in a given area of international relations".[21]

When asked the type of rules or norms that could constitute an international regime for STM, all US interviewees followed the same cautious semantic approach: 'norms of behaviour, yes, norms and rules, no'. Although not phrasing it with the same professionalism as US officials, French and Japanese officials agreed on the impracticality of binding measures, that would be both detrimental to their own interests with regards to the freedom of activities in

[19] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.
[20] 'Remarks from AMOS Conference 2019'; Diane Howard, 'OSC Remarks at UN General Assembly', Office of Space Commerce, 31 October 2019, https://www.space.commerce.gov/osc-remarks-at-un-general-assembly/; Kevin M O'Connell, 'O'Connell Remarks to U.S. Chamber of Commerce', Office of Space Commerce, 3 December 2019, https://www.space.commerce.gov/oconnell-remarks-to-u-s-chamber-of-commerce/; Kevin M O'Connell, 'Remarks from SSA Workshop in Japan', Office of Space Commerce, 28 February 2020, https://www.space.commerce.gov/remarks-from-ssa-workshop-in-japan/.
[21] Krasner, *International Regimes*, 2.

space and impractical in terms of adoption at the UNCOPUOS or any other intergovernmental forum. Moreover, even within the category of norms of behaviour, some interviewees insisted on covering 'safe behaviour' rather than 'appropriate behaviour' which would be an excessive interference in their military's freedom of action. In other words, norms of behaviour should be focussing on prescribing safe practices rather than proscribing supposedly inappropriate conducts.

2. Validity of the hypotheses and conceptual implications

This section provides the final review of the three hypotheses of this study based on the cases of the United States, France and Japan. It then shows the conceptual implications of these findings.

2.1. The military only reluctantly engages in space safety and sustainability

The core hypothesis of this study, giving the dissertation its title, describes the military as a reluctant participant in domestic space safety and sustainability efforts. It hypothesises that in the absence of competent and legitimate civilian agency, the military would initiate a tactical incursion in space safety and sustainability, be it based on a sense of duty or simply because it is preoccupied by the potential degradation of a key operation domain.

Hypothesis 1: the military as reluctant leader in space safety and sustainability
[H1.1] If no civilian agency has the capabilities *and* officially granted authority to lead national space safety and sustainability efforts, then the military will temporarily assume this responsibility (*tactical manoeuvre*).
[H1.2] Conversely, if a civilian agency obtains the capabilities and officially granted authority to lead national space safety and sustainability efforts, then [H1.2.1] the military will support the said agency or [H1.2.2] will gladly transfer its position of lead of national space safety and sustainability efforts to the said agency.

It is critical here to remember that the hypothesis was built in Chapter 1 with two levels in mind: tactical, corresponding mostly to space safety, and strategic, encompassing issues related to the long-term preservation and sustainability of the outer space environment. Similarly, in the course of the dissertation, another distinction was made between involvement in policymaking and involvement through the provision of actual space safety services. As reaffirmed below, the latter is the most salient element of analysis as space safety services are being provided in most advanced space powers and *a fortiori* in the three countries of this study, whereas STM policymaking is still a mostly abstract concept. This concludes the explanation of the dissertation title chosen by the author.

The textbook example validating Hypothesis 1, and on which it was inspired, is the case of the United States. The DoD's SSA Sharing Program is actually the perfect illustration of H1.1: taking over a NASA failure, fuelling it with almost unlimited DoD resources, staffing it with prominent experts, signing agreements with more than a hundred partners around the world and then handing it over gladly to the DoC when it obtains both the mandate and the resources to do a proper job. Although it is on a much more modest extent, this is true for France and Japan too. Being the only agency with the resources and authority to bring to life the once experimental GRAVES radar, the French Air Force seized the mission but from the start decided to fuel all the data to the CNES, which then started to provide space safety services without having to devote considerable budget for LEO SSA infrastructure building and maintenance. The Japanese MOD is also doing its share by purchasing on its budget an advanced SSA radar for GEO monitoring, that would surely benefit JAXA more than itself. As such, although they tactically involved (US) or simply contributed heavily while keeping a support role (France and soon Japan), all three military are glad to, respectively, transfer the mission or simply not compete for it, hence validating respectively H1.2.1 and H1.2.2.

2.2. Knowledge and culture precede concrete action

Originating from Janowitz's constabulary force concept like the previous one, Hypothesis 2 focusses on the role of 'space military technologists' – as formal or informal structure – in the promotion of space safety and sustainability issues in the military establishment as a whole.

Hypothesis 2: the need for specialised space officers

The development of a critical mass of space military technologists is a pre-condition to space safety and sustainability being placed on the policy agenda of the armed forces.

Evaluating this hypothesis required two steps. Firstly, the form that such structure can take in the armed forces of advanced space powers, and specifically in the US, France and Japan, needed to be evaluated. During interviews in the three countries, only US experts were naturally evoking the existence of an informal community of "pure space officers". Such understanding therefore served as the standard for the French and Japanese analyses. Secondly, after understanding who these "pure space officers" were – partially defined by their original expertise but most importantly by their career coherence – and clearly identifying them, it was necessary to analyse their actual role within their respective institutions. Once more, the US case is the most enlightening as it clearly demonstrated that, based on objective facts as well as on the subjective views of experts both inside and outside the DoD, officers of the like of General Hyten, Raymond and Shelton have been instrumental in bringing up key topics of discussions such as the need for increased transparency – through declassification – the importance for the DoD to transfer space safety services to civilians, the necessity to frontally tackle the issue of space debris, etc.

France and Japan, while not strictly speaking validating the hypothesis, support it. In fact, both of these countries do not possess any formal or informal structure that can be assimilated to a 'space military technologist corps' like it exists in the US, Russia or China. However, their national space security strategies indicate the strong belief of their decision-makers that Hypothesis 2 is valid. The French government in particular, seems to have understood, after a half-conducted reform in the mid-2000s, that the pure top-down creation of a space pole in the armed forces was doomed to fail unless accompanied by the progressive establishment of a space expertise – and therefore culture. This explains why the 2019 Space Defense Strategy emphasised with the same strength, on the one hand, the creation of a space career track and of a space academy and, on the other hand, the building of new sensors and the establishment of a new space command.

2.3. The unevenness of military influence in space policymaking

The final hypothesis proposed and evaluated in this study is the most debatable and the less conceptual. It consists in describing qualitatively the level of influence of the military on space safety and sustainability domestic decision-making processes. It differentiates two opposite forms of influence, proscription and prescription, and hypothesises the former to be absolute while the latter is strong, though not absolute. In other words, it means that the opposition of the military on a specific issue is perceived as overriding all others, while the support of the military to a certain course of action is received with great considerations.

Hypothesis 3: military as most influential actor in STM policymaking
[H3.1] If the military opposes a position on space safety and sustainability, then this position is perceived as inacceptable by other agencies involved in domestic decision-making (*absolute proscriptive influence*).
[H3.2] Conversely, if the military supports a position on space safety and sustainability, then this position is perceived very favourably by other agencies involved in domestic decision-making (*strong prescriptive influence*).

Again, and surely due to an initial bias, this hypothesis is fully validated by the case of the US where the military has a very strong prescriptive influence based on its clear domination – domestically and internationally – in terms of space safety and sustainability capabilities. Secondly, as largely commented in Part I, the DoD has the ability to draw a near-veto in most discussion platforms (including in Congress) by invoking national security reasons.

Although this hypothesis works perfectly for the US, it shows a dire lack of robustness when confronted to the cases of Japan and France. In both of these countries, the military, although at very different levels of capacity, is clearly dominated by the national civilian space agency. In France, the MINARM's involvement in space safety and sustainability is limited to data collection and its incursion in policymaking is fairly limited, although an expert insisted on the necessary approval – "blessing" – of the MINARM before any international discussion involving STM-related topics, such as the COPUOS's LTS negotiations. The case is even worse in Japan where the MOD has neither the capabilities nor the willingness to engage in space policymaking, *a fortiori* on space safety and sustainability.

2.4. Conceptual implications

This section investigates the implications of this study on its conceptual framework, namely Janowitz's constabulary force concept and Allison's three-model framework.

2.4.1. Janowitz's constabulary force prophecy

In the case of military space affairs, Janowitz's description of what is a constabulary force and how it is built seems to have more of a prophecy than of a mere theory. The evaluation of Hypotheses 1 and 2 has been the occasion of analysing the defining characteristics of the space-related armed forces of the US, France and Japan. Both hypotheses were derived from

Janowitz's constabulary force concept and have proved very robust across the cases. Two elements were particularly striking.

Firstly, the distinction between tactical and strategic objectives is reflected in space safety and sustainability by the difference between short-term activities for the coordination of space activities and deeper initiatives aiming at improving operational practices for the long-term sustainability of the outer space environment. It therefore provides a convenient framework to explain temporary incursions of the military in space safety to prevent short-term adverse impacts, even if such incursions are not part of the traditional scope of national defence. It is however important to mention that Janowitz's mentions of tactical and strategic levels is quite shallow and that the use made of it here is primarily an interpretation of the author of this dissertation.

Secondly, Janowitz's expectations on the evolution of the skill structure in the armed forces correspond to the letter to the development of a space expertise – if not a space force – in the armed forces of the US, France and Japan. To point out specific elements, he accurately predicted:

1. The increased recruitment of career officers from civilian universities through reserve training programs. In the US, the two most recent senior space officers, Generals Hyten and Raymond, where recruited through the ROTC and in France, the current strategy envisions the creation of a space-related training pole that includes civilian universities and academies.
2. The development of highly specialised programs at military academies. We have seen with the case of General Shelton that the US Air Force Academy provides specialised education in astronautics. In France, the Air Force Academy is opening a space track, a Space Academy is being established and it is customary for space officers to do postgraduate studies in the leading national aerospace university (ISAE-SUPAERO). Finally, in Japan, the National Defense Academy has its own aerospace department.
3. The civilianization of the military with increasing exchanges on both directions such as exchanges of staff between the DoD and DoC in the US, between CNES and the MINARM in France and finally between JAXA and the MOD in Japan.

In conclusion, although it still requires confirmation with the cases of France and Japan in particular, **space forces of advanced liberal democracies can be seen as archetypal constabulary forces.**

2.4.2. On Allison's framework

Overall, Allison's framework has proved to be robust and versatile, providing very interesting insights across the cases, regardless of the scope or setting. It is therefore very complex to add to it without being superfluous. Chapter 3 introduced possible additions to Allison's framework in the form of two "specific propositions":

1. *Skill Structure of the Military Establishment*
2. *International Finality of Domestic Decision-Making*
    a. *Actions and decision are reflected in a country's international respectability*
    b. *Domestic decisions are to be defended on the international stage*

The first of these propositions, emphasising the importance to take into account the skill structure of the military establishment rather than simply the position (*Where You Stand Depends on Where You Sit*) and career type of the individual (*Styles of Play*) naturally derives from Hypothesis 2 and can therefore be considered validated. It could now be interesting to test it against other fields than space.

The second proposition goes beyond the one-to-one situation of the Cuban Missile Crisis by considering that domestic decisions are made with the awareness that their nature will have an impact on how the country is perceived by other countries, and consequently the decision itself influence its promotability and those of other related decisions. This point is particularly salient in the case of the US. In fact, keeping this specific proposition in mind helps to understand why purely domestic decisions like the approval of a mild revision of the ODMSP or conversely the push for compliance of the USAF with the same ODMSP impact the respectability of the US government and the US military on the international stage and consequently their ability to promote their equities without being blamed for their hypocrisy.

3. Conclusions

The main takeaway of this chapter is the identification of a common vision on STM among the US and its two most unique allies: France and Japan.

Firstly, STM is not a core military function. Faced with the increasing number of threats in outer space, leading space militaries should more than ever focus on their core warfighting missions and cannot afford spending time and resources on intrinsically civilian tasks of space safety. STM is by definition somewhere between a regulatory and a promotional issue and is therefore the primarily responsibility of the civilian side of government. Consequently, the militaries of the US, France and Japan favour the attribution of the STM lead to a civilian agency, while they can keep a support function, both in terms of data provision and, specifically in the case of the US, for the maintenance of the authoritative catalogue of space objects.

Secondly, building upon the previous point, having a civilian lead is more adapted to coordination with both the private sector and international partners. In fact, a close relation with commercial actors in space is necessary to promote self-regulation among owner-operators of satellites as well as to leverage the exceptional innovations made by commercial entities for the improvement of SSA technologies. As for international partners, and in particular negotiations at the UN, having a civilian focal person – just behind the official diplomatic lead – would give a more benevolent vehicle to a military-infused domestic position.

The last point of agreement among military personnel is that the term of STM itself is to be blamed in the fantasised vision many people have of the establishment of an overarching framework similar to air traffic management. Most interviewees favoured the use of space traffic coordination as it is both the most likely and most desirable outcome. Consequently, they do not expect nor wish for the development of actual STM rules to regulate behaviour in space but would favour the promotion of norms of behaviour, standards and best practices to provide a basic framework in which a responsible, well-intentioned actor could draw useful lessons.

In terms of domestic decision-making, and based on the hypothesis evaluated throughout the dissertation, military role in space safety and sustainability can be summarised with this final sentence: **the military is a reluctant participant in domestic space safety and sustainability efforts, with a related policy agenda driven by its internal body of highly specialised space military technologists.**

Chapter 10. Implications for STM regime-making, recommendations and way forward

After lengthy analyses on the role and influence of the American, French and Japanese militaries on their respective domestic on SSA/STM policymaking processes, this chapter delves into their implication on international regime-making. As shown in Chapter 2 and throughout the dissertation, there is very little consideration in the academic literature for military equities in STM. By choice or by severe short-sightedness, this lack weakens most of existing proposals on the establishment of an international STM regime. Not considering military and national security actors in a space governance framework, knowing their overwhelming presence in orbit, would be equivalent to pretending to develop a comprehensive air traffic regime without including civil airliners.

Willing to modestly contribute to reducing these shortcomings, the author of this dissertation decided to hear the voice of those largely ignored in the academic space policy community: the militaries of advanced space powers. Contrary to his expectations – and probably those of other scholars that should have done this work long ago, the author discovered a vibrant community of military experts, very welcoming to discuss and share their views, often expressing their pleasure to have someone finally considering their views, equities and willing to understand in detail the level of their influence, domestically and internationally. This chapter, beyond outlining the implications of this dissertation's findings on international regime making, fulfils its public policy inclination by providing a series of general recommendations on how to take into account military equities in STM-related discussions and therefore increase the likelihood of the adoption of elements of international STM regime. These recommendations are targeting different actors as finding an appropriate scope and format for a prospective international STM regime will require intense and parallel work in governments, international organisations, academic and research circles and the private sector. Finally, this chapter reflects on the research carried out by the author for this dissertation and proposes possible future areas for discussion.

1. Towards a bloc approach on regime-making

Going against the usual scholarly interests for multilateral platforms (e.g. UNCOPUOS), if the US really wishes to “lead the world in creating the conditions for a safe, stable, and operationally sustainable space environment”,[1] it needs to act at two levels: 1) dealing with China and Russia in a pragmatic three-player game and 2) maintaining trust within its bloc of allies, some of them – in Europe mostly – fearing a hidden American agenda. The previous chapter has shown that their exists points of agreement among the militaries of the US, France and Japan, but are these valid for most of US allies? This section answers this question by showing that the US, France and Japan represent three extreme cases within the US bloc, having radically different historical approaches to military affairs and space government structures. As such, if they have common views on a topic as complex as STM, these views are highly likely to be acceptable by other members of the US bloc, namely NATO and Five Eyes countries.

1.1. Outer space operations: a three-player game

According to the Union of Concerned Scientists (UCS), there are 2218 active satellites orbiting the Earth as of 30 September 2019.[2] Of these objects, 1595 were officially registered at the UN by a member state. Figure 10-1 shows the repartition of UN-registered satellites per major space country.[3]

[1] Executive Office of the President, ‘Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy’, sec. 3.
[2] ‘Union of Concerned Scientists Satellite Database’.
[3] It is important to keep in mind that a satellite can be registered by one country as launching state but could be under the control of another nations or entity. These figures are therefore only rough indications of a country’s weight in space, not a perfect measurement. Moreover, according to the UCS database, 623 satellites out of a total of 2218 active satellites orbiting the Earth are not officially registered at the UN.

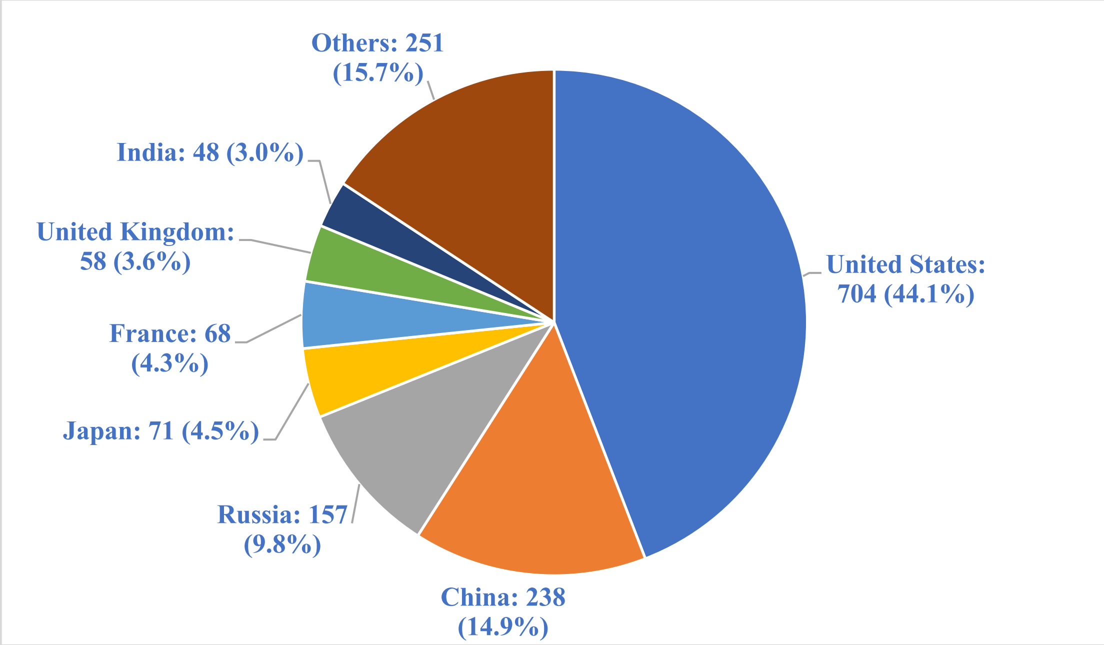

Figure 10-1. Number and share of UN-registered satellites per major space country[4]

It is clear from figure 10-1 that solving the issue of the long-term sustainability of space is a three-player game, the US, China and Russia officially accounting for more than two thirds of all satellites registered at the UN. Then, below the big ones are Japan, France, the UK and India, followed by Germany (2%), the European Space Agency (ESA; 1%) and Canada (1%).

Figure 10-2, representing the share of space defence budget of major space powers, shows the same order of countries with US being the unchallenged largest spender, followed by China, Russia and the usual lower-rank powers: Japan and France. In terms of defence spending, other following countries are well below France (e.g. the UK spends half and Germany one third).

[4] Extracted from: 'Union of Concerned Scientists Satellite Database'.

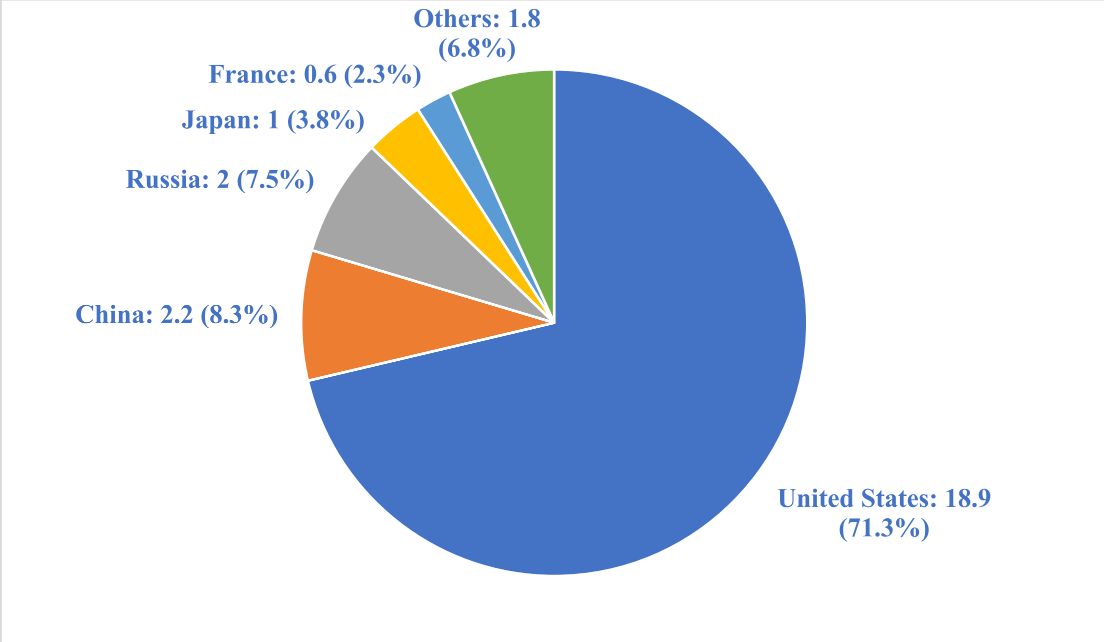

Figure 10-2. Amount (in billion USD) and share of space defence budget per major space country[5]

Most of secondary though influential players are longstanding US allies. They all have close collaborations with the US on military, intelligence and space through bilateral security agreements (e.g. Japan), NATO (e.g. France, the UK, Germany and Canada) or the Five Eyes intelligence group (e.g. Canada, the UK and Australia). By selecting the two most powerful space countries among traditional US allies, Japan and France, this dissertation aims to identifies the foundations an STM regime acceptable for the US military and its key allies.

1.2. "Freedom-loving nations" around the US

This distinction of different blocs is now part of the official American discourse on space competition. As already quoted in this dissertation, the speech of US Vice President Mike Pence at the opening of the 70th International Astronautical Congress in October 2019 in Washington DC, calling for maintaining US leadership in space in collaboration with "freedom-loving nations,[6] while epitomising a typical and laughable American flight of lyricism, perfectly aligns with the purpose of this dissertation. Before imagining a hypothetic coordination with China and Russia on the issue of STM, it is necessary for the US-and-allies bloc to reach a common understanding, *a fortiori* with regards to the protection of military interests in space. Japan and

[5] Calculated from: Seminari, 'Op-Ed | Global Government Space Budgets Continues Multiyear Rebound'. Note: The surprisingly high figure of Japan's defence budget is due to the fact that Cabinet Secretariat's Information Gathering Satellites program budget are included, accounting for 72% of the total. Others is mostly composed of MENA countries, accounting for USD 626 million. World total: USD 26.4 billion.
[6] 'Remarks by Vice President Pence at the 2019 International Astronautical Congress Opening Ceremony'.

France, representing radically different approaches to military alliance with the US, well serve this purpose.

As shown on Chapter 8, the Japanese approach to SSA is intrinsically related to the US. In fact, the idea of further developing domestic capabilities was seen by numerous interviews as the direct resultant of pressure from the US (*gaiatsu*), willing to extend the coverage of the US Space Surveillance Network (SSN) in an under-equipped area of the world. In terms of STM, while there is no coherent Japanese approach, most expert have already internalised an approach basically mirroring the US, either unconsciously or based on desire to facilitate intergovernmental collaboration, as materialised in the support of some Japanese actors to a framework led by the Ministry of Economy, Trade and Industry (METI; counterpart of the US Department of Commerce) rather than the natural candidate, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT; counterpart of the US Department of Transportation).

Radically different from the passive attitude of Japan with regards to its military alliance with the US, France epitomises the European attitude of alliance with conditions, caution and doubts. Without delving into the historical developments of the relation between the US and its oldest ally (continuously since 1778), what needs to be said is that there were ups and downs and that the relation was never one of perfect trust. As shown on Chapter 7, the same is true with regards to SSA and STM. While France is one of the major partners of the US for SSA data exchanges, it also has doubts about a potentially US-led establishment of global STM regime, doubts shared by other European nations fearing an extension of US interference with European space activities.[7]

Finding the greatest common divisor among the positions of the US and its two most radically different allies, the devoted Japan and the recalcitrant France, is surely the most direct way to identify a position satisfying the full palette of the US bloc, in particular NATO and Five Eyes member countries. More details are provided below.

1.3. Reaching generalisation through three extreme cases in the US bloc

As mentioned in the previous section, the challenge here is too identify a common military vision in the US bloc. It was therefore chosen to extrapolate such vision from the comparison of three cases: the US, Japan and France. In fact, although they are part of the same group of traditional allies, they have radical differences on three features: traditional military

[7] Moranta, Hrozensky, and Dvoracek, 'Towards a European Approach to Space Traffic Management'.

influence in politics and policymaking, the organisation of domestic space policymaking and therefore consequently military involvement in space policymaking.

1.3.1. Military influence in politics and policymaking

Each of the three countries studied in this dissertation has its own approach to civil-military relations. In particular, the influence of their military on politics and policymaking varies greatly.

The great social and political role played by the military in the US is nothing new. Originating from the very beginning of the Union with the American Revolutionary War (1775–1783), the trust of US citizens for their military and its veterans is a very common topic in academic literature as well as popular culture. In particular, as seen in Chapters 4, 5 and 6, senior military leaders have a special echo in domestic debates, that is unrivalled among liberal democracies. On the other hand, the United States is the country having gone the farthest in studying and implementing a tight control of the military by plural civilian authorities, as already commented in Chapter 3.

On the other side of the public trust spectrum are the Japanese SDF. Following the dominant antimilitarist trait of the Japanese political culture since the end of WWII, the SDF have very little influence over domestic politics. In fact, William L. Brooks, referencing Akihiro Sado, mentions "a persistent anti-military bias among the Japanese public, as well as in the political world".[8] While the normalization of the relations between the Japanese people and the SDF will surely take some time, the situation is progressively changing due to numerous reasons, such as: the SDF's role in emergency relief operations, in particular after the Tohoku Earthquake of 2011, that led to a surge of public support,[9] the heightened tensions in the region that are increasing people's understanding of the relevance of having fully functioning armed forces,[10] and the fact that the post-war generation is now in power and has limited attachment to pacifism.[11] Some scholars also advance an indirect influence of the SDF through a "triple

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[8] William L Brooks, review of *The self-defense forces and postwar politics in Japan*, by Akihiro Sado, *Contemporary Japan*, 12 June 2019, 3, https://doi.org/10.1080/18692729.2019.1630591.
[9] Brooks, 1.
[10] John H Miller, 'Will the Real Japan Please Stand Up', *World Policy Journal* 22, no. 4 (Winter 2006): 36–46, https://doi.org/10.1215/07402775-2006-1003.
[11] Miller.

alliance with powerful LDP politicians and trading houses to form a kind of embedded military-industrial complex inside Japan".[12]

The French military is somewhere in between the American and the Japanese with oscillations between strong public positions and self-effacement when faced with assertive civilian leaders. In fact, the French military never refrained from developing and sharing its own vision of society and political affairs. Michel Louis Martin explains that "continuously the armed forces have served as refuge to partisans of ideas and beliefs more or less in opposition to civilian authorities and the society", loyal to aristocratic beliefs during the Revolution or Republican at the Restauration of the Monarchy in the early 19th century.[13] Distrust of the military notably grew during the *Décolonisation*, in particular after the "Putsch of the Generals" in Algiers in April 1961, that implanted the idea in French people's mind that the military could be a threat to the Republic. After that, the French military reached its current self-effacement posture.[14] As political analyst Jean-Marie Domenach declared in 1961: "On occasions when military chiefs came into conflict with the Government, they always ended by obeying it".[15] The resignation of Chief of Defence Staff General Pierre de Villiers after having a budgetary disagreement with President Emmanuel Macron in 2017, mirroring General de Boissieu's resignation after the election of President François Mitterrand in 1981,[16] shows a typical example of strong military opposition to its civilian leaders, while maintaining necessary respect for the Republic's institutions.

1.3.2. Approach to space policymaking

The United States, France and Japan have major differences in their approaches to space policymaking, both in the structure of their domestic decision-making processes and in the level of their sovereignty.

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[12] Andrew K Hanami, 'Japan', in *The Political Role of the Military: An International Handbook*, ed. Constantine P Danopoulos and Cynthia Watson (Westport, Connecticut and London: Greenwood Press, 1996), 248.
[13] Michel Louis Martin, 'France', in *The Political Role of the Military: An International Handbook*, ed. Constantine P Danopoulos and Cynthia Watson (Westport, Connecticut and London: Greenwood Press, 1996), 122–23.
[14] Martin, 131.
[15] Jean-Marie Domenach, 'The French Army in Politics', *Foreign Affairs*, January 1961, https://www.foreignaffairs.com/articles/france/1961-01-01/french-army-politics.
[16] Martin, 'France', 132.

Structure of domestic space policymaking

The structure of government space activities heavily varies among the three countries studied here, from the balanced American approach involving various organisations to the quasi-monopolistic role of the MEXT in Japan.

The huge scale of the American space program allowed the parallel development of powerful actors, both on technological and regulatory aspects, independent from one another. In terms of budget for example, there is no clearly dominant actor with most experts estimating the budget of the Department of Defense (DoD) – including the classified National Reconnaissance Office (NRO) budget – as roughly similar, if not slightly superior, to NASA's. As for regulatory aspects, already largely commented in Chapter 2, there exist various independent and fully sovereign structures such as the Federal Aviation Administration's Office of Space Transportation (FAA-AST) for launch, the Federal Communications Commission (FCC) for frequency use and the National Oceanic and Atmospheric Administration for remote sensing. This governance system with independent and highly specialised actors explains the reliance of spiralling interagency processes for the definition of national space policies, starting at expert/technical level and progressively going up to the White House, through directors, assistant secretaries, undersecretaries, etc. Finally, apart from Executive processes, it is important to remember that the US Constitution gives Congress the final word with full sovereignty over authorisation and appropriation.[17]

In France, the situation is similar but on a smaller scale and titled towards civilian applications. The majority of the budget is devoted to CNES's civil applications and contribution to the European Space Agency (ESA). Other space-related organisations such as the Ministry of Armed Forces (MINARM) – including the Defense Procurement Agency (DGA) – and the French Aerospace Labs (ONERA) are important actors though on a lower level than CNES. This situation leads to small scale inter-ministerial processes mostly among three principal ministries: the MINARM, the Ministry of Higher Education, Research and Innovation (MESRI) – joint supervisory authorities of CNES and ONERA – and the Ministry of Europe and Foreign Affairs (MEAE). Moreover, compared to the US, the smaller size of the French government leads to a more direct control of the Presidency over policy discussion, which is an integral part of the political philosophy of the Fifth Republic, often nicknamed a "republican monarchy" or "presidential monarchy". Moreover, contrary to the US Congress, the French Parliament is traditionally a passive registration desk of governmental

[17] 'Constitution of the United States of America', 1788, Art. 1, Sec. 8.

recommendations. Finally, another specificity of the French space governance system is its strong ties to the European Union's (EU) and the ESA's programs.

Japan has, contrary to the US and France, a strongly unbalanced system both in terms of budget and technical capabilities with the MEXT having – through its crown jewel JAXA – *de facto* leadership over the Japanese space program. The establishment of the IGS program at the Cabinet Secretariat led to the emergence of another strong operational entity, and the progressive development of space applications at the Ministry of Defense/Self-Defense Forces (MOD/SDF) will contribute to bring the system closer to equilibrium. Policy-wise, the establishment of the National Space Policy Secretariat (NSPS) at the Cabinet Office contributed to reduce the monopolistic power of the MEXT by taking over the role of coordination and licensing (though NSPS officials are mostly seconded from the MEXT and the METI), while the National Space Policy Committee composed of independent external experts took over policymaking responsibilities. To this should be added the important role played by the LDP, almost continuously in power since its foundation in 1955 (except for 4-5 years in 1993-1994 and 2009-2012).

Having radically different approaches to space governance in these three countries lead to a very different outcomes in the analysis of national priorities.

Different levels of sovereignty

Although the US government develop policies with its own interests in mind, the situation is more complex in France and Japan. Both of these countries are involved in alliances that influence some of their domestic decision-making: the EU for France and American alliance for Japan.

Saying that France lost its space policymaking sovereignty in Brussels would be both exaggerated and wrong. However, due to its participation in EU and ESA space programs and therefore the close interconnections between its space programs and those of Germany or Italy, the French posture on subjects like STM cannot be disconnected from the interests of its European partners and of the EU as a whole. In fact, Chapter 7 has shown that the collaboration with other European nations is an integral part of the French approach to space at all levels. After having supported the dying ESA SSA program, France is now the keystone of the EU Space Surveillance and Tracking network. The French Space Defence Strategy of 2019 clearly mentions the development of joint-military capabilities with other European countries, in particular Germany. Finally, and in order to stop here a list than can go on forever, when asked about France's posture on STM, most interviewees expressed their preference for a coordinated

European approach in order to carry more weight in the discussions with the US, China and Russia. This conception is actually realistic when checking the numbers. Figure 10-3 presents the same data as figure 10-1 but with a "Europe" category incorporating all satellites registered in the UN by Western and Northern European countries, EU countries, ESA and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), in other words countries and intergovernmental entities that would participate in the definition of the coordinated European approach praised by French experts. While this category does not prove that Europe – in a voluntarily loose sense – is the second space power in the world, due to obvious issues of internal governance, it gives a hint at the weight that a coordinated European view on STM could bear.

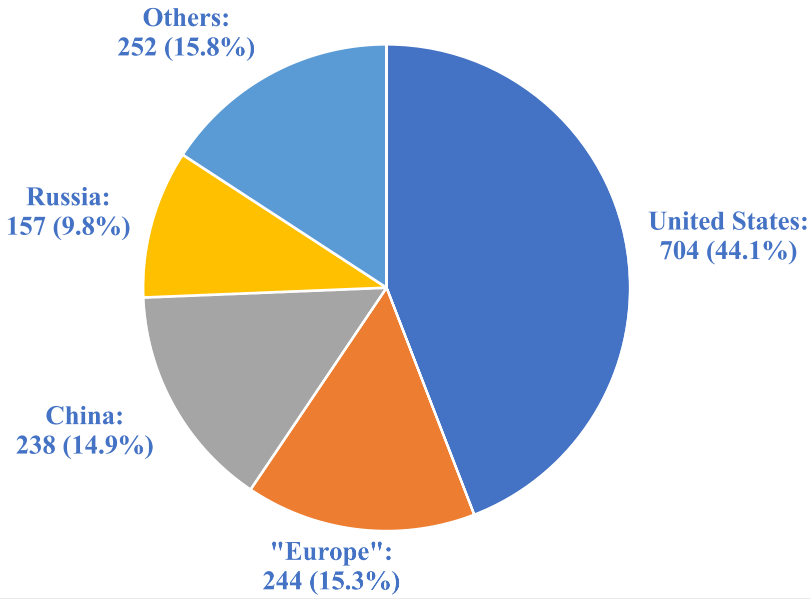

Figure 10-3. Number and share of UN-registered satellites per major space country, with a composite "Europe" category[18]

As for Japan, Chapter 8 has already evoked considerations related to the concept of 'gaiatsu', that is to say the pressure exerted, intentionally or not, by a foreign partner or adversary on Japanese domestic politics. It is usually used to describe the background presence of American interests in the rationale behind Japanese governmental decisions. It is however a debated concept, sometime used by Japanese analysts and bureaucrats as an easy explanation

[18] Extracted from: 'Union of Concerned Scientists Satellite Database'. "Europe" includes all satellites registered in the UN by Western and Northern European countries, EU countries, ESA and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

for debatable domestic choices, as pointed out by a scholar met by the author. Without mentioning ‘gaiatsu’, it is common in the literature to describe Japan as a junior partner in its security alliance with the US.

1.3.3. Military involvement in space affairs

The final nuances between the cases of the US, France and Japan concern their experience in military space operations and – it is related – the degree of involvement of their armed forces in space policymaking.

National experience in the military uses of space

National experience in the military uses of space is a major difference between the US and France on one side and Japan on the other side. In fact, the American and French space programs, respectively second and third in terms of historical development, were based on military motivations and initiated by the military. Even now, these two countries retain a very important military component in their space programs. Japan on the other hand is an absolutely unique case in the circle of great powers. Latecomer in the realm of space security, trying to catch up with other major powers since 2008, Japan still suffers from the ankylosis induced by its 40-year-long non-military interpretation of the peaceful uses of space. This is reflected in a series of difficulties. First, contrary to other space powers with a long space military history, the MOD does not have any institutional legacy on which to build a vision or a position on a sensitive topic like STM. In turn, due to its dual position of new-born in the space security world and of passive organisation subjected to civilian leadership since the end of World War II, the MOD does not have any legitimacy to involve in domestic policymaking, including for space affairs. Finally, in terms of relations with international partners, the technical inabilities of the MOD with regards to both the military uses of space and space security policy limit its capability to discuss with the US and France on an equal footing.

Overall, these shortcomings make it very difficult for Japan to meaningfully contribute to discussions on the preservation of military equities in a prospective STM regime, *a fortiori* with two advanced military space powers like the US and France. The fact that the only two countries with which Japan has officially announced being involved in SSA cooperation are the US and France is surely not a coincidence. However, Japan is quickly catching up thanks to massive investments in space defence applications since the early 2010s and thanks to its increased participation in staff exchange programs with the US and to international fora of discussion and practice such as the Schriever Wargame (since 2018).

Military involvement in space policymaking

The final major difference among the three countries studied here concerns the level of direct and indirect involvement of their militaries in domestic space policymaking. Once again, the US and Japan have diametrically opposed practices while France is somewhere in between.

As largely commented in Chapter 6, beyond its direct prescriptive and proscriptive (near-veto) influence in interagency and congressional discussions, thanks to its extensive institutional capabilities, the US military also benefits from the great attention given to the declaration of its respected senior military leaders. Adding to this the fact that the US military is currently the only institution in the world capable of monitoring most of the near-Earth environment, it is clear that the protection of military equities in a prospective STM regime is at the core of the government-wide US position.

On the opposite side of the spectrum, the Japanese SDF lack both technical capabilities and political influence that would allow them to ensure the preservation of their interests in internal Japanese discussions on STM. In fact, to the knowledge of the author, there is no clear position, even informal, at the MOD/SDF on what could be the scope and contents of an international STM regime. Most of the knowledge being in JAXA or in the academic world (well represented at the NSPC), it seems unlikely that the Japanese government would play the role of champion of military equities in STM. Nevertheless, the MOD can benefit from the support of retired officials and supportive politicians for the defence of a certain vision of the use of space for national security. LDP lawmakers in particular have been supportive of increased investments in the SDF with regards to space.

Due to its long history of the military uses of space, both at the MINARM and at CNES, France is well aware of the implications that an STM regime could have on the autonomy and freedom of its armed forces in outer space. Moreover, the personal inclination of President Emmanuel Macron for space security is a unique opportunity for the French military to advance its interests. Nevertheless, the traditional self-effacement of the military in front of its civilian leaders (President and Minister of Armed Forces) and its lack of knowledge if compared to CNES, does not allow it to have a domestic space policymaking power remotely comparable to the DoD in the US. It is however important to understand that, while not proactive in domestic space policymaking processes, the MINARM cannot be passive either. In fact, as one of the supervisory authorities of CNES and sole proprietor of France's SSA capabilities, its approval is required before any position is defended in international fora. As summarised by an interviewee, at COPUOS, "the French delegation is carried by the MEAE with the support of CNES and the blessing of the MINARM".

In sum, the lack of influence of the French and the Japanese militaries in domestic space policymaking may place the preservation of military equities in STM at a different level of priority as it would be for the US. It could in turn complicated the quick definition of a common view on the issue.

2. Implications of military influence in domestic decision-making processes for international regime-making for STM

Previous chapters have demonstrated the indispensable support of the military for the creation of any form of international regime for STM. After briefly reminding the reader of this key fact, this section analyses the implications of the military's influence on domestic decision-making on space safety and sustainability on the creation of an international regime on STM.

2.1. Military support indispensable

On the most important takeaway of this dissertation is the rigorous confirmation of a common-sensical aspect of international space affairs: the militaries of advanced space powers are central actors whose support is indispensable to any ambitious political or legal venture. Their objective unavoidability in outer space is further strengthened by the legitimacy they acquired in space safety and sustainability discussions through improved practices and example setting.

The previous chapter has shown that all three militaries have an impact on domestic decision-making processes for space policy, although on different scales and following different approaches. Proactive and boasting the most extensive national capabilities, the DoD is considered by a huge majority of interviewees to be the most influential organisation in USG interagency discussions on space safety and sustainability. Even in congressional discussions, although it cannot impose its own vision over other agencies', its possibility to use the "national security trump card" allows it to hold a "near veto". Following another approach based on different historical developments, the French military has adopted a relatively passive approach to space policymaking but retaining a level of control over the final conclusions. In the particular case of international space law and policy discussions, "the French delegation is carried by the MEAE with the support of CNES and the blessing of the MINARM". In Japan finally, the influence of the MOD is rather minimal but should not be confused with the influence of the idea of developing the military uses of space that has gained momentum since the mid-2000s and can boast support from LDP lawmakers. Highlighting the respective influence of the three militaries was the main purpose of hypothesis 3. As such, even if it was invalidated due to its extreme wording corresponding only to the case of the US, analysis showed the core role played by the military in space safety and sustainability policymaking, hence fully justifying the focus of this dissertation as well as confirming the necessity to take into account the role and influence of the armed forces of advanced space countries in the drafting of international STM regime proposals.

The second pillar of the indispensability of military support to any ambitious international space law and policy initiatives is the legitimacy acquired by the militaries of advanced space powers in such discussions. This legitimacy relies both on a track-record of good operational practices and of valuable participations in international fora of discussion. Using the example of the US, the responsible behaviour of DoD components in space has become apparent through various elements such as the USAF's drive towards compliance with the USG Orbital Debris Mitigation Standard Practices (ODMSP) shown in Chapter 4 and the work being done to increase transparency on American national security assets in outer space analysed in Chapter 5. Moreover, the public display in domestic and international discussions by DoD civilian and military officials of the department's attachment to safe and responsible practices in outer space is playing an important role for the advancement of space safety and sustainability. To the credit of the DoD can be put its participation in the definition of the UNCOPUOS Long-Term Sustainability guidelines, where DoD representatives were the technical focal points for the USG, as well as in its push for better behaviours and tougher rules at domestic level – though there was a debate about the 2019 revision of the ODMSP. The French and Japanese militaries, although their limited capabilities – staffing in particular – did not allow them to play such a visible role in international space policy discussions, have been clear in their adherence to the best standards and practices for ensuring the safety and sustainability of space operations.

The reason for the responsible attitude of most militaries in space is not a mere ethical posture but rather the understanding that outer space, key operational environment on which most military operations are critically dependent, is jeopardised. This 'enlightened self-interest' shared by most public and private actors around the world is driven by the parallel unfolding of a major environmental crisis with space debris and of the development of counterspace technologies by potential adversaries (e.g. China and Russia for the US and allies).

2.2. Implications on the purpose of an STM regime

As shown with the various definition listed in Chapter 2, STM is in itself a complex and rather unclear topic. Each new study proposes a new understanding of what it covers, what it is, what it contains, what it is supposed to solve, etc. In particular, there is a common confusion between the technical and regulatory aspects of STM. This is what led the author to choose, based on the definition provided by the International Academy of Astronautics (IAA),[19] to view STM as the combination of a regime – made of rules, norms and principles – and a technical system providing necessary monitoring and analysis functions, through what is commonly known as SSA.

A second area of confusion with regards to STM is its name itself. As often pointed out by government officials interviewed by the author, and *a fortiori* those affiliated with the military, the choice of the wording 'management' in relation to air and maritime traffic management is a mistake. Far from the fantasised idea of an overarching supranational structure for the actual control of activities in outer space dear to air and space law scholars, practitioners reject the idea of management. Merriam-Webster defines the verb 'to manage' as "to handle or direct with a degree of skill: such as (a) to exercise executive, administrative, and supervisory direction of, (b) to treat with care, (c) to make and keep compliant".[20] The Collins English Dictionary provides the following definition, supporting the idea of effective control inherent to the term of management: "management is the control and organizing of a business or other organization".[21] None of these definitions really correspond to the purpose of STM as usually discussed in space policy circles, where it is considered as primarily involving the facilitation of worldwide coordination of space activities as well as the promotion of a shared understanding on outer space activities. In fact, policy proposals faithful to an idea of management and involving the attribution of STM to an existing or newly established international agency (i.e. Ram Jakhu's ICAO for Space[22] or the IAA's International Space Organisation[23]) were all seen as utterly unrealistic, impractical and undesirable by most governmental officials met by the author.

[19] Contant-Jorgenson, Lala, and Schrogl, 'Cosmic Study on Space Traffic Management'; Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation'.
[20] 'Definition of Manage', Merriam-Webster, accessed 27 April 2020, https://www.merriam-webster.com/dictionary/manage.
[21] 'Management Definition and Meaning', Collins English Dictionary, accessed 27 April 2020, https://www.collinsdictionary.com/dictionary/english/management.
[22] Jakhu, Sgobba, and Dempsey, *The Need for an Integrated Regulatory Regime for Aviation and Space: ICAO for Space?*
[23] Schrogl et al., 'Space Traffic Management - Towards a Roadmap for Implementation'.

In addition, it appears clearly in the rhetoric of military experts interviewed by the author that it is necessary to differentiate what constitutes a 'safe behaviour' in opposition to an 'appropriate behaviour'. While the former embodies the idea of objective and scientific measurement of the risk generated by a specific activity, regardless of the actor behind it, the latter invokes an idea of moral judgement based on subjective values. If using the terminology introduced by James G. March and Johan P. Olsen, on the continuum between the logics of appropriateness and consequences, military space actors tilt towards the latter.[24]

2.3. Implications on the nature of an STM regime

Following the idea that space safety and sustainability should not be about management *per se* but rather about developing a common understanding of what is a safe and responsible behaviour in outer space, all military experts support the development and promotion of non-binding instruments such as standards, best practices, guidelines and norms of behaviour, the latter being the ultimate keyword used by almost all the American interviewees and mentioned as such in the 2019 French Space Defence Strategy. This regime based on non-binding instruments would aim to facilitate communication among operators in a coordination framework based on voluntary participation. They however firmly reject going further in the development of binding instruments, opposing the idea of an overarching STM regime with binding rules potentially limiting the freedom of – military – activities in space without the possibility of clear guarantees of "reciprocity" from other major space powers (e.g. China and Russia).[25]

In fact, all successful outcomes of STM-related initiatives such as the UNCOPUOS Long-Term Sustainability guidelines, the Inter-Agency Debris Coordination Committee's guidelines, or the Space Safety Coalition's best practices, fall under the scope of 'space safety promotion' or 'space traffic coordination'. Such understanding was the basis of the change of language operated by the US Department of Commerce now communicating primarily on "space safety

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[24] James G March and Johan P Olsen, 'The Logic of Appropriateness', in *The Oxford Handbook of Political Science*, ed. Robert E Goodin (Oxford, UK: Oxford University Press, 2011), https://doi.org/10.1093/oxfordhb/9780199604456.013.0024.

[25] 'Reciprocity' here should be understood in its ordinary meaning of 'showing one's intention to abide by the same rules as one's counterpart', without delving into the interesting but here irrelevant overinterpretations present in the literature. For example, see: Robert O. Keohane, 'Reciprocity in International Relations', *International Organization* 40, no. 1 (1986): 1–27.

and sustainability", as described in Chapter 9, slightly disavowing the rather unfortunate title of Space Policy Directive 3 "National Space Traffic Management Policy".[26]

2.4. Implications on the likelihood of STM regime-making

Knowing the great influence of military forces in domestic space policymaking and therefore on international negotiations, what is the likelihood of the establishment of an international STM regime following some of the proposals introduced in Chapter 2, section 5.3: the comprehensive and restricted-multilateral top-down approaches and the incremental bottom-up approach?

2.4.1. Comprehensive top-down and restricted-multilateral highly unlikely

It is clear from all the information presented in the previous chapters that the establishment of a comprehensive STM regime following a top-down approach is very unlikely, not to say utterly unrealistic. Not only STM is too unclear a topic to be put on the agenda of UNCOPUOS discussions but, even it was, it would be premature to initiate multilateral negotiations without securing the agreement of the three largest players in space (US, China and Russia) and their main partners. Similarly, a restricted multilateral approach around the US would be unacceptable for the militaries of the US, France and Japan, all three being unwilling to tie their hands without assurance of similar behaviour from China and Russia.

Going even further, the author of this dissertation believes that the establishment of a comprehensive international STM regime would not be necessary to ensure the long-term sustainability of outer space. As such regime would require the strong commitment of the world's largest space players, let us reverse the argument: if all of them are committed to improving their practices, then norms of behaviour should be enough. The only benefit of binding rules would be the creation of mechanisms of monitoring and verification, similar to those present in arms control regimes, but without realistic possibility for enforcement.

2.4.2. The progressive apparition of a bottom-up 'patchwork' regime

Although the interests and vision expressed by the military officials interviewed by the author ruled out the top-down approach, they on the contrary perfectly fit the current progressive apparition of a bottom-up 'patchwork' regime thanks to lot of valuable initiatives

[26] Executive Office of the President, 'Space Policy Directive-3 of June 18, 2018: National Space Traffic Management Policy'.

in international (e.g. UNCOPUOS LTS, International Organisation for Standardisation), interagency (e.g. Inter-Agency Debris Coordination Committee, Consultative Committee for Space Data Systems) and private fora of discussion (e.g. Space Data Association, Space Safety Coalition). Military experts are supportive of these initiatives as they are based on voluntary participation and only aiming at the development of non-binding rules. In fact, more than merely supportive, military officials are often attending these discussions, either to contribute or at least make sure that a minimum level of military equity is preserved. However, all these discussion platforms tend to focus on civil and commercial activities in space, none of them investigating the specific issue of military equities in STM – which is the main reason for this dissertation (cf. recommendations 2 and 3 in section 3 below).

2.4.3. An STM system as precursor

While the creation of an international STM regime is not considered a priority for most space actors – *a fortiori* military ones, everyone agrees on its necessary prerequisite: a comprehensive STM system providing actionable SSA data and standards of communication, key elements in achieving a high level of understanding of the outer space environment. In fact, almost all STM-related efforts currently happening around the world focus on the development of technical capabilities for space surveillance and tracking. Such project can take various forms such as the building of independent capabilities (e.g. Space Fence in the US, new GEO radar at the Japanese MOD and post-GRAVES in France), the development of frameworks to connect diverse governmental assets (e.g. the US Space Surveillance Network and the EU SST) or the setting up of an infrastructure to pool data from both government and commercial sources (e.g. the DoC's Open Architecture Data Repository).

Even on the regime-side of STM described above, most successful initiatives concern the development of technical standards for issues such as debris mitigation (e.g. ISO and IADC), exchange of trajectory data (e.g. Space Data Association and Consultative Committee for Space Data Systems), etc. As outlined in the previous part, such positive results, while facilitating the drive towards a comprehensive regime, are also rendering it fairly unnecessary.

3. Considering military equities in STM: recommendations

Owing to the fact that this dissertation is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in International Public Policy, it is important to go beyond mere commentary and delve into the complicated field of practical –

policy – recommendation. Accordingly, this section aims to provide a few simple recommendations, addressed to different actors in the space law and policy field, that would improve the level of consideration for military equities in STM discussions, wherever they are being held. It is only through this process that a really comprehensive and realistic STM regime proposal can emerge. Each subsection corresponds to one recommendation, specifies its target audience and provides detailed explanations on its rationale.

Recommendation 1: Forget about space traffic 'management', semantic shift needed

Target: everyone

The idea of dealing with space traffic having originated in the minds of international air and space law experts rather than in those of pragmatic governmental decision-makers, it is not surprising that it crystallised around the idea of 'management'. In fact, as repeated multiple times in the dissertation, 'management' is contrary to the interest and beliefs of most actors, *a fortiori* military ones. It will therefore require a coordinated effort of the space law and policy community to extract itself from the trap of STM, on which the author himself is falling throughout the dissertation and even in its title. Having the spectre of management floating over our heads does not bring anything else than confusion. A good example to follow is the semantic shift operated by the US military when it decided to replace the term of SSA by SDA (Space Domain Awareness). Even though it does not change the situation of space surveillance at the DoD, it clarifies its military focus and its scope based on similar concepts in other domains (e.g. Maritime Domain Awareness).

Then, what can replace STM? It seems that a large number of expressions would be better: 'space traffic coordination' as the Europeans love to say? The new DoC catchphrase of 'space safety and sustainability'? The debate is still open.

Recommendation 2: Taking into account the reality of military influence in space

Target: academic community mostly

Most of the so-called 'STM academic community', but not the governmental one, seems to fail to consider how important military influence in space is, be it direct or indirect. Let it be clear once and for all: the militaries of advanced space countries, along with other national security-related operators, are the most powerful and influential actors in space, period. As already presented in the previous chapters, the US DoD is considered to be the second largest satellite operator in the world with 189 satellites owned and operated by DoD-affiliated institutions.[27] If adding to this number the military satellites operated by China (105) and Russia (100), this accounts for around 18% of all satellites in orbit. Moreover, if considering commercial satellites used in support to military operations as well as the satellites which existence has not been discovered yet, one can easily understand the immense influence of military forces in outer space.

An argument often raised by people overlooking the military element in space safety is the huge growth of commercial actors in space, whose assets are expected to largely exceed those devoted to national security. This view is not only naïve but is wrong. Even if the number of military assets in space becomes quite small compared to the myriads of commercial satellites, what matters is the echo that military actors have in domestic decision-making. In fact, the weight of the national security voice in domestic space policy making is not a linear function of the number of assets in space but rather an exponential one and will always exceed the one of commercial owner-operators, in particular in the current context of rise of tensions. The three largest space players, concurrently the three largest militaries in the world, are well too aware of the extreme reliance of national defence infrastructure on space technology. It is without mentioning all the unavoidable daily uses of space technology for entire fields of their economy: timing services for financial markets, positioning for all modes of transportation, communication for virtually everything, etc. Therefore, the defence of this infrastructure, permitted by the protection of the activities of their military and national security agencies, is the most important factor in their domestic position on an international regime for space safety and sustainability.

The author has no doubts that most researchers working on space safety issues are well aware of this situation but regrets the fact that it is not visible in their output. In other words, unless the equities and influence of the major armed forces in the world are taken into account in space safety policy studies, these are basically deemed to fail before having started. A typical example of this are the two world-famous but rather incomplete STM studies of the International Academy of Astronautics (IAA).

Recommendation 3: Forum of discussion on military equities in space safety

Target: research community (academia and think tanks)

Drawing from the examples of the Manual on International Law Applicable to Military Uses of Outer Space (MILAMOS) and of the Woomera Manual on the International Law of

[27] 'Union of Concerned Scientists Satellite Database'.

Military Space Operations, an international forum of discussions on military equities in space safety and sustainability could be established. This forum, preferably organised under the auspices of an academic institution, would be primarily devoted to policy experts and military practitioners rather than pure space law experts, in order to stay grounded and practical. In fact, some elements of MILAMOS and Woomera are overlapping with issues identified throughout this dissertation such as the detection of hostile acts in space.

Such academic setting would also be the way to have valuable input from countries traditionally not transparent on their approach to space safety and sustainability from a military perspective, such as Russia and China. Although the Chinese and Russian military tend not communicate on their space operations, academics from both countries' leading university are frequently attending international space gatherings.

Recommendation 4: Favour a bloc approach

Target: governments of leading space countries

As discussed previously, regulating activities in outer space is essentially a three-player game – four if Europe manages to build a strong and united position. The situation is then not very different from the Cold War era, with three major powers instead of two, and a few secondary powers in Europe and Japan.

Therefore, if the world is tripolar, why engaging in fully multilateral discussions at the UNCOPUOS? In other words, why including in the discussion countries with virtually no equity in the situation? There is a clear benefit to multilateralism: any rule, norm or principle adopted is intrinsically international. Every participant, through its participation in the negotiations and its vote in favour of adoption, expresses its clear intention to abide by the said-rule, norm or principle. This is the beauty and strength of the Long-Term Sustainability guidelines adopted by the UNCOPUOS in June 2019.[28] These guidelines are a breakthrough as they provide a basic level of good practices to be followed by any country willing to develop its domestic regulations for the preservation of the outer space environment, as explained in their text:

> "States and international intergovernmental organizations should voluntarily take measures, through their own national or other applicable mechanisms, to ensure that the guidelines are implemented to the greatest extent feasible and practicable, in accordance with their respective needs, conditions and capabilities, and with their existing obligations under applicable

[28] 'Press Release: Guidelines for the Long-Term Sustainability of Outer Space Activities of the Committee on Peaceful Uses of Outer Space Adopted'.

> international law, including the provisions of applicable United Nations treaties and principles on outer space"[29]

The adoption of the LTS guidelines however came as a surprise in the space community, even for people familiar with the matter, which shows how unlikely it would be to try to go further in the negotiation of a more comprehensive space safety and sustainability regime. Moreover, it took more eight years from the establishment of the working group on LTS in 2011 up to their adoption in 2019.[30] In fact, direct stakeholders interviewed by the author expressed their frustration over the UNCOPUOS process due to the fact that every country has a right to comment, request some modification on the six official versions of the text, even when they have no knowledge on the issue and are, simply put, wasting everyone's time. Therefore, even in an extremely optimistic setting, STM-like discussions at the UNCOPUOS could last decades.

If compared to the beginnings of space law, this situation is alarming. Let us look at the example of the first and most important piece of space legislation to date: the Outer Space Treaty. In early 1963, the US and the USSR agreed bilaterally on the importance to ban the deployment of nuclear weapons and other weapons of mass destruction in outer space, leading to an initially trilateral[31] treaty (the Partial Test Ban Treaty) and two UN General Assembly resolutions on the same year, including the pioneering *Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space*.[32] Paving the way to a more comprehensive treaty on outer space activities, it led a bit more than three years later to the adoption of the Outer Space Treaty.[33] The following three major space treaties, the Rescue Agreement, the Liability Convention and the Registration Convention were adopted

[29] 'Guidelines for the Long-Term Sustainability of Outer Space Activities', Conference room paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities (Vienna, Austria: United Nations Committee for the Peaceful Uses of Outer Space, 27 June 2018), https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_1052018crp/aac_1052018crp_20_0_html/AC105_2018_CRP20E.pdf.

[30] Martinez, 'Development of an International Compendium of Guidelines for the Long-Term Sustainability of Outer Space Activities'.

[31] The UK joined the US and the USSR as initial signatory in Moscow on 5 August 1963.

[32] 'Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Known as Partial Test Ban Treaty)', 480 UNTS § 43 (1963); 'Resolution 1884 (XVIII) of 17 October 1963 "Question of General and Complete Disarmament"' (New York: United Nations General Assembly, 17 October 1963); 'Resolution 1962 (XVIII) of 13 December 1963 "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space"' (New York: United Nations General Assembly, 13 December 1963); Cited in: Peter Jankowitsch, 'The Background and History of Space Law', in *Handbook of Space Law*, ed. Frans von der Dunk and Fabio Tronchetti (Cheltenham, UK and Northampton, MA: Edward Elgar Publishing, 2015), 3–4.

[33] 'Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Known as Outer Space Treaty)', 610 UNTS § 205 (1967); Cited in: Jankowitsch, 'The Background and History of Space Law', 4.

respectively in 1968, 1972 and 1975 on the basis of the Outer Space Treaty. When thinking that it took eight years to negotiate, on the one hand, these three major treaties, and on the other hand, the LTS guidelines, it is clear that the multilateral international space law machine is not working well anymore.

Based on the ideas briefly evoke above, the author of this dissertation believes that it is time to go back to a bloc-type approach to international space negotiations. What allowed an US-USSR space agreement to have such a great echo during the Cold War was the recognition by other countries that they were the two nations with the most equities in the situation. In the current situation, the fact is that three main players, US (+ Europe), China and Russia have most of the objects in space and should be the primary decision-makers. Excessive liberal thinking since the end of the Cold War has led minor space powers and even non-space countries to genuinely believe that their voices could and should be heard. In order to solve the current environmental crisis in space, a tri- or quadripartite discussion body should be established to negotiate principles regarding space safety and in particular the preservation of military and national security equities. Only after such principles are determined among the players that count can meaningful multilateral discussions be initiated. It is, the author believes, the message sent by General Raymond in a February 2020 interview for Times magazine: "We [the US military] think that responsible space-faring nations need to have conversations about developing these norms going forward".[34] In fact, in July 2020, Chris Ford, Assistant Secretary of State for International Security and Non-Proliferation declared that the US and Russia would hold discussions aiming to "help advance the cause of setting responsible norms of behaviour" in outer space.[35] The author hopes that it will be the first step towards ambitious bloc discussions.

Recommendation 5: Trust private sector initiatives

<u>Target: everyone</u>

The absence of international binding rules to ensure space safety and sustainability does not prevent the happening of excellent initiatives from private satellite operators. In fact, understanding the importance to preserve the environment on which their entire business model is based, commercial owner-operators and space safety-related companies have been prone to

[34] W J Hennigan, 'Exclusive: Russian Craft Shadowing U.S. Spy Satellite, Space Force Commander Says', Time, 10 February 2020, https://time.com/5779315/russian-spacecraft-spy-satellite-space-force/.
[35] Theresa Hitchens, 'Space War: US To Meet With Russia; Rolls Out Warfighting Doctrine', Breaking Defense, 24 July 2020, https://breakingdefense.com/2020/07/space-war-us-meet-with-russia-rolls-out-warfighting-doctrine/.

autoregulate, by developing and endorsing good practices, communication and technical standards and even debris mitigation rules much stricter than governmental ones (e.g. the 5-year rule of the Space Safety Coalition).

While it does not seem to directly relate to military equities in outer space, such initiatives contribute to an overall improvement of space safety that is in the interest of armed forces around the world. The growth of commercial actors being tremendous in recent years, driven by SpaceX's Starlink constellation, good and voluntary industrial practices will be key in maintaining a safe and sustainable space environment.

On the other hand, the development of commercial SSA services can bring some concerns to military actors, as they contribute to going further in the progressive disappearance of the secrecy of space activities. However, recent history has shown that military leaders should not worry much about the development of domestic SSA commercial actors as they tend to exert self-restraint with regards to the disclosure of information on the military assets of their own country, primarily because the military is one of the most lucrative customers they can hope for.

4. Way forward and future research

This section introduces a few issues that the author would like to continue investigating, building on the work accomplished for this dissertation.

4.1. Investigate Chinese and Russian militaries' approach to STM

This dissertation having provided a lengthy analysis of military role in space safety and sustainability within the US bloc, it is now critical to carry out similar studies for the two other players of this global space game: China and Russia. The main challenge is however to understand how to do it. A first step could be the establishment of an international non-governmental discussion forum that would include Russian and Chinese academics (cf. recommendation 3 above).

4.2. Follow the development of a unified European vision on STM

The development of a unified European vision on space safety and sustainability would have a significant impact on international space discussions, as it would bring a fourth major actor to the table – which is in fact the hope of major European spacefaring countries. It will therefore be critical to follow closely the development of the policy, building on the necessary technical foundations currently being laid out by the EU SST. As such, initiatives from the European External Action Service and the German Presidency of the EU in late 2020 will be crucial.

4.3. Continue to follow the development of a space operational culture in the military

All three countries studied in this dissertation have, although starting at different levels, initiated efforts to develop a pool of space military technologists in their armed forces. The development of such skill structure would contribute to the apparition of a distinct space operational culture, radically different from the dominant one in most air forces. How this sociological evolution of the militaries of advanced space powers will unfold is a fascinating topic to investigate.

Appendix A. List of interviewees

A.1. United States

US-1	Senior Civilian Official. Office of the Secretary of Defense, Department of Defense. 28 August 2019. Arlington, Virginia. Interviewer: Author.
US-2	Senior Official. Federal Communications Commission. 30 August 2019. Washington, DC. Interviewer: Author.
US-3	Senior Official. Department of Commerce. 30 August 2019. Washington, DC. Interviewer: Author. Interviewed with US-4.
US-4	Official. Department of Commerce. 30 August 2019. Washington, DC. Interviewer: Author. Interviewed with US-3.
US-5	Senior Official. Department of State. 3 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-6.
US-6	Official. Department of State. 3 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-5.
US-7	Senior Staffer. Senate Committee on Commerce, Science, and Transportation, United States Senate. 3 September 2019. Washington, DC. Interviewer: Author.
US-8	Staffer. Office of Senator Ted Cruz, United States Senate. 5 September 2019. Washington, DC. Interviewer: Author.
US-9	Senior Engineer. Pure Commercial Entity. 5 September 2019. Washington, DC. Interviewer: Author.
US-10	Senior Official. National Aeronautics and Space Administration. 6 September 2019. Phone. Interviewer: Author.
US-11	Space Policy Analyst. 6 September 2019. Washington, DC. Interviewer: Author.
US-12	Former Senior Civilian Official. Office of the Secretary of Defense, Department of Defense. 9 September 2019. Phone. Interviewer: Author.
US-13	Senior Official. National Space Council, Executive Office of the President. 9 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-14.
US-14	Senior Official. National Space Council, Executive Office of the President. 9 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-13.

US-15 Senior Policy Advisor. United States Air Force. 9 September 2019. Washington, DC. Interviewer: Author.

US-16 Senior Civilian Official. Office of the Secretary of Defense, Department of Defense. 10 September 2019. Arlington, Virginia. Interviewer: Author. Interviewed with US-17.

US-17 Civilian Official. Office of the Secretary of Defense, Department of Defense. 10 September 2019. Arlington, Virginia. Interviewer: Author. Interviewed with US-16.

US-18 Space Policy Analyst. 10 September 2019. Washington, DC. Interviewer: Author.

US-19 Senior Official. Office of Commercial Space Transportation, Federal Aviation Administration. 11 September 2019. Washington, DC. Interviewer: Author.

US-20 Official. Office of Commercial Space Transportation, Federal Aviation Administration. 11 September 2019. Washington, DC. Interviewer: Author.

US-21 Senior Official. Department of State. 11 September 2019. Washington, DC. Interviewer: Author.

US-22 Former Senior Civilian Official. Office of the Secretary of Defense, Department of Defense. 13 September 2019. Arlington, Virginia. Interviewer: Author.

US-23 Military Officer. Department of Defense. 13 September 2019. Washington, DC. Interviewer: Author.

US-24 Space Policy Analyst. 14 September 2019. Washington, DC. Interviewer: Author.

US-25 Retired General Officer (OF-9[1]). Department of Defense. 16 September 2019. Washington, DC. Interviewer: Author.

US-26 Retired Military Officer. United States Air Force. 20 September 2019. Maui, Hawaii. Interviewer: Author.

US-27 Official. Department of Commerce. 20 September 2019. Maui, Hawaii. Interviewer: Author.

US-28 Retired General Officer (OF-7). United States Air Force. 30 September 2019. Phone. Interviewer: Author.

US-29 Retired General Officer (OF-9). United States Air Force. 1 October 2019. Phone. Interviewer: Author.

US-30 Space Policy Analyst. 28 February 2020. Tokyo, Japan. Interviewer: Author.

US-31 Space Policy Analyst. 10 September 2019. Washington, DC. Interviewer: Author.

[1] The NATO scale is used here to compare ranks among American, Japanese and French general officers.

US-32 Senior Researcher. Center for Strategic and International Studies. 5 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-33.

US-33 Researcher. Center for Strategic and International Studies. 5 September 2019. Washington, DC. Interviewer: Author. Interviewed with US-32.

US-34 Professor. The George Washington University. 29 August 2019. Washington, DC. Interviewer: Author.

US-35 Senior Researcher. Brookings Institution. 30 August 2019. Washington, DC. Interviewer: Author.

US-36 Former Member, United States House of Representatives. 24 September 2019. Tokyo, Japan. Interviewer: Author.

US-37 Senior Engineer. Pure Commercial Entity. 20 September 2019. Maui, Hawaii. Interviewer: Author.

US-38 Retired Military Officer. United States Air Force. 23 October 2019. Washington, DC. Interviewer: Author.

A.2. France

FR-1 Senior Official. Centre National d'Études Spatiales. 14 February 2020. Paris, France. Inteviewer: Author.

FR-2 Military Officer. Commandement de l'Espace, Ministère des Armées. 17 February 2020. Paris, France. Interviewer: Author. Interviewed with FR-3 and FR-4.

FR-3 Military Officer. Commandement de l'Espace, Ministère des Armées. 17 February 2020. Paris, France. Interviewer: Author. Interviewed with FR-2 and FR-4.

FR-4 Military Officer. Délégation Générale pour l'Armement, Ministère des Armées. 17 February 2020. Paris, France. Interviewer: Author. Interviewed with FR-2 and FR-3.

FR-5 Official. Ministère de l'Europe et des Affaires Étrangères. 17 February 2020. Paris, France. Interviewer: Author.

FR-6 Senior Official. Ministère de l'Éducation Supérieure, de la Recherche et de l'Innovation. 18 February 2020. Paris, France. Interviewer: Author.

FR-7 Senior Official. Centre National d'Études Spatiales. 26 February 2020. Undisclosed location. Interviewer: Author.

FR-8 Space Policy Analyst (Government and Think-Tank). 20 April 2020. Phone. Interviewer: Author.

A.3. Japan

JP-1 Senior Policy Advisor. Liberal Democratic Party. 9 September 2019. Tokyo, Japan. Interviewer: Author.

JP-2 Member. National Space Policy Committee, Cabinet Office. Tokyo, Japan. Interviewer: Author.

JP-3 Former Member. Advisory Panel on Security and Defense Capabilities, Cabinet Secretariat. 19 December 2018. Tokyo, Japan. Interviewer: Author.

JP-4 Official. Bureau of Defense Policy, Ministry of Defense. 13 December 2018. Tokyo, Japan. Interviewer: Author.

JP-5 Retired General Officer (OF-9). Air Self-Defense Forces. 11 December 2018. Tokyo, Japan. Interviewer: Author.

JP-6 Official. Japan Aerospace Exploration Agency. 3 December 2018. Tokyo, Japan. Interviewer: Author.

JP-7 Official. Japan Aerospace Exploration Agency. 30 November 2018. Tokyo, Japan. Interviewer: Author.

Appendix B. Sample interview questions

This document presents sample questions having been asked to American interviewees. There was no fixed interview protocol as interviewees had various backgrounds and very different fields of expertise. Instead, the questions below are organized by theme.

General background questions

- Can you describe the responsibilities associated with your position and any relevant experience you have in SSA and STM issues?
- Could you explain the focus of your office, your role within the US government?
- What are the responsibilities of this office on SSA and STM issues?
- Do you believe in the secrecy of operations in outer space?

On internal DoD affairs

- What are the structures having space law and/or policy expertise at the DoD?
- Can you comment on the traditional posture of relevant DoD components on issues related to SSA and STM, including in particular the transparency of military operations in space?
- The Air Force Space Command being under the responsibility of both the Air Force and US Strategic Command, which has the final say for matters related to the transparency of military space operations?
- Is there a unified – even informal – position on STM at the DoD? If not, what are the existing views of different offices and/or individuals? What is your view?

On interagency decision-making processes

- What is the composition of the interagency working group for the UNCOPUOS Long-Term Sustainability guidelines? Which are the most influential participants?
- Do you see any interest on STM in the Intelligence Community? In particular, do you feel that the NRO is playing along the idea of more transparency and more coordination in the space environment?
- Did the re-establishment of the National Space Council have an influence on the ability for the DoD to promote its views in interagency discussions?

On the role of Congress and congressional processes

- How would you evaluate the likelihood of 1) having a Bureau of Space Commerce and 2) having a Space Force?
- Could you explain very briefly the role and the focus of the Senate Committee on Commerce? In particular knowing that you have some oversight that intersects with STM.
- As an external observer of executive processes: how would you evaluate the DoD's importance in decision-making on SSA and STM?
- What is the influence that the DoD has on the Senate Committee on Commerce? In internal committee discussions on issues related to STM, to what extent do you take into account the DoD's position and how can the DoD's position reach you, through official and unofficial channels?

On international discussions

- What is the interagency process for the definition of the American position for international negotiations on space safety and sustainability (e.g. UNCOPUOS)?
- Do you believe in the establishment of an international regime for STM? If yes, in what form?

On the DoD's SSA sharing program

- What factors led to the transfer of space surveillance data sharing responsibility from NASA to the DoD, or in other words, the establishment of the CFE Pilot Program?
- What factors led to the two extensions of the CFE Pilot Program and later to its establishment as the permanent USSTRATCOM SSA Sharing Program?
- Can you remember specific individuals having been instrumental in the creation and/or daily operations of the CFE Pilot Program and the SSA Sharing Program?
- What factors led to the October 2018 announcement by General Hyten of the release of more information on American national security assets than previously available?

On the Air Force's compliance with the Orbital Debris Mitigation Standard Practices

- Is the Air Force committed to the preservation of the outer space environment?
- Based on the results of a FOIA request I made on the Air Force's compliance with the ODMSP, it seems that compliance has been improved only from 2015-2016: how to explain this delay? Moreover, do you agree with the FOIA results I am showing you?

- Can you remember specific individuals having been instrumental in the Air Force’s drive towards compliance with the ODMSP?
- What are usual reasons for violating the ODMSP and requesting a waiver?

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