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Uses of Outer Space**
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Item 13 of the provisional agenda*
Long-term sustainability of outer space activities

**General presentation of French activities and views for the
long-term sustainability of outer space, in relation with the
implementation of the first set of guidelines (A/71/20, Annex)**

Conference room paper submitted by France¹

1. France is pleased to present its activities and views for the long-term sustainability of outer space, in relation with the implementation of the first set of guidelines adopted by the Committee on the Peaceful Uses of Outer Space at its 59th session (A/71/20, Annex) and which the Committee noted was ready for States and international intergovernmental organizations to consider implementing on a voluntary basis (A/71/20, para. 135).
2. As a preliminary remark, France has always attributed a serious interest to the long term sustainability and has played an active role in the Working Group on the Long-term Sustainability of Outer Space Activities (LTS). In particular, France would like to recall that the idea of creating such a Working Group was proposed by Gérard Brachet in 2008 in his capacity as Chairman of the Committee on the Peaceful Uses of Outer Space. The necessity of strengthening the long-term sustainability, safety and security in space is shared by nations. It is in the collective interest of all peaceful space-faring or space-using nations to encourage the responsible use of space and minimize orbital debris, to protect any in-orbit manoeuvring spacecraft from risks of collision and to preserve the space environment. France is convinced that this first set of 12 consensual guidelines agreed in June 2016 in Vienna was a major achievement for the Committee on the Peaceful Uses of Outer Space.
3. However, much work remains to be done. Additional draft guidelines, arguably not the least difficult, still need to be discussed over the next two years, with the goal of forming a full compendium of guidelines to be adopted by the Committee and referred to the General Assembly in 2018 to coincide with UNISPACE+50. This timely conjunction requires the LTS working group to fulfil its mandate and succeed

* A/AC.105/C.1/L.355.

¹ Courtesy translation submitted by the French delegation.



in its endeavours in accordance with its workplan (A/71/20, para. 137). In accordance with the terms of reference of the LTS Working Group (A/AC.105/C.1/L.307/Rev.1, §4), France re-affirms that voluntary guidelines need to be « focused on practical measures that could be implemented in a timely manner to enhance the long-term sustainability of space activities ».

4. Consistent with the above, France would like to present the following initial elements pertaining to the implementation of the first set of guidelines and to long-term sustainability of outer space activities as a whole.

5. The French Space Agency, CNES, founded in 1961, is a major actor for outer space sustainability and implementation of voluntary guidelines. CNES is the government agency responsible for shaping and implementing France's Space policy in Europe. Through its ability to innovate and its forward-looking vision, CNES is helping to foster new technologies that will benefit society as a whole, focusing on 5 themes: access to space (with Ariane), telecommunications, observation, science, security and defence.

A. Policy and regulatory framework for space activities (Guidelines 1, 2 and 3):

6. France has adopted three main laws in support of sustainable development for Earth and space activity: Law on Energy Transition to Green Growth (LTECV), Law on Biodiversity, Space operations Act (LOS). In order to respect the environment and to mitigate climate change, France implements exemplary policy concerning the impacts of space missions and the corresponding technical means.

7. The French Space Operations Act of June 2008 the 3rd, supplemented by decrees and a Technical Regulation, establishes the legal framework for space activities in France.

8. The French Space Operations Act (LOS) sets up an authorization and continuous supervision process of the space activities of the French operators, in accordance with the international treaties in particular the treaty of January 27th, 1967 on the principles governing the activities of States regarding exploration and use of outer space and the convention of March 29th, 1972 on international liability for damage caused by space objects. This process allows mastering the liability of France for the space activities for which it is responsible in accordance with the aforementioned international treaties.

9. The French Space Operations Act leads to authorize and supervise all the space operations performed by French operators and takes into account the long-term development of space activities. In particular, the Technical Regulation was developed with due consideration paid to the Space Debris Mitigation Guidelines adopted by the Committee on the Peaceful Uses of Outer Space and endorsed by the United Nations General Assembly (A/RES/62/217), the recommended practices and voluntary guidelines proposed by the Inter-Agency Space Debris Coordination Committee (IADC) and the Committee on Space Research (COSPAR) as well as the existing international technical standards, including those published by the International Organization for Standardization (ISO) and the Consultative Committee for Space Data Systems (CCSDS), generally accepted by the international space community for the safe conduct of outer space activities.

10. In France, the authorization to perform a space operation (launch or in orbit control) is given by the ministry in charge of Space only after evaluation of compliance with the Technical Regulation. The detailed analysis of compliance with the Technical Regulation is performed by CNES on behalf of the ministry.

11. This Technical Regulation comprises requirements ensuring that any space operation:

- limits the number of fragments and performs end of life operations respecting the protected regions,
- limits ground risks to populations and properties during the launch and re-entry of space objects,
- limits risks to public health and the environment associated with the elements coming back to Earth,
- is compliant with applicable nuclear safety prescriptions via a specific plan, in case of use of radioactive materials.

12. The Space Act provides that every operator has to carry out, for any space operation, an impact assessment on the environment and a hazard study with a plan to manage risks and ensure safety of populations, properties, public health and the environment.

13. The authorization process and the assessment of compliance with the technical regulations provides assurance that the operators have the means, resources, necessary skills and are appropriately organized to perform the operation in compliance with the Space Act. It also allows competent authorities to verify that compliance is maintained throughout operational life of the space object up until disposal, through the processing of the technical and organizational events.

14. This regulation is updated as and whenever necessary. In this respect, a first amended version should be finalized and adopted in 2017 to take into account the lessons learnt from 6 years of implementing the Space Act enforcement as well as the evolution of outer space environment.

15. The French Act includes a transition period of 10 years until 2020, during which some requirements of the Technical Regulation are not applicable or based on the best strategy considering the definition of the vehicle. It gives time to operators to implement measures that will allow full compliance with the regulation after 2020.

16. It should also be noted that CNES has initiated the « Collective for Space Care » which gathers, on a voluntary basis, space operators and partners who jointly acknowledge responsibility for complying with international treaties and principle pertaining to space matters, compliant with applicable space legislations and applying the best practices derived from them.

B. Safety of space operations

B.1. Orbital data on space objects and debris monitoring (Guidelines 12 and 13):

17. As an active participant of Expert group B, France agrees with the recommendations provided by the Expert group B in its report on Space Debris, Space Operations and Tools to Support Collaborative Space Situational Awareness ([A/AC.105/2014/CRP.14](#)).

18. In the domain of Space Situational Awareness (SSA) for outer space sustainability, awareness of the highly dynamic and increasingly complex near Earth space environment appears essential to safeguarding space-based assets, ensuring access to space and contributing to the safety, security and sustainability of space in the long run. The increasing pressure on orbital regimes such as LEO and GEO will drive and foster the need for large-scale SSA.

19. The whole strength and efficiency of the SSA organization in France is based on its dual civilian-military character, which is considered as a key success factor for contributing to outer space sustainability. There's a full cooperation between the

French MoD and the French Space Agency. France is convinced that it is an efficient way to proceed to address national issues as well as the international cooperation ones for outer space sustainability.

20. The French dual operational activities in SSA consist of 3 different levels.

- At programmatic and decision-making level, the French Space Agency (CNES) and the French MoD closely cooperate together for many years to define policy, capacities and priorities in space surveillance.
- At the sensors level, the French MoD operates the GRAVES survey radar and several tracking radars that CNES uses on a regular basis. GRAVES is a bi-static radar, operational since 2005 that was designed by ONERA (the French Aerospace Lab) and is operated by the French Air Force. GRAVES is a unique asset in Europe, as it is the only operational space surveillance radar of LEO objects available to date. CNES together with CNRS (National Centre for Scientific Research) also operates three TAROT telescopes located at Calern, in Chili and in La Réunion for survey and tracking purposes.
- At the operational level, there are two Operations Centres in France. On the one hand, the military COSMOS Ops Centre of the French Air Force is responsible for Air and Space Defence and reports to the Office of the Prime Minister, as provided for by the French Code of Defence. On the other hand, the CNES Ops Centre consists of a 24/7 on call team of 10 specialists dedicated to conjunction assessment, alerts and recommendations of collision avoidance manoeuvres to spacecraft operators and owners. Today, 23 satellites are currently protected from risks of collisions. It also performs operational re-entry monitoring campaign of risky space objects into Earth.

21. The CNES Ops Centre is connected to the COSMOS Ops Centre through a dedicated link. In particular, CNES ensures maintenance of a French LEO database using GRAVES's measurements in a secure and classified room). As a result, CNES is able to perform a screening of known spacecraft against the GRAVES database and elaborate its own Conjunction Data Messages (CDM). CNES also retrieves and analyses CDM from the United States' JSpoC (approximately 100 CDM per day with the enlarged criteria at 7 days).

22. The CNES operational centre is internationally recognized for its expertise in conjunction assessment, sensitivity analysis of dispersion to better assess the geometry of a risky collision and recommendation of collision avoidance manoeuvres, with demonstrated skills to improve methods and accuracy for more safety in space. The operational team has contributed to the definition of the well-known Conjunction Data Message (CDM) at the Consultative Committee for Space Data Systems (CCSDS), later on endorsed as an ISO standard. CDM is currently used by spacecraft operators and other appropriate entities performing conjunction assessment as a common, internationally recognized standard message to enable collaboration and information in case of a risky conjunction in orbit.

B.2. Space weather (Guidelines 16 and 17):

23. A national group of experts on space weather has been set up in France, under coordination by CNES and with participation of more than 30 experts from various institutes and governmental agencies such as CEA, CNES, CNRS, CLS, DGAC, DSNA, Météo France, Ministry of Defence (CIE, DGA, CDAOA), Ministry of Environment, Energy and Sea, Ministry of Higher Education and Research, Observatory of Paris (LESIA), ONERA, University of Strasbourg and the Air and Space Academy. The purpose of this group is to provide an assessment of impacts on 4 domains: defence, space, civil aviation, terrestrial technological infrastructure, and promote the sharing of information on space weather events (post-event analysis).

24. At national level, the French Air Force (CDAOA/COSMOS) has developed a space weather system for the armed forces. ONERA, with the support of CNES, has developed an important expertise over the last 20 years in the space radiation domain with advanced space weather applications such as real-time nowcasting of the Earth's trapped particle environment, based on data assimilation techniques allowing combination of in-situ measurements and physics-based models in an optimal way. These products are provided to the space industry in charge of the satellite design and to spacecraft operators. Involvement of the French Sun-Earth scientific community is an important asset for developing models and tools intended to better understand underlying physical processes and improve forecasts of space weather events.

25. At the European level, France (as a participating Member State since 2008) supports the development of a European space weather system and associated pre-operational services within the space weather segment of the ESA space situational awareness programme. France also endorses a future evolution towards an operational system delivering space weather services, as indicated in the recent European Union space strategy for Europe.

26. At international level, France recommends to better define and characterize extreme space weather events and their probability of occurrence and assess their impacts on technological systems, with a focus on spacecraft and aircraft. This work should be done at international level, including through UNISPACE+50 Thematic Priority IV (International framework for space weather services). For instance, during the 39th session of the Assembly of the International Civil Aviation Organization (ICAO) in Montreal, September 27th – October 6th, 2016, France, on behalf of the 44 Member States of the European Civil Aviation Conference (ECAC) drew the attention of ICAO to the importance of investigating the resilience of modern civil aviation to exceptionally strong space weather events. France offered to provide ICAO with an initial contribution on this topic. This contribution aims at assessing whether exceptionally strong solar events, which are known to occur, could be hazardous or seriously disruptive to highly sophisticated modern aviation and whether mitigation strategies should be developed.

C. International cooperation, capacity-building and awareness (Guidelines 25 and 26):

27. International and regional cooperation in SSA and space debris are of primary importance for outer space sustainability. They allow common actions to improve accuracy of orbital data and sharing of orbital information on space objects.

28. At United Nations level, France supports two subjects that deserve specific attention in the future: exchange of information on space objects and events (A/AC.105/L.302) and impact of extreme space weather events.

29. At regional level, in Europe, following the Decision n°541 of the European Parliament and the Council establishing a Space Surveillance and Tracking Support Framework in 2014, France (CNES together with MoD) currently focuses its efforts on building the European initiative together with its European partners (United Kingdom, Germany, Italy and Spain) and with the support of the European Commission. Sharing of data and information is of primary importance in order to improve the operational services (collision, re-entry, fragmentation).

30. At inter-agency level, France is involved in the work of the Inter Agency Space Debris Coordination Committee (IADC) since 1996. IADC is composed of 13 members. The defence community (CIE, DGA, CDAOA and ONERA, with acronyms defined above) is part of the French delegation under the responsibility of CNES. In accordance with the terms of reference (article 1), the general purpose of IADC is “to

exchange information on space debris research activities between member space agencies, to facilitate opportunities for cooperation in space debris research, to review the progress of ongoing cooperative activities and to identify debris mitigation options”. The activities of the working group 4 on space debris mitigation are “primarily designed to promote and to improve orbital debris research by members of IADC” (article 7). France confirms to the Committee on the Peaceful Uses of Outer Space its view that IADC only provides technical recommendations to the international space community as options to be considered and does not act as a regulatory organization. France participates to activities related to detection and monitoring of space debris (optical and radar sensors), operational monitoring of risky re-entry, modelling of space debris evolution, satellite protection and study of measures to reduce or avoid the creation of space debris or reduce the hazards created by space debris.

31. Through its space missions, France also intends to be at the forefront of efforts contributing to sustainable development, including climate change and water monitoring. In this respect, it regards Space as being essential to monitoring and mitigating climate change, as well as helping societies adapt to its effects. Indeed, out of 50 essential climate variables, 26 can only be monitored from space. Space-based systems provide by far the highest amount of data for climate models and continue to improve their forecasting ability. The data provided by these systems, and in particular those developed and operated by France or in partnership with ESA, were of primary importance in the context of the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (or “COP 21”) which led to the adoption of the Paris agreement on 12 December 2015 and its subsequent entry into force on 4 November 2016.

32. CNES played a leading role in this context and agreed together with space agencies partners to share an international space-based exchange data system to monitor the greenhouse gases (New Delhi declaration, May 16th, 2016). Satellites such as JAXA GOSAT and NASA OCO-2 already permit to measure greenhouse gases concentrations, but other projects will improve the forecasting and the ability to verify the efficiency of the actions taken to mitigate climate change. Several projects, in which France is strongly involved, are currently underway: MicroCarb and Merlin in Europe, the forthcoming satellites for the European ESA’s Copernicus programme, the NASA-CNES Calipso satellite, Earth’s poles with ESA’s CryoSat, and surface waters, which will be the focus of SWOT (Surface Water and Ocean Topography).

33. The COP 22, held in Marrakesh in November 2016, provided an occasion to confirm the key role of space activity with respect to climate change and focused mainly on water management, a major subject which impacts millions of people on the planet. France, through its space agency and space industry, has deployed the successful Jason satellite series in cooperation with NASA and NOAA since years (Jason-3 has been launched in 2016).

34. Since 2000, the satellite has been integrated into crisis management to provide a global vision of the areas affected by disasters. It provides valuable assistance in the management of crises and the organization of relief in the aftermath of major disasters. In addition, France regularly contributes images of its Pléiades satellites within the framework of the « International Charter Space and Major Disasters ». This was, for instance, the case in October 2016 when the International was activated by the French Civil Security (among other organizations) to help its contingents sent to Haiti in the wake of Cyclone Matthews.

35. CNES has a strong involvement with higher education students. An approach based on the « project learning » logic allows them to use, validate and enrich their achievements on specific themes through a multidisciplinary approach. For launchers, PERSEUS allows them to develop innovative technologies but also to make launchers

and even the airplane (EOLE - 17m of wingspan) capable to launch a mini rocket (2m long). For cubesat and nanosatellites, JANUS leads to the development of real complete and operational systems. 12 satellites are under investigation and 4 will be launched in 2017. Finally, on futuristic projects, PRAGMATIC offers students the possibility and framework to study and realize functional models using soil technologies (Martian drone, rovers, servicing satellites, etc.). Overall, more than 1000 students and 30 structures are involved each year in these three programs.

D. Scientific and technical research and development (Guidelines 27 and 28):

36. At the research and development level, CNES provides its technical expertise in the following domains:

- Space Act compliance and spacecraft design related activities:
 - establish a Guide of Good Practices to help the operators for Space Act compliance
 - develop and improve tools to model the behaviour of a vehicle during re-entry which is used to orient vehicle design to favour design to demise and limit risk to population and the environment and to model the evolutions of the orbits after end of life and then define the necessary resources mission disposal
 - propose design solutions and technologies favouring compliance with the Space Act
- Space situational awareness and space debris activities:
 - perform SSA architecture system studies to improve capabilities and geographical distribution of existing and new sensors, and therefore improve accuracy of orbital data for spaceflight safety
 - develops orbit determination and image processing algorithms to prepare future operational use, in particular with the Tarot telescopes (Calern, Chili, La Réunion) used for optical surveillance of space objects on the geostationary region
 - investigate the evolution of the space debris population in the long term and uncertainties in models, in order to have an autonomous appreciation of the future space debris environment. For instance, there's a need today to assess the impact of small satellites and mega constellations with realistic hypothesis. This tool could also be used to assess technical requirements for future evolution of the French Space Act.

E. French contribution to ITU (Guideline 4):

37. ITU (International Telecommunication Union) is a specialized agency of the United Nations, responsible for issues concerning Information and Communication Technologies. ITU coordinates the shared global use of the radio spectrum and satellite orbits, works to improve telecommunication infrastructure in the developing world, and assists in the development and coordination of world-wide technical standards.

38. The ITU Radio-communication Sector (ITU-R) plays a vital role in the global management of the radio-frequency spectrum and satellite orbits. These are limited natural resources which are increasingly in demand from a large and growing number of services such as fixed, mobile, broadcasting, amateur, space research, emergency

telecommunications, meteorology, global positioning systems, environmental monitoring and communication services. The ITU-R primary objective is to ensure interference free operations of radio-communication systems, through implementation of the Radio Regulations and Regional Agreements, and the efficient and timely update of these instruments. World and Regional Radio-communication Conferences develop and update international regulations on the use of radio spectrum and satellite orbit.

39. ANFR (Agence Nationale des Fréquences) officially represents France in international meetings within ITU and Europe. In particular, it coordinates the WRC (World Radio-communication Conference) agenda items, prepares, coordinates and supports French positions in international forums. CNES is responsible within France of scientific satellite frequencies (Earth Observation, Space Operation, Space Exploration, satellite radio-determination) and actively attends international forums. CNES proposes WRC agenda items and therefore, CNES is often European coordinator of WRC agenda items. In addition, CNES acts as chairman or vice chairman of ITU-R Study Group 7 (Science Service such as space operation, space research, Earth exploration and meteorology, inter-satellite service, systems for remote sensing, including passive and active sensing systems, operating on both ground-based and space-based platforms, radio astronomy, dissemination, reception and coordination of standard-frequency and time-signal services, including the application of satellite techniques, on a worldwide basis). In addition, CNES is also involved within ITU-D (Development Sector of ITU) and has been responsible of a question dealing with ICT and climate change.

Conclusion

40. In conclusion, the French space act for ensuring the safety of space operations, adopted in June 2008, imposes spacecraft operators to adopt a strategy of space debris limitation. The derived technical regulation in force since March 2011 is applicable to launch operations, in-orbit operations during the operational lifetime and end-of-life post-mission disposal operations. CNES has the responsibility to control spacecraft operators, on behalf of the Ministry of Higher Education and Research, which in turn delivers the authorizations to the operators. The national regulatory framework highly contributes to the long term sustainability of outer space activities.

41. France considers that the sustainability of space activity is a necessity and is to be considered part of the wider sustainable development goals. In particular, space activities contribute to the monitoring of climate change and all related matters such as the detection of greenhouse gases, their atmospheric distribution and major sources. Water management is also a major concern of French space activity. France contributes regularly, with the help of CNES, by bringing images of the Pleiade satellites within the framework of the « International Charter Space and Major Disasters » and acts actively in the working group organized in the Committee on the Peaceful Uses of Outer Space.

42. The French efficient dual SSA activities highly contribute to the security, safety and sustainability in space. The goal in France and in Europe is to share the burden of space situational awareness in order to improve the efficiency of the collective actions. Since space is a global challenge that nations need to address together, main decisions in France are often taken and implemented in coordination with European and international partners.