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COMMISSION STAFF WORKING DOCUMENT

EXECUTIVE SUMMARY OF THE IMPACT ASSESSMENT

Accompanying the document

Proposal for a Decision of the European Parliament and of the Council

establishing a space surveillance and tracking support programme

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COMMISSION STAFF WORKING DOCUMENT

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1. INTRODUCTION

In the last few years, the development of a European Space Surveillance and Tracking (SST) service has been the subject of political debate among EU Ministers responsible for space. The outcome of those debates, reflected in several Council conclusions, reveal that there is a consensus among Member States, satellite operators and other stakeholders on the need to protect space infrastructure, that the establishment of a European SST service to protect such infrastructure should be done under the leadership of the EU (with the technical R&D support of the European Space Agency) and should build on existing capacities to be complemented by new assets. Moreover, public opinion is aware of and supports the need to protect space infrastructure (two consultations of the broad public have been carried out over the past three years).

2. PROBLEM DEFINITION

2.1. Security of critical European space infrastructures is not ensured

Space-based systems enable a wide spectrum of applications which play a fundamental role in everyday reality (TV, Internet, GPS etc). They have also become critical for the implementation of EU policies. With Galileo and EGNOS, the EU itself will soon become one of the largest satellite operators in Europe. However, space infrastructures are increasingly threatened by the risk of collision between spacecraft and, more importantly, between spacecraft and space debris. Space debris has become the most serious threat to the sustainability of space activities.

In order to mitigate the risk of collision it is necessary to identify and monitor satellites and space debris so that satellite operators can be alerted to move their satellites. This activity, which is highly sensitive with regard to national security, is known as space surveillance and tracking (SST). SST is also a dual use activity that can serve both civil and military users. A SST service comprises three basic functions:

– Sensor function: radars and telescopes to identify and track spacecraft and debris;

– Processing function: to determine the probability of collision or to determine the re-entry path of space objects;

– Front desk function: to handle the dissemination of SST information (e. g. collision risk alerts, re-entry warnings) to satellite operators and relevant authorities.

Europe has today no SST service: the exisiting sencor capacity is insufficient and disconnected, the processing capacity is very limited and there is no front desk function at all. Furthermore, there is no suitable alternative at international level, including the system of the United States, which is not accurate enough, or other systems which are not open to international cooperation.

2.2. Increased collision risks due to space debris

During the last half century, objects have been launched in space regularly. This material, orbiting the Earth at very high speed and in an uncontrolled manner, poses an ever increasing potential risk for the launch of spacecrafts and of their exploitation due to collision with other debris or other spacecrafts in orbit.

According to latest estimates, there are 16 000 objects orbiting Earth larger than 10 cm, which are catalogued and between 300 000 and 600 000 objects larger than 1 cm, not catalogued. According to ESA, the population of objects larger than 1 cm will continue to grow, and will reach a total of approximately 1 million debris in 2020. Furthermore, it is estimated that there are more than 300 million objects larger than 1 mm. The vast majority of these space objects are in the commercially most exploitable areas of the outer space region. According to the most conservative estimates (based in partially traceable objects), there is at present a risk of 1 collision every three years.

2.3. Collision avoidance manoeuvre shorten the lifetime of satellites

As collision risks for potentially traceable or untraceable debris is difficult to predict, satellite operators tend to carry out avoidance manoeuvres on the basis of alerts of close approaches of space debris.

Each avoidance manoeuvre requires fuel, which shortens the active life of satellites, or requires additional fuel to be carried into orbit thus increasing the cost of launch. Furthermore, due to the inaccuracy of data related to the position of the objects in question, it can be assumed that a good number of manoeuvres may not be indispensible but have to be made as a precaution generating extra costs.

2.4. Re-entry of debris or uncontrolled spacecraft to Earth threaten the security of EU citizens

Re-entries of spacecraft and debris to Earth form an increasing hazard for the security and health of the Earth population. Whilst active spacecraft re-entries into the atmosphere are controlled (e.g. the US Space Shuttle, the Russian Soyuz, and the European Automated Transfer Vehicle), inactive satellites and debris regularly re-enter the atmosphere in an uncontrolled manner.

The ability to predict the trajectory of an object (which is highly dependant on the survey and tracking capability of a space surveillance system) is essential to mitigate risks related to re-entries. With an increasing population of satellites in orbit, the number of uncontrolled re-entry events can be assumed to increase over the coming years.

2.5. Overview of estimated annualised losses due to hazards from space debris

On the basis of available data and the estimates on market growth, the annualised quantifiable estimated loss due to collision and collision avoidance manoeuvres (e.g. due to loss of satellites, satellite lifetime shortening, loss of revenues generated by the satellite) was estimated at a total of 140 M€. As the number of active satellites in orbit is expected to grow by 50 % in the next 10 years, annualised estimated losses can be expected to increase to 210 M€ in the next decade

These costs are almost certainly just a small fraction of possible non-quantified costs and, to some extent, the non-quantifiable consequences that may result from the absence of a European space surveillance and tracking capability. For example, the loss of a satellite may result in the loss of critical satellite communication capacity in an emergency situation resulting in loss of life.

3. THE EU'S RIGHT TO ACT AND ANALYSIS OF SUBSIDIARITY

Article 189 TFEU introduces a right for the EU to act in drawing up a European Space Policy, while building on past achievements at the level of the European Space Agency and Member States, and gives the European Commission a clear mandate to exercise its right of initiative. Space policy is defined as a shared competence between the EU and its Member States.

From discussions with stakeholders over the past years, it became clear that the setting up of operational European SST services will require the intervention of the EU. This stems from a consensus among EU and ESA Ministers responsible for space. In this regard, a European SST service will have a security dimension with which the EU, unlike ESA (a R&D agency), has competence to deal with.

The EU does not seek to replace initiatives taken by Member States individually or in the framework of ESA. It seeks to complement actions taken at their level (in particular in the framework of the ESA SSA preparatory programme) and reinforce coordination where such coordination is necessary to achieve common objectives.

The EU involvement would be necessary to aggregate the investment required to fund certain space projects, set in place governance arrangements, define a data policy and ensure that existing and future capacities are broguht to work in a coordianted and efficient manner ensuring a robust and interoperable system benefiting all relevant European stakeholders.

Furthermore, the proposed EU action does not seek to replace or duplicate existing mitigation measures at international or multi-lateral level, since these measures will not solve the problem at hand, but will only reduce the growth of space debris in the long-term.

4. OBJECTIVES

The general objective of the proposed initiative is to safeguard the long-term availability and security of European and national space infrastructures and services essential for the smooth running of Europe’s economies and societies and for European citizens’ security.

Specific Objectives	Operational Objectives
(a) Reduce the risks related to the launch of European spacecrafts; (b) Assess and reduce the risks to in-orbit operations of European spacecrafts in terms of collisions, and to enable spacecraft operators to more efficiently plan and carry out mitigation measures (e.g. more accurate collision avoidance manoeuvres; avoidance of unnecessary manoeuvres which are risky in itself and reduce a satellite's lifetime); (c) Survey uncontrolled re-entries of spacecraft or their debris into the Earth's atmosphere and provide more accurate and efficient early warnings to national security and civil protection/disaster management administrations with the aim to reduce the potential risks to the security and health of European citizens and mitigate potential damage to critical terrestrial infrastructure.	(a) set up an operational space surveillance and tracking capability at European level building on existing European + national assets and capable of integrating future new assets; (b) implement an appropriate governance structure; (c) define and implement data policy principles for the handling of SST information through the European SST capability; (d) define and deliver the SST services open to all European and national public and private/ commercial actors; (e) ensure the necessary quality of SST services and their efficient and sustainable operational provision; (f) supervise the implementation and efficient functioning of the proposed operational SST capability and the operational SST services and by ensuring a sustainable EU funding contribution.

5. POLICY OPTIONS

5.1. Option 1: Baseline: No EU financial involvement in SST

Under the baseline scenario the EU would not engage in any action or provide any support (legal or financial) to the setting up and operational provision of European SST services

Due to lack of an organisational framework, the development of a broader cooperation between Member States with a view to providing a veritable European SST capability and operational European SST services is unlikely.

In addition, taking into account the fact that Member States do not see the development of a European SST service as a mission to be entrusted to ESA, the setting up of operational SST services at European level under the baseline scenario cannot be expected.

Cooperation between EU Member States and third countries is expected to remain at its current status.

There are debris mitigation initiatives at international level which seek to prevent the exponential growth of debris. These initiatives may only be effective in the long-term, although these actions cannot replace short-term mitigation measures such as collision avoidance manoeuvres.

5.2. Option 2: Partnership approach – EU Funding for the European SST front desk function

This option would seek a reduction of the collition risk by a factor of 3 to 5 and therefore a reduction of economic loss due to satellite failure or destructions by the same factor. There is convergence among experts that in order to achieve such reduction the sensor function must be developped linking and operating as a netwok existing assets and adding to this network 1 tracking radar, 1 surveillance radar, 8 telescopes and a data center. These assets should be linked by secure lines. The processing function must be set up to determine the probability of collision or to determine the re-entry path of space objects. A front desk must also be set up to deliver alerts and handle request from SST users.

This would require an overall investement, coming from EU and Member States, of some 60 M€ per annum (for details see annex V on the calculation method). According to the most conservative estimate the current anualised estimated loss of 140 M€ would be reduced to between 28 to 46 M€.

In this option, operational European SST services would be set up in partnership with EU Member States owning relevant assets. The EU would define the legal framework for the setting up and operations of European SST services (on the basis of existing sensors and capacities as well as those Member States may decide to develop), inlcuding the data policy.

A consortium of Member States would be responsible for the sensor function and the processing function of the European SST capability. The front desk function would be entrusted to an existing operational entity/agency with proven security credentials to handle SST information (for example the EU Satellite Centre). The European Commission would not engage in any day to day operational activity, but would ensure the overall coordination of the SST functional elements.

The overall costs of the setting up and operation of the European SST capability would be co-funded by the Member States constituting the consortium and the EU. While the consortium would fund all capital investstments related to the sensor (including the development of the new assets) and the processing functions (estimated at 58 M€ per anuum), the EU would provide funding for the setting up and operation of the front desk function (an estimated total of 2 M€ per annum). The introduction of service fees could be examined in the context of the evaluation of the initative's implemementation.

5.3. Option 3: Partnership approach – EU Funding for the networking and operation of sensor, processing and front desk function

This option is identical to option 2 in all respects except as regards the distribution of funding provided by the consortium of Member States and the EU. Under this option, Member States participating in the consortium would again fund all capital investments related to the sensor (including the development of new assets: 1 surveillance radar and 1 tracking radar, 8 telescopes and a data center) and the processing functions. However, in addition to what it is in charge of in accordance with option 2, the EU would fund the maintenance and operational costs of the sensors and processing functions necessary for the Europan SST service.

As in option 2, the acquisition of new assets by Member States necessary to guarantee the target collision risk reduction factor of 3 to 5 is estimated at 50 M€ per annum. The EU funding contribution would amount to 10 M€ per annum. As in option 2, the introduction of service fees could be examined.

5.4. Option 4: EU-led SST development and exploitation (risk reduction factor of 3 to 5)

Under this option, the risk reduction factor would be identical to that under options 2 & 3 but there would be potentially some differences in terms of governance and funding because the EU would be the system owner and would fund the totality of the costs.The EU defines the related legal framework (including data policy), and takes the responsibility for the development of the structures needed to federate existing national and European sensors and capacities and to ensure the provision of SST services.

The Commission would become owner of new SST infrastructure elements. This option also assumes the development of 1 surveillance radar and 1 tracking radar, 8 telescopes and a data center and the required equipment to network existing assets. The total contribution from the EU would amount to some 60 M€ per annum.

5.5. Option 5: EU-led SST development and exploitation (risk reduction factor of 10)

Option 5 follows the same logic as option 4, but seeks to reduce the risk of collision by a factor of 10 and consequently of the estimated losses above a factor of 10. This option requires the acquisition of 2 surveillance radars, 2 tracking radars and 14 telescopes and a data centre, thereby improving the quality and accuracy of the services provided to the various user groups and would also leverage on existing sensors in Europe.

Funding would follow the same logic as in option 4 but with double the number of new assets as described above. EU funding can be estimated at some 120 M€ per annum for the period 2014-2020.

5.6. Summary of stakeholder views on the options

Both the manufacturing industry and the satellite operators are strongly in favour of the setting up of a European SST capability. While the manufacturing industry is clearly in favour of the option that guarantees the highest investment and therefore industrial return, operators are concerned with the performance of the system and that high performance would not result in any additional costs imposed on them. The industry has not expressed a particular view on governance or data policy.

As regards Member States, they all agree on the need of a SST system and that the system should build on existing assets. All Member States agree on the governance model in options 2 to 5. One of them has indicated on a number of occasions that it would prefer a European entity to be set up to deal with the sensor and processing functions, although it accepts the proposed governance scheme on the condition that it ensures the participation of all Member States willing to be part of the consortium. Furthermore, they all agree on the proposed data policy and are open to the idea of a European entity acting as a Front Desk. Member States owning SST sensors and capacities under military control highlighted the importance for the data policy and governance to take account of national security concerns. All options respect these concerns.

As regards performance, Member States are in favour of an improved performance of the order suggested in options 2 to 4. When it comes to funding, some Member States are concerned that if the EU completely funded the system, geographical return of investments in the way ESA guarantees it would be affected. Notwithstanding the above, Member States understand budgetary constraints and while potentially open to any of the options proposed, their most favoured options are 3 and 4.

6. ASSESSMENT OF IMPACTS

6.1. Impacts of option 1: baseline scenario

6.1.1. Strategic impact

Under the baseline scenario, the EU would not invest in the setting up and operations of SST services at European level. This would not affect the implementation of the EU flagship programmes Galileo and Copernicus (new name for GMES), but their long-term security and sustainable exploitation could be affected.

6.1.2. Economic impact

The problems identified would not be addressed and are likely to aggravate over the coming years. With increasing space activity and increasing space debris, economic losses due to launch failures, satellite loss or damage, and service outages are expected to increase. Industrial activity in SST in Europe would stay at current limited level.

6.1.3. Social impact

In absence of EU action and the fact that Member States do not seem to be ready to engage in major SST development activities in the framework of ESA, the impact on job creation of this option is negligible. Security threats from uncontrolled re-entries of space debris into the Earth's atmosphere as explained in the problem definition section would not be addressed or mitigated. With increasing space activity, the risks to the security of European citizens or critical ground-based infrastructure risks to increase.

6.1.4. Environmental impact

All estimates agree on the constant and significant growth of the debris population in the future (in fact each collision between space objects leads to an exponential growth of the debris population) and the need for action to preserve the space environment. In the absence of EU intervention none of these premises will be affected.

6.2. Impacts of option 2, 3 and 4:

6.2.1. Strategic impact

The proposed governance and data policy schemes will allow Member States to actively contribute and safeguard their national security interests. These options would build on existing international cooperation with the US. In general terms, the setting up of a European SST capability would allow the EU to collaborate with and influence developments in the US as an equal partner with a view to mutually enhancing SST performance. Furthermore, these options would strengthen Europe's independent access to space and its capacity to make independent decisions concerning the safety of spacecraft operations. Finally, these options offer a pragmatic framework for European cooperation in SST which can be extended to plug in further sensors should it be needed in the future.

6.2.2. *Economic impact*

The proposed initiative would improve the European SST's ability to detect hazardous situations and provide more accurate SST information for the launch and in-orbit operation of satellites. It would imply a reduction of the risk of satellite losses and the number of collision avoidance manoeuvres leading to a reduction of economic losses. The current anualised estimated loss of 140 M€ would be reduced by a factor of 3 to 5 to between 28 to 46 M€. These options would build on existing SST sensors and human expertise and foresee the development of new SST sensors. The development of new sensors as suggested in these options is likely to have a multiplier effect in terms of industrial activity of 2.3. Considering only that the investment in new assets would amount to roughly 50 M€ per annum, i.e. 350 M€ over the seven year period 2014-2020, the total industrial return can be estimated at 805 M€.

6.2.3. *Social impact*

The proposed action would generate a minimum of 50 permanent staff positions.

Moreover, it will lead to an improvement of Europe's ability to predict the trajectory of space objects, and will as a consequence improve its capacity to control re-entries of space debris into the Earth's atmosphere. Due to lack of any quantitative data and studies on material damage caused by un-controlled re-entries it is not possible at this point of time to quantify this positive impact.

6.2.4. *Environmental impact*

These options would increase Europe's capacity to monitor uncontrolled re-entries of space debris and to put in place a coherent and clear procedure to issue meaningful and timely warnings to national security authorities.

6.3. Impacts of option 5: EU-led SST development and exploitation (risk reduction factor of 10)

6.3.1. *Strategic and governance impact*

In addition to the strategic impacts outlined for the previous options, option 5 could clearly increase the EU's strategic potential to strengthen and intensify cooperation in SST with other space-faring nations (notably the US) through established political channels. In this option, the EU would have the full control over the setting up of the European SST capability, and would ensure that the initiative is open to all EU Member States that wish to participate.

6.3.2. *Economic impact*

The EU SST programme proposed in this option implies the development/procurement of new SST assets for the amount of 810 M€ during the period 2014-2020. Investments are likely to have a multiplier effect in terms of industrial activity of 2.3. This would result in a direct and indirect industrial turnover of 1.863 billion €. Applying the same approach to estimate the reduction of economic losses likely to be brought about by option 3, it could be estimated that option 5 could reduce the risks identified in the problem definition by a factor of 10 or above. This would imply a possible reduction of estimated annual losses due to collisions to 14 M€ from the current estimate annualised economic loss of 140 M€.

6.3.3. Social impact

In accordance with this option, the potential for the creation of permanent jobs in the engineering and data analyst domain would be around 100 new jobs across Europe. As option 2, 3 and 4, this option would lead to an improvement of Europe's ability to predict re-entries of space debris into the Earth's atmosphere. Option 5 provides a potential to reduce risks to the security of European citizens and critical terrestrial infrastructure even further.

6.3.4. Environmental impact

As in option 2 to 4, this option would strengthen Europe's capacity to monitor the debris population, avoid collisions, and thus to mitigate the risk of further space debris creation. Option 5 would allow the detection of debris up to 3 to 5 cm which are today not catalogued. This would significantly increase Europe's capacity the risk of debris clouds and their long-term proliferation in Low Earth Orbit.

Comparing the options and conclusions:

	Strengths	**Weakness**
Option 1: Baseline	A limited service is provided by the US at no cost. Public funds may be diverted to other priorities.	The risk of collision remains and will get worse. EU unable to protect critical space infrastructure. Negative strategic, economic, social and environmental impacts. It does not meet either Member States or industry expectations.
Option 2	A collision risk reduction of 3 to 5 is targeted. Positive strategic, economic, social and environmental impacts. Several Member States have given indications of their willingness to develop additional SST assets in the framework of an EU-led SST initiative. This option comforts Member States' perception that developing their own assets guarantees that their investment benefits national industry.	This option requires significant funding from both the EU and from Member States willing to develop new assets. Although there is evidence that some Member States are indeed supportive of this idea and willing to develop new assets, the EU does not have full control over the funding required to set up a European SST service. The EU investment does not cover an important part of the costs directly linked with the setting up of a European SST; i.e. the operations of the sensor and processing function. It does not meet Member States' expectations that as a minimum the EU would cover the operational costs of the European SST service and therefore may not provide sufficient incentive for Member States to invest.
Option 3	As in option 2, a collision risk reduction of 3 to 5 is targeted. Positive strategic, economic, social and environmental impacts. Several Member States have given indications of their willingness to develop additional SST assets in the framework of an EU-led SST initiative. This option comforts Member States' perception that developing their own assets guarantees that their investment benefits national industry. This option meets Member States expectation that as a minimum the EU would	As in option 2, this option requires significant funding from both the EU and from Member States willing to develop new assets. Although there is evidence that some Member States are indeed supportive of this idea and willing to develop new assets, the EU does not have full control over the funding required to set up a European SST service.

	cover the operational costs of the European SST service.	

Option 4	A collision risk reduction of 3 to 5 is targeted. Positive strategic, economic, social and environmental impacts. It gives the EU practically full control over the funding required to set up a European SST service. Some Member States would welcome higher funding from the EU as this guarantees the setting up of an EU SST service and would give tem the choice of either invest further in SST or in other space projects.	As sole contributor, the EU has a higher responsibility for the overall system and in particular it has to supervise the acquisition of new assets. As the EU funding for SST is to be redeployed from other sources, the amount required under this option would impose a non-negligible burden on those sources.
Option 5	A collision risk reduction of 10 is targeted. This option provides the most positive strategic, economic, social and environmental impacts. It gives the EU practically full control over the funding required to set up a European SST service. Some Member States would welcome higher funding from the EU as this guarantees the setting up of an EU SST service and would give tem the choice of either invest further in SST or in other space projects.	As sole contributor, the EU has a higher responsibility for the overall system and in particular it has to supervise the acquisition of new assets. As the EU funding for SST is to be redeployed from other sources, the amount required under this option can only be made available through very significant cuts in other programmes and would require very difficult trade offs.

A further comparison on the effectiveness, efficiency and coherence of the different options is provided in the IA report.

7. MONITORING AND EVALUATION

A mid-term and ex-post evaluation will be carried out. As far as monitoring is concerned, the Commission will ensure that grant agreements or contracts under the framework of the proposed initiative provide for supervision and financial control by the Commission, if necessary by means of on-the-spot checks, sample checks, and audits by the Court of Auditors.

In addition to the financial supervision, the Commission will put in place mechanisms to ensure the continuous quality of the SST services provided. This will be realised by measuring users' satisfaction on one side and by technical audits on the other side. The IA report presents a table with objectives and their corresponding indicators. As regards anti-fraud, the EU funding contribution is proposed to be provided through grant agreements which will allow for appropriate financial control through the Commission.