EUROPEAN
COMMISSION

Brussels, 6.6.2018
SWD(2018) 327 final

PART 2/2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

GOVSATCOM

Accompanying the document

PROPOSAL FOR A REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

establishing the space programme of the European Union, relating to the European Union Agency for Space and repealing Regulations (EU) No 1285/2013, No 377/2014 and No 912/2010 and Decision 541/2014/EU

{COM(2018) 447 final} - {SWD(2018) 328 final}

Table of Contents

1. Context

The notion of governmental satellite communication (GOVSATCOM) with an EU dimension was first raised and welcomed in the European Council Conclusions of December 2013[1] and subsequently elaborated in the December 2014 Competitiveness/Space Council[2] and May 2015 Foreign Affairs Council[3].

> The December 2014 Competitiveness/Space Council conclusions on Underpinning the European space renaissance, include the following paragraph in the section on main emerging priorities:
>
> "*UNDERLINES the need to continue pursuing synergies in space, security, and defence (…), RECOGNISES that Satellite Communications is a unique capability which can ensure long-distance communications and broadcasting also in remote areas. Given the nature of security activities, bearing in mind that most security capabilities are owned and operated by Member States, NOTES the growing demand for GOVSATCOM and therefore UNDERLINES the importance of investigating on potential forms of collaboration with Member States, with the foreseeable intent to resort to their GOVSATCOM assets to fulfil EU operational requirements.*"

In the meantime the EU and global context have changed. As highlighted in the European Commission White Paper on the future of Europe[4], in the Rome Declaration of the leaders of 27 Member States (MS)[5], and in several recent European Parliament resolutions[6], the EU has a major role to play in ensuring a safe, secure and resilient Europe that is prepared for the unprecedented challenges facing it, such as regional conflicts, terrorism, cyber threats, and growing migration pressures. The EU also has ambitions to be a stronger and more autonomous power on the global scene, and is therefore committed to strengthen its common security and defence capabilities.

Satellite communication, or 'satcom', is an indispensable tool for governmental security actors, such as police, border guards, fire fighters, and civilian and military crisis managers. They need a type of satcom that is highly reliable and has a certain level of protection against ill intentioned acts. In terms of security aspects GOVSATCOM is therefore positioned between the highly robust and secure military satcom (MILSATCOM) and commercially provided satcom services (COMSATCOM). As pointed out in the Council Conclusions of the 2014 Competitiveness/Space Council (see box), the demand for GOVSATCOM is growing and operational needs are not always fulfilled under the current circumstances.

The EU Governmental Satellite Communication legislative proposal was initially part of the Commission's 2017 Work Program, and is now part of the 'Regulation establishing the EU Space Policy Programme'' for the Multi-annual Financial Framework 2021-2027. The initiative is situated at the interface between space, security and defence. It aligns with the priorities of President Junker's White Paper and of the Rome Declaration. EU GOVSATCOM is of major political interest since it can provide crucial new capabilities – guaranteed access to secure satellite communications - for all

[1] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/140245.pdf
[2] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/146072.pdf
[3] http://www.consilium.europa.eu/media/24520/st08971en15.pdf
[4] https://ec.europa.eu/commission/sites/beta-political/files/white_paper_on_the_future_of_europe_en.pdf
[5] http://www.consilium.europa.eu/press-releases-pdf/2017/3/47244656633_en.pdf
[6] http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A8-2016-0151+0+DOC+PDF+V0//EN
http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+MOTION+B8-2017-0381+0+DOC+PDF+V0//EN

security actors[7] in the EU and in Member States. It will in particular support national Police-, Defence- and Border Protection Forces and the Maritime communities. It will also serve the Commission and the European External Action Service (EEAS), by providing robust and secure connections between Brussels Headquarters and Delegations around the world, and by supporting civil and military Common Security and Defence Policy (CSDP) missions. EU GOVSATCOM will facilitate the work of operational EU Agencies and entities such as FRONTEX, EMSA, and the Emergency Response Coordination Centre (ERCC), and will enhance the effectiveness of civil protection and humanitarian interventions in the EU and globally. The initiative relies on space-based communication systems because they are the only viable option in situations where ground-based systems are non-existent, disrupted or unreliable. They are also indispensable in remote regions and in the high seas. For the purposes of this initiative, some of the national satellites that may be used are dual-use systems; Member States defence forces may be among the users of EU GOVSATCOM.

In order to capture the existing and future user needs, the document High Level Civil Military User Needs for Governmental Satellite Communications (HLUN)[8] has been developed in close cooperation between the Member States, the Commission, the EEAS, the European Defence Agency (EDA), and the European Space Agency (ESA). This document was endorsed by the Council's Political and Security Committee in March 2017, and serves as a reference document for the development of EU GOVSATCOM.

Finally, EU GOVSATCOM is an integral part of the Space Strategy for Europe[9], the European Defence Action Plan[10], and the European Union Global Strategy[11]. It will bring a tangible contribution to the objectives for a strong, secure and resilient European Union.

Initial GOVSATCOM activities, testing partial solutions and potentially relevant technologies have already started in EDA and ESA: a demonstration project is currently being set-up by EDA to test the pooling & sharing concept of national satellite capacities for military users. ESA has started an optional programme (with a sub-set of its Member States) with precursor projects focussing on enabling technologies for secure satellite communications (see also the Research and Innovation Annex in 9.5). However, the coherent EU-level framework for GOVSATCOM is currently absent and is the subject of this impact assessment report.

This EU GOVSATCOM impact assessment addresses security risks only in generic terms. For reasons of security and confidentiality, specific operational shortfalls and detailed justifications from users as to why, and to what extent, they need secure EU autonomous means of satellite communications cannot be included in this report.

[7]The term 'security actor' is also used in A Global Strategy for the European Union's Foreign and Security Policy (2016).

[8] High Level Civil Military User Needs for Governmental Satellite Communications (Council Doc. 7550/17 LIMITE of 22.03.2017), endorsed by the Political and Security Committee of the Council of the European Union on 29 March 2017

[9] Space Strategy for Europe COM(2016) 705 final

[10] European Defence Action Plan COM(2016) 950 final

[11] Global Strategy COM(2016) 950 final

2. Problem definition

2.1. The use of secure Satellite Communication (satcom)

Communication and exchange of information is essential to almost any activity in our society. In most cases, ground-based infrastructure (phone, GSM, cables, fibre) is perfectly suitable. But in specific circumstances, Satellite Communications (satcom) is indispensable, namely when ground infrastructure is inexistent (maritime, air, remote areas), or unreliable, disrupted or destroyed by natural disasters, crisis situations or conflicts. Finally, security critical missions and operations (e.g. crisis management) and the transmission of security-sensitive information (e.g. diplomatic communications) requires both guaranteed access and protection against interference, interception, intrusion, and cybersecurity risks; secure satcom has multiple advantages in this regard.

Satellite communications is a domain where globally operating private companies (COMSATCOM[12]) coexist with nationally-owned and –operated military satcom systems (MILSATCOM[13]). Each type of system is designed for its primary users, ranging from TV broadcasting for millions of global users, to supporting specific military operations through MILSATCOM. The latter requires a very high level of availability, security, and robustness, including nuclear hardening, advanced anti-jamming capabilities, and a military-grade ground segment. For commercial satcom applications a global market exists. For example, shipping companies procure satcom services to be able to communicate on the high seas, currently more and more airlines provide their passengers with internet access during the flight, using private satcom solutions.

For the use of satcom by public authorities the situation is different. Satcom is a strategic asset, closely linked to national security. Hence, public users tend to favour either fully government owned solutions (e.g. the French Syracuse and the German Satcom BW system) or make use of specific accredited private providers. When using commercial satcom providers, the public entities (military or civilian) typically negotiate specific contractual assurances regarding the control of satellites and their payload. This may include constraints on the sourcing and location of infrastructure manufacturing and operations, and/or inclusion of specific hosted payloads. However, only the largest global customers with sufficient buying power can leverage such tailor-made commercial solutions. The close public-private link in the satcom sector is also apparent from the fact that most current privately owned satcom operators were originally public entities (often intergovernmental, such as Inmarsat, Eutelsat, Intelsat) which were privatised in the 1990's.

However, civilian and military public users need different services in different circumstances. For defence forces, the use of satcom is clearly segmented in three domains with specific security requirements (see Figure 1). Strategic, operational and tactical connectivity is required both from an area of operation to the Operational Headquarter and within the area of operation. The highest levels of security and reliability (MILSATCOM) are required to guarantee operations under (nuclear) stressed conditions. In particular, maintaining reliable command and control is crucial. However, for a wide range of usages there is no need to acquire (very expensive) MILSATCOM. For example intelligence, surveillance and reconnaissance platforms, RPAS, telemedicine applications, or logistics and administrative communication systems can in many cases rely on less expensive systems that provide guaranteed access together with a higher degree of security than the current commercial

[12] COMercial SATellite COMmunications
[13] MILitary SATellite COMmunications

systems. This is the intermediate 'GOVSATCOM' domain. Finally, at the lowest security level, to support the welfare use-case (e.g. soldiers' communications with families or friends during deployments abroad), simple internet access may be sufficient. Such applications do not have particular security and access requirements and can thus be met with standard commercial systems, referred to as 'COMSATCOM'. The European Defence Agency is managing a project called 'EDA satcom Market' in which EDA centrally manages requests for commercial, non-secured satcom services from any provider.[14]

All types of civil and military satcom use-cases have common, continuously growing requirements for quick access with sufficient bandwidth. Civilian and military users alike also indicate that their needs in the intermediate GOVSATCOM security domain are almost identical. As further elaborated in Section 2.2, the GOVSATCOM domain of the satellite communications sector is dominated by public actors, both on the supply and demand side. The commercial providers have a limited role, in the form of public-private partnerships with major public actors. Therefore the notion of 'GOVSATCOM market' is misleading – in this domain there is no functioning, competitive market that could serve all users.

For the EU, the scope of the GOVSATCOM initiative is defined in the aforementioned High-Level User Needs document. Access to EU GOVSATCOM will be limited to the so-called 'security actors': governmental satcom users who have a responsibility for the safety and security of European citizens and for safeguarding national or EU security interests.

The GOVSATCOM High Level User Needs combines the earlier Military needs[15] and the Civilian needs identified through the EDA Project team Satellite Communication and the MS' GOVSATCOM Expert Group. The High Level User Needs describes the purpose and perimeter of EU GOVSATCOM, defines the different users and security needs, and identifies a number of priority use-cases (see Figure 2) such as crisis management, border-and maritime monitoring and the operation of critical infrastructure including diplomatic communications. Those use-cases, and their individual needs per mission, had already been analysed in detail in an earlier PWC study (PWC-1)[16] in 2015/2016.

[14] Since no security or autonomy requirements apply to the EDA Satcom Market, services may come from any worldwide provider, e.g. from Russia, China, the United States, etc.

[15] Common Staff Target for Governmental Satellite Communications, adopted in November 2014 by the Steering Board of the European Defence Agency at Ministerial level.

[16] 'Satellite Communication to support EU Security Policies and Infrastructures', by PWC, published in 2016, see https://publications.europa.eu/en/publication-detail/-/publication/92ce1a30-0528-11e6-b713-01aa75ed71a1

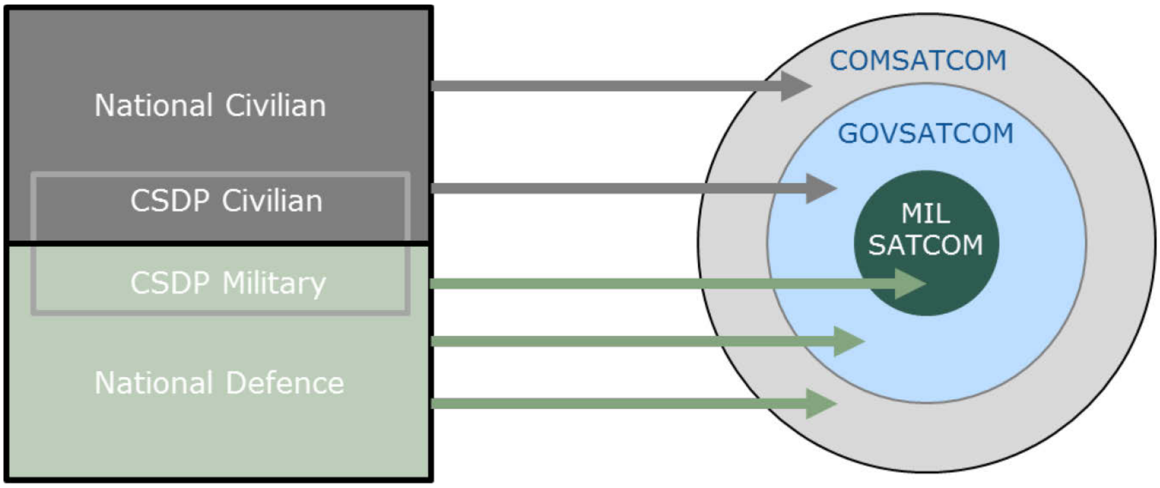


Figure 1 Civilian and military users (EU-CSDP and national) of the different tiers of satellite communications (Commercial, Governmental and Military).

Currently there are three main use-case families which require secure satellite communications for part of their overall communication needs:

Surveillance includes land and maritime surveillance, border surveillance, the fight against illegal activities, and the monitoring for potential environment disasters (oil spills, forest fires). Operations typically need various manned or un-manned connected platforms (ships, airplanes, satellites, drones) for intelligence surveillance reconnaissance (ISR) missions. Civil and military actors may be involved at national and EU level. Secure satcom will play a major role in the provision of maritime surveillance services, as a central part of the EU coast-guard functions characterized by cooperation among three EU agencies (EMSA, FRONTEX and EFCA). Secure Satcom will in particular enable enhancements to current services (e.g., allowing for communication with the Remotely Piloted Airborne Systems (RPAS) beyond radio line of sight).

Crisis management, including civil protection and humanitarian operations in natural or man-made disasters: Multiple actors collaborate at the local, regional, national, or international level and across civil-military boundaries. The EU's military and civilian CSDP missions and operations alone currently occur in around 15 theatres, involving some 6.000 deployed EU staff, 4.000 of which are military personnel from EU Member States. The response to disasters is coordinated at EU level in the EU Civil Protection Mechanism, which currently includes the Emergency Response Coordination Centre (ERCC) of the European Commission. Here, too, secure satcom is a critical enabler for successful operations.

Key infrastructures include a wide range of national infrastructures, such as nuclear power plants and energy systems, dykes and dams, and essential transport systems (e.g. airports, major tunnels or bridges), as well as EU infrastructures, such as the space systems Galileo and Copernicus. While all major infrastructures require communications, only a subset need secure communications and cannot use ground infrastructure. For example, remote operational sites of Galileo currently use commercial satellite communications. Transport infrastructures are usually managed and controlled by public and/or private actors, and some safety-related aspects are managed by governmental entities. For example in aviation, passenger communications can very well be managed by private entities with commercial satcom providers. However, Air Traffic Management and global flight tracking are governmental responsibilities. Almost all security- or safety-critical applications could benefit from EU GOVSATCOM capacities, either as primary or backup solutions.

A particular type of EU key infrastructure is the **diplomatic network** of the EU Member States and EEAS, which maintain hundreds of embassies and delegations around the world. Most communications with embassies and delegations is managed through landlines with end-to-end encryption. But in several important cases, fragile or 'interruptible' local infrastructure cannot be relied on, especially for the exchange of sensitive or time-critical information.

> "When I worked in the EU Delegation in XXX, local authorities blocked internet, mobile phones and landlines every time there were local demonstrations or political trouble. The local representative of Heineken had his Satellite phone, so he at least could communicate..."
>
> *EEAS Political Advisor, posted in Africa*

The usage of secure satcom by governmental entities is evolving rapidly. For example, Remotely Piloted Aircraft Systems (RPAS) are increasingly used in surveillance and crisis management operations: RPAS make such operations more efficient because they can continuously monitor large areas without the cost and restrictions of piloted aircraft. However, commanding a long-range RPAS and retrieving the acquired data require a secure and stable satcom link.

> "Remotely Piloted Airborne Systems (RPAS) complement Maritime surveillance activities, and secure satcom are indispensable to enable communications of RPAS beyond radio line of sight. Existing commercial satcom capacities do not offer suitable costs-effective solutions, the current satellite throughput and user data rate do not meet the performance requirements and satcom beams are not necessarily directed to maritime areas of interest. EU GOVSATCOM could bring more capacity over areas of interest, and secure civilian RPAS' command & control- and payload-links at a more reasonable cost by pooling demand and increasing satellite capacity."
>
> *European Maritime Safety Agency (EMSA)*

Surveillance and monitoring of Key Infrastructures increasingly rely on automated Machine-to Machine (M2M) links. For example sensors in forests are used to prevent the outbreak of large fires, and the water levels and system performance in remote dams is monitored to permanently keep track of the infrastructures' status and health. In some cases, the transmission of such information between the infrastructure and the monitoring centre is best provided by a satcom link, in particular if the object is in a remote or inaccessible location. The resilience of these communication links against ill-intentioned acts or cyber-attacks is becoming an increasingly important issue.

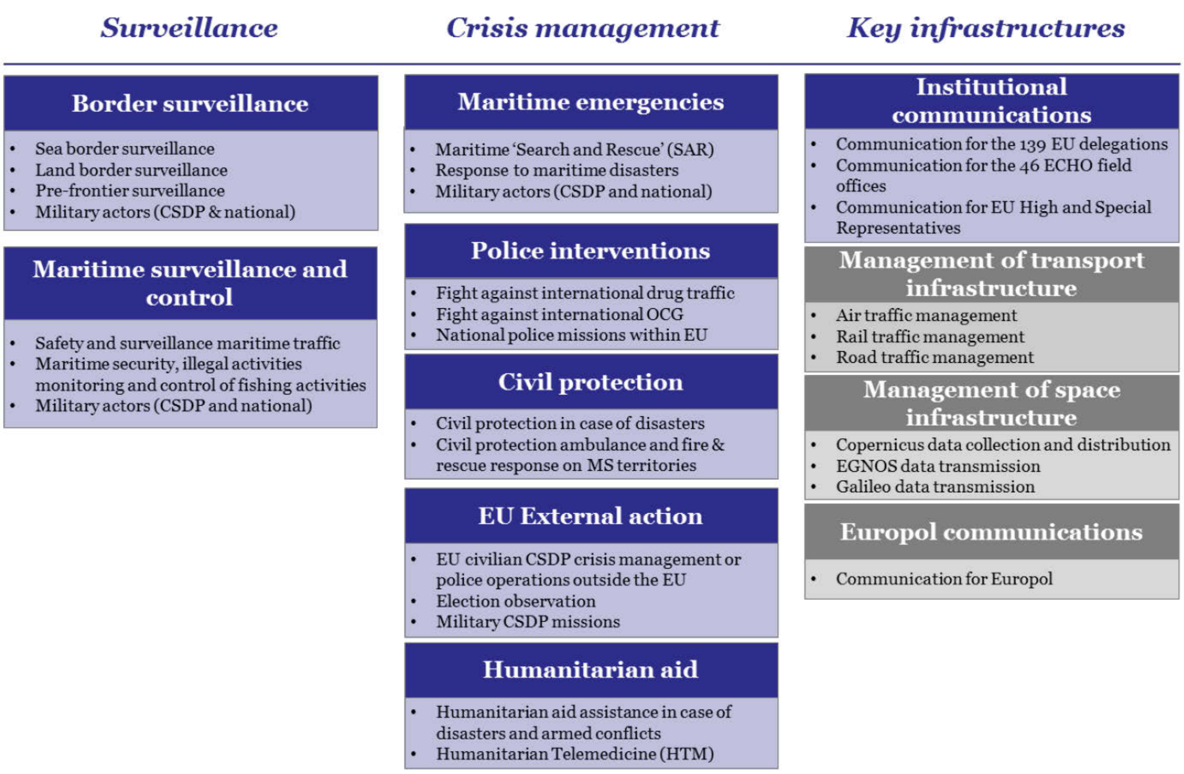


Figure 2 EU GOVSATCOM main use-case families Surveillance, Crisis management, and Key Infrastructures, with examples of user communities and typical use-cases. In many of those use-cases Remotely Piloted Aircraft Systems and Machine-to-Machine connections are increasingly used (situation as of beginning 2017).

The global political context and security environment is changing, too. Most importantly Europe's security 'ecosystem' has changed significantly in recent years, with consequences that affect all EU citizens. Conflict and instability in Europe's neighbouring areas have created spill-over effects that now concern the entire EU, but in particular the EU countries forming the outer border and first entry point of the EU. Threats have also become more 'hybrid'[17], characterised by a range of hostile and subversive activities by state- and non-state actors below the threshold of traditional warfare. Cyber-attacks are on the rise, posing security risks to citizens, administrations and infrastructure. Military and civilian operations outside the EU require autonomous communication systems that are permanently accessible, independent from local conditions and power structures. They need to function under stress, in hostile environments and during conflicts, and must be able to deliver an appropriate level of protection against attacks (cyber-attacks, jamming). In short, secure communication is an indispensable capability that forms the backbone of a resilient society.

[17] Joint communication to the European Parliament and the Council. Joint Framework on countering hybrid threats a European Union response. JOIN/2016/018 final

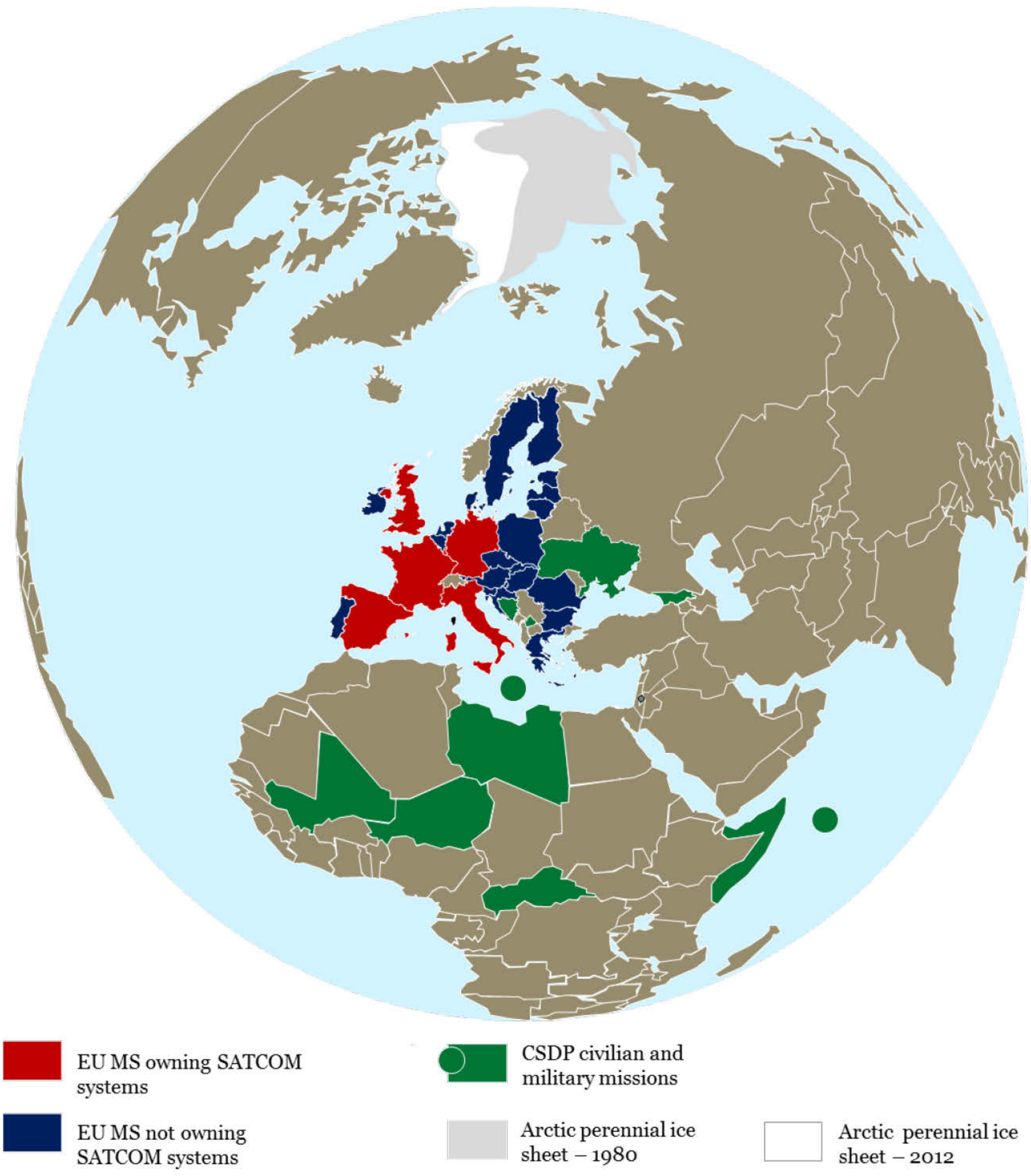


Figure 3 Globe showing Europe's neighbouring areas, the changing size of the polar cap (Source: https://www.nasa.gov/topics/earth/features/thick-melt.html) and EU Member States with or without national satcom systems, and current CSDP missions (military and civilian). In addition, the EU has 140 Delegations distributed over the entire globe.

Climate change, too, is affecting Europe and its environment. One of the most noticeable areas is the Arctic, forming the northern neighbourhood of the EU (see Figure 3). The decreasing polar ice-caps bring new risks, but also new opportunities: new, shorter shipping routes from Europe to Asia, as well as increased economic activities (fishing, natural resource exploration). To cover the Arctic, with its very limited possibilities for land-based communication infrastructure, satcom is an ideal solution[18]. However, most of today's satcom systems use geostationary orbits; circling the equator

[18] Joint Communication to the European Parliament An integrated European Union policy for the Arctic - JOIN(2016) 21 final

at an altitude of 36.000 km. Geometric limitations prevent them from reaching the area beyond 70 degrees north and south, including parts of northern Europe.

In all of the above-mentioned use-cases, the lack of autonomous, secure and cost effective means of communications in situations where ground-infrastructure is absent or cannot be relied on, creates significant risks to the operations, to staff involved, and to citizens at large.

2.2. The core problem and its drivers

The core problem

In the Inception Impact Assessment, the core problem has been defined as follows:

"***Under the increasingly hostile environment and the evolving governmental needs, the mismatch between governmental satcom needs and timely and appropriate solutions increasingly creates risks to key missions, security operations and infrastructures of the Union and its Member States.***"

This mismatch between the needs of security actors on the one hand, and available capabilities on the other, has major consequences: many governmental users do not have access - at least not at a reasonable cost, in time and/or in the needed location - to the most suitable form of satellite communications, especially when they have stringent security requirements. This may lead to delays or non-execution of particular crisis management operations, to higher costs for operations, or to greater vulnerability of deployed staff. In extreme cases, lacking or malfunctioning communication tools in crises situations can lead to fatalities. Lessons from recent crises situations (e.g. terrorist attacks in Brussels March 2016[19], forest fires in Portugal June 2017) invariably point to communications being the Achilles heel of such operations. This does not mean that every communication problem can be solved with secure satellite communications. The best tool for the job needs to be assessed for each mission. Nevertheless, the security actors' toolbox will increasingly benefit from access to secure satcom. There is a strong ongoing trend to make more and more use of remotely piloted aircraft systems (RPAS), which require satcom. Internet of things is also a strong trend, requiring secure means of communication. Such developments and new systems decrease the operational cost, but the communication link needs to be guaranteed and secure and needs to function in remote regions where ground-bases ICT connection are absent. Those development are therefore leading to an increased demand for GOVSATCOM type services.

To be able to act in an autonomous manner, all mission-critical tools of governmental security actors need to be under their control. Satcom is an indispensable tool for surveillance and crisis management operations. Dependence on third parties can lead to risks, undue influence or even coercion. For example, diplomatic or crisis-management missions that rely on local communications infrastructure may be blocked from accessing the network when local power structures change or when local unrest or civil war breaks out (e.g. South Sudan). On a larger scale, depending on the goodwill of a third country or on the availability of commercial satcom solutions (often from satellite operators controlled by third countries), carries a non-negligible risk of non-availability, disruptions, or even embargoes if a third country decides for economic or strategic reasons to deny access to European users. Last but not least, given the fragmented European user demand and the

[19] http://www.dekamer.be/FLWB/PDF/54/1752/54K1752008.pdf

small size of contracts, commercial satcom providers will serve larger clients first, be they the US Department of Defence or international media companies (CNN, Al Jazeera, etc.)

The core problem can be described by a problem tree, based on the PWC-1 study (see Figure 4). This study analysed the risks and problems associated with each mission of security actors as potential EU GOVSATCOM users. The problem analysis also benefitted directly from stakeholder consultations during the impact assessment of user communities/security actors involved in the various use-cases (see Annex 2) and inputs from the GOVSATCOM Member States Expert Group. In line with the Inception Impact Assessment, both the PWC-1 study and the stakeholder consultations were based on targeted approach: qualified users were asked whether and how they use satellite communication tools, which problems and risks they perceive or have experienced during their operations, and which level of risk they find acceptable.

Drivers to the problem and their effects

Three main drivers to the problem have been distinguished: fragmentation, unfulfilled security needs, and a rapidly changing environment.

Problem driver 1: Fragmentation of supply and demand

The current satcom landscape for governmental users in the EU is strongly fragmented. On the supply side, some EU Member States (IT, FR, DE, UK) have operational or planned fully nationally-owned military or dual-use systems, many of which will need to be renewed around 2025 (see Figure 5). Governmental actors in other Member States with smaller budgets have to rely on commercial solutions, or on systems provided by third countries such as the US system WGS. In some EU countries, intermediate solutions have been developed in the form of national public-private partnerships (PPPs) between commercial satellite operators and governments, for example HISDESAT in Spain, HellasSAT in Greece, or LuxGovSat in Luxemburg. Other Member States are engaged in joint bilateral projects such as Athena-Fidus (IT, FR).

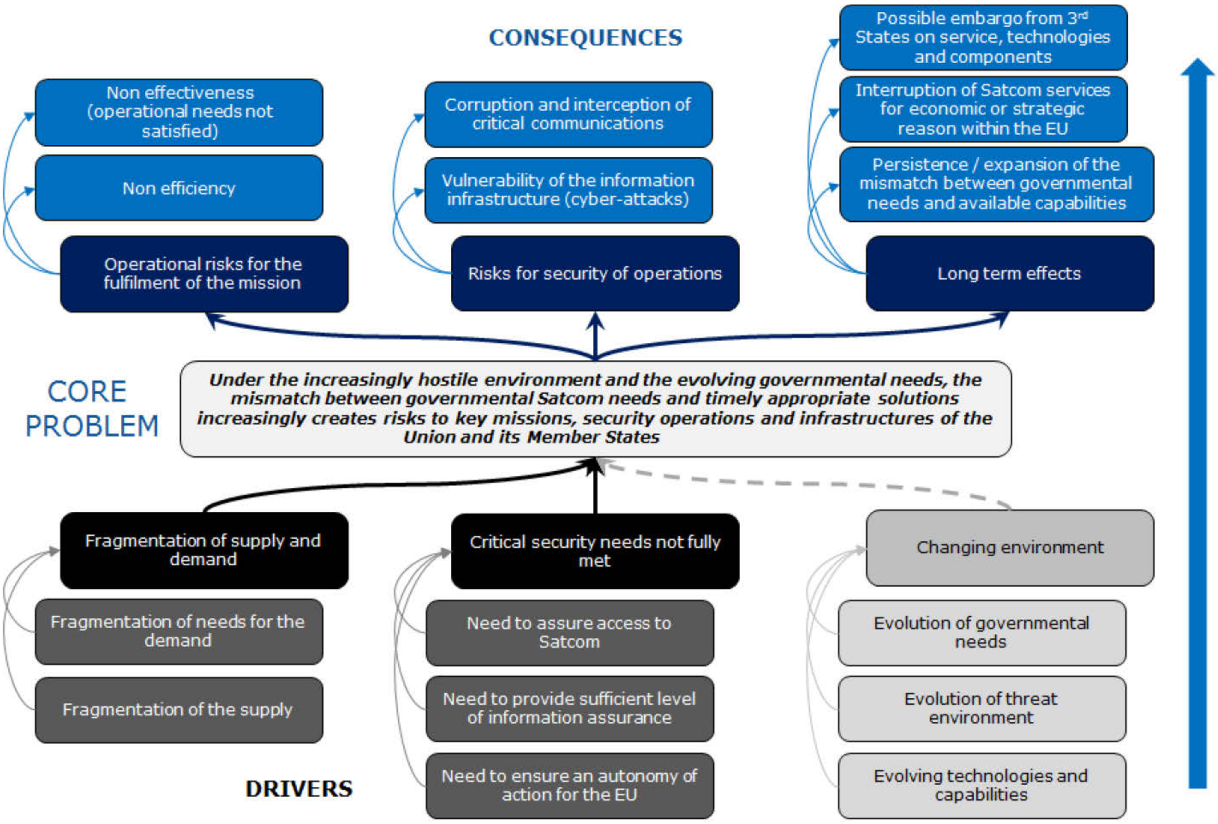


Figure 4 EU GOVSATCOM problem tree.

The overall effect is that security actors' access to governmental satcom capacity is usually limited by national borders, and that capacity from one national system cannot be used by a security actor from another Member State. This leads to inefficiencies, and leaves actors in those EU Member States without national capacities an uncomfortable choice between not using satcom at all, using low-security commercial satcom, or using third country solutions (e.g. US WGS).

On the commercial side, there is a variety of satellite operators who target different types of users (TV broadcast, satellite phones and data-links, internet access), different regions of the world and different frequencies (see Figure. 6).

System	Beginning of services	Expected end of services	Operating MS	Ownership	Coverage	Frequency							
						UHF	SHF	EHF	S	C	X	Ka	Ku
Athena Fidus (Dual-Use)	2014	2030	France/Italy	**Governmental** French and Italian DoDs	Europe, Africa and Middle East				Deep space			✓	
Heinrich Hertz (Dual-Use)	2021	2036	Germany	**Governmental** German DoD	Europe							✓	✓
Syracuse III (Military)	2005	2030	France	**Governmental** DGA *(French MoD procurement agency)*	Global		✓	✓		TV Broadcast			
Satcombw (Military)	2010	2025	Germany	**Governmental** German Armed Forces	Europe, Middle East & Africa, Asia & South East Asia, North America & South America	✓	✓				✓		✓
LuxGovsat (Dual-Use)	2018	2033	Luxembourg	**PPP** SES and Luxembourg	Europe, Middle East and Africa						✓	✓	
Spainsat (Dual-Use)	2006	2021	US	**PPP** Spain DOD and HISDESAT	North America, South America, Eastern Brazil and the Atlantic Ocean, Europe, Africa, the Middle East, and Southeast Asia						✓	✓	
Skynet 5 (Military)	2007	2027	UK	**PPP** Paradigm (Airbus D&S) and UK DoD (PPP)	Europe, Middle East & Africa, Asia & South East Asia, North America & South America	✓	✓				✓		

Figure 5 Table indicating different systems of EU Member States, including national level Public-Private Partnerships where the satellite system is governmentally owned (Adapted from PWC-2). Frequency bands used are in the range of 300 MHz (UHF) to 40 GHz (Ka).

Security actors can procure satcom services from commercial operators, and the diversity of commercial providers is not considered to be a problem *per se*. On the contrary, a diverse offer in terms of coverage, frequency bands, and overall service portfolio can be an asset. The fact that Europe counts several major satellite operators, which successfully act on the competitive global market is indeed a major advantage. However, most commercial systems currently do not contain security features specified in the High Level User Needs, and security actors from individual EU Member States, especially the smaller ones, do not have the buying power to leverage tailored solutions from commercial operators.

Satellite Operator	Type of system	Frequencies	Status	Main Shareholder
Avanti	GEO	Ka, Ku	Operational	UK
Eutelsat	GEO	C, Ku, Ka	Operational	FR
Eutelsat – Quantum	GEO	Ku	Planned	FR
Globalstar	LEO	L, C, S	Operational	US
Hispasat	GEO	C, Ku, Ka	Operational	ES
Inmarsat	GEO	L, Ka	Operational	UK
Europsat	GEO	S, Ka, Ku	Planned	UK
Iridium	LEO	Ka	Operational	US
Iridium Next	LEO	L, Ka	Planned	US
O3b (SES owned)	MEO	Ka	Operational	LU
SES	GEO	C, Ku, Ka, X	Operational	LU
HellasSat (Arabsat owned)	GEO	Ku	Operational	SAU
Thuraya	GEO, LEO	C, L	Operational	UAE

Figure 6 Main commercial satellite operators used by EU governmental users (source: PWC-2).

On the demand side, the needs of EU security actors remains highly fragmented. The different defence forces rely on national contracts, and many civilian governmental actors who need satellite communication solutions are organised at regional or local level (e.g. civil protection, police). This situation is exacerbated by the fact that the cost of a permanent contract for capacity or services is too high for the limited needs and resources of individual actors. Small procurements on an *ad hoc* basis, e.g. in case of natural disasters, are unsatisfactory: from the users' perspective, they are costly, lengthy and have no guaranteed results, and from the suppliers' perspective they are commercially unattractive and may lead to sudden, unpredictable peaks in the event of a crisis. For both parties, this leads to high overheads and administrative burden. The stakeholder consultation shows that commercial satcom providers can and will adjust their services to meet the evolving needs of major long-term customers. But contrary to the US, no aggregating 'anchor customer' exists in today's fragmented European landscape for secure satcom demand.

> "When the earthquake struck Haiti, all land-based telecom systems were virtually wiped out. So from one day to the other, we were faced with some 200 ad hoc demands for urgent satcom services, from Haitian authorities, the UN Agencies, the Red Cross family, European and international humanitarian aid organizations, plus dozens of big and small NGOs ... and of course CNN and other international media. They all wanted the same satcom services, in the same spot, with the same urgency – but with different contracts and different procurement rules. No satcom provider in the world can deliver this type of Services..."
>
> *A representative of a European Satellite*

The problem of fragmentation is further aggravated by the boundaries between the civilian and defence domains. Nationally owned satcom capacity is often designed for, and limited to, military users. Civilian users who may have similar security and accessibility requirements, cannot access the (military-controlled) satcom capacity that may be most suitable to their needs. Interoperability in the user equipment is an additional fragmentation problem: if satellite systems require specific user equipment that cannot communicate with other systems, this leads to a lock-in situation for the user. Most importantly, the synergies from civilian and military users exploiting the same mid-level security systems across national borders are not yet exploited.

In conclusion, fragmentation on the demand side is a problem in cases where it leads to proliferation of small contracts by a multitude of isolated users at national or regional level who in essence need the same service. This leads to inefficiencies and a sub-optimal exploitation of existing resources. GOVSATCOM services would frequently cater for unexpected events, and there are similarities to the insurance sector: the larger the common pool of 'insured' entities, the better resources can be optimised and the lower the individual exposure and cost is, because the risks are shared. Fragmentation is also a problem on the supply side where national systems with excess capacity cannot be used by users from another EU Member State. Because the individual demand is unpredictable (crisis management), this leads to situations where security actors from some Member States have no access to secure satcom capacity when and where they need it; the Member States with national satcom systems are faced with high investment costs and limited means to ensure a return on investments.

Problem driver 2: Critical security needs

European security actors have well-defined security needs for satcom, as reflected in the High Level User Needs. For the purposes of this Impact Assessment, the security needs identified in that document are sufficient to demonstrate the mismatch between security actors' needs and the solutions currently available, whether they come from national or commercial satcom capacity. Annex 4 sets out the detailed analysis of risks expressed by users vs. the non-suitability of the currently available satcom capacities.

For all governmental security actors, the **guarantee of access** and availability of sufficient capacity for unpredictable needs are extremely important. This is easy to understand with the example of an environmental crisis, such as major forest fires or an earthquake: such events always occur unexpectedly, both in time and location, they tend to destroy ground infrastructure such as telecommunication cables and GSM towers, and if a response is not immediately adequate, can easily escalate into major casualties or even a humanitarian or public health crisis. In order to enable security actors to respond in the most efficient manner, access to satcom communication has to be semi-immediate (High Level User Needs: within 12 or 48 hours) and has to be guaranteed. This is currently not the case: most EU Member States (and EU institutions and Agencies) do not own communication satellites, and for relatively small and infrequent users it is too costly to continuously reserve capacity with commercial satellite operators.

> Communication capabilities are of critical importance for all missions. Between 2008 and 2015, most civilian CSDP missions used ad hoc communications- and satcom solutions, with different contracts, different standards and different performance- and security-levels. Since 2015, most of the civilian (and non-executive military) CSDP missions are now procuring lowest security satcom services via the EDA satcom market. The EEAS hopes to implement secure and guaranteed GOVSATCOM solutions by 2021. Several specific features are expected, such as ground segment standardisation and supply chain, total control of expenses, synergies between military and civilian CSDP missions, high availability and deployment's speed, technical support, and improved security including non-localisation of terminals in the field and anti-jamming.
>
> *European External Action Service (EEAS)*

Many potential users of EU GOVSATCOM also confirm the need for an **appropriate level of information assurance.** This includes the confidence that information systems protect the information they handle, that they function as they need to and when they need to, and that they remain under the control of legitimate users. Effective information assurance must ensure appropriate levels of confidentiality, integrity, non-repudiation, authenticity[20] and availability. In most cases, these requirements cannot be met by the currently available offer on the commercial market. For example, users who need to transmit classified information need assurance that this information has not been changed or intercepted during transmission by non-trusted parties. This is the case for EU delegations and MS' embassies, but also for CSDP operations or civilian actors with an executive mission (maritime surveillance, fight against trafficking, etc.). For staff engaged in civilian or military crisis management operations in a risky or hostile environment, it is equally important to prevent third parties from identifying their location via information from unsecured satcom links. The general security needs as defined in the High Level User Needs distinguish clearly between MILSATCOM and GOVSATCOM: for instance, MILSATCOM needs to be resistant to military

[20] Cf. Council Decision 2013/488/EU on the security rules for protecting EU classified information, which includes a section on Information assurance' in the field of communication and information systems

grade jamming[21] equipment, whereas GOVSATCOM only needs to be resistant to commercially available, state-of-the-art "off-the-shelf" jamming equipment. Future EU GOVSATCOM Services should ensure an appropriate level of information assurance and mitigate relevant security risks to an acceptable level. This is usually done by establishing the risks and vulnerabilities of a system and agreeing on the commonly acceptable level of risk. This forms the basis for a **security accreditation**.

From the users' perspective, the current lack of security accreditation process can be an obstacle to communicating sensitive information. Using non-secure communication systems may result in information leaks or interruptions that can harm the interests of the EU and its Members States, as well as the missions and their staff. Finally, unprotected communication systems can become entry point for cyberattacks.

The problems encountered by security actors can be summarized into two linked categories:

Guarantee of access and availability[22]:

- the available ground equipment is not interoperable with the available satellite system
- the satcom provider prioritizes another user;
- no satcom link in the area of operation (and no ground connections either);
- the deployment of the satcom service takes too long;
- interruption or degradation of connection by an ill-intentioned act (jamming, spoofing);
- communication services by a 3rd country operator are stopped;
- the frequency band for which the user's system has been setup is no longer available for satcom (long-term Ku-band issue);
- the provider no longer possesses the security accreditation and is barred from providing services;
- the supply chain for essential equipment or infrastructure components is interrupted.

Information Assurance (confidentiality, integrity, non-repudiation, authenticity):

- cyber-attack of vital satcom system elements compromises the reliability or makes it impossible to communicate;
- A cyber-attack my act as an entry point to other ICT systems;
- the communication link is not secured against eavesdropping;
- sensitive data and information may be intercepted;
- part of the information may be missing or modified without the user being aware;
- data and information from a non-trusted source may be added without knowledge of the user.

[21] A 'jammer' is a device that deliberately blocks, alters, or interferes with authorised wireless communications. This is usually done by creating a signal of random radio noise. It is a common tool used to censor radio signals, and in conflicts to prevent military and civilian communications.

[22] Guarantee of access and availability are often regarded as part of 'Information assurance'. It is analysed separately here because of its extreme importance to users.

Guarantee of access and information assurance are strongly linked to the notion of **autonomy.** For operational users this has a very practical consequence: if the communication system (satellite and ground equipment) is fully under their control - or by extension under the control of their MS government or the Union - they can be certain that their system will not suddenly be switched off. Conversely, having to rely on the communication system of a local power in a conflictions situation is considered a considerable risk in any operation (from defence to humanitarian aid).

But autonomy of action is also important on the longer term, as discussed in the next section.

Problem driver 3: Changing environment

In the last years the political and security environment has changed significantly, notably with regard to the **origin, nature and severity of threats** within and around the EU. This is leading to increased risks for citizens in general, and to a greater exposure of security actors in particular. Security actors who rely on satcom need a guarantee that the systems and services they are using are sustainable, in particular when investments in proprietary ground systems and user terminals have been made.

Satcom technologies are evolving fast. Important areas of technology development are Very High Throughput Satellites (VHTS) in Geostationary orbits, anti-jamming and other security-related features, secure hosted payloads, optical communications, Quantum technologies including Quantum Key Distribution, Highly Elliptic Orbit constellations for Arctic coverage, Low Earth Orbit small satellites (mega-)constellations for low-latency and low data-rate applications, active antenna's for coverage flexibility, flexible multi-frequency user equipment, and integration with ground-based communication systems (5G). However, only few of these features are deployed commercially, and many of those technologies are still the subject of Research and Innovation (R&I) projects managed by ESA in the ARTES programmes[23]. For a more extensive overview of the main technology development areas related to GOVSATCOM see Annex 5.

Satcom systems are typically built for a lifetime 15 years, and neither the space infrastructure itself nor the way it is used adapts quickly to changing threats and new technology developments. The current satcom systems, whether owned by private companies or by Member States, will need to be renewed at some stage, for Member States systems mostly around the year 2025. From an operational point of view, the current situation will probably remain stable for the next 5 years. Nevertheless, early political, financial and design decisions will have to be taken, both for the **renewal of existing space infrastructure and for potential investments** in 'gap-fillers' (e.g. Arctic coverage, M2M) or in new systems. Different satellite system owners have different timelines and different interests. Commercial satcom operators develop their business case for the global market, whereas national satcom system owner develop their system for national users. All system owners need to make decisions for the next decade on the basis of limited clarity on the future needs, threats, opportunities or technological developments.

In conclusion, the security and technological environment is constantly evolving in terms of user needs, changing use-cases, and more stringent security requirements. The total demand for secure satcom capacity and coverage is expected to increase significantly over the coming years (see Section 2.5). On the side of risks and threats, new actors emerge together with new forms of attacks and new capabilities due to technology developments. If Europe does not adapt to this changing

[23] Cf. https://artes.esa.int/

environment through the development and use of innovative concepts and technologies, the mismatch between user needs and solutions will increase further.

Out of scope drivers

Some of the drivers are part of the wider global landscape, and action at the EU-level would be unlikely to directly influence such elements. For example, the US GOVSATCOM-like system WGS has been opened to allied countries, and several EU countries have already started using satellite communications through WGS, e.g. NL, DK.

2.3. Who is affected, in what ways and to what extent?

Those primarily affected by the identified problem are the EU and EU Member States' security actors (see Figure 1), including both civilian and military actors. By extension, the mismatch will also affect, directly or indirectly, the security and safety of all EU citizens.

The magnitude of this mismatch depends on the country's geography (outer EU borders, Arctic or maritime needs, remote areas, etc.), on their proneness to natural disaster (earthquakes, floods, forest fires), on their access to autonomous national solutions, and on their ambitions as global actor (participation in crisis-management or humanitarian aid operations). But the national or regional deficits (e.g. Member States with no national satcom systems), together with the lack of autonomous capacities at the EU level, create increasing risks to all security actors and European citizens, because security risks tend to ignore national borders. These deficiencies amplify the operational, financial and industrial inefficiencies, and may become an obstacle for national operations and EU missions. '

EU citizens have become acutely aware of the importance of reliable communication during crisis situations, and the effect of the absence of such systems for security actors who protect them. During and in the wake of the 2017 hurricane in the Caribbean all infrastructure was so severely damaged that it tool several days to restore limited means of communication, leading to a breakdown of public order on some of the islands. During the 2017 forest fires in Portugal the system of communications by radio and by telephone suffered a general failure in the whole region. The lack of back-up systems, such as satcom, is believed to have contributed to the lack of coordination of the fire-fighting and rescue services, and to the worsening of the consequences of the fire. The general conclusion is that when security actors do not have access to the right tools to carry out their difficult work, security actors and citizens alike suffer from the consequences.

The European space industry is also directly affected by the problem, especially in the context of strong international competition. Europe has a space industry sector that is commercially competitive and technologically 'world-class'; this is a major strategic asset for the EU. European space industry captures one third of all global satellite sales. However, other spacefaring nations have a much stronger and more stable domestic customer base, mainly in the form of national programmes. Often, these national programs are not accessible for European players, in particular when there is a security dimension. In this wider space context, satellite communications represents one of the largest and most commercially-driven domains. Satcom generates about 50% of the total revenues of the EU space manufacturing industry[24], and constitutes thus an important pillar of the EU space industrial base. In a mature global market, major customers have a strong leveraging

[24]http://eurospace.org/Data/Sites/1/pdf/positionpapers/spacetelecomspositionpaper2015-draftfinal.pdf

power and can impose their conditions on satcom suppliers. For example, the US Department of Defence, as one of the major customers of European satellite operators, can impose US autonomy-enhancing measures, such as US Department of Defence encryption of commanding and telemetry, standard waveforms, US-based operations centres, and satellites built by US companies. In contrast, the fragmented European demand provides insufficient commercial incentives and little long-term visibility and stability for satcom manufactures and operators to adjust to the specific needs of European customers. One of the side-effects is that some EU Member States have established national partnerships for governmental satcom with non-EU industry, weakening the European space industrial base.

2.4. What is the EU dimension of the problem?

The fundamental EU dimension of the problem is that security risks do not stop at national borders and propagate throughout the Union, while the secure satcom tools which are essential to all European security actors are organised at national level. Member States cannot achieve an effective solution to the problem on an individual basis. This is exemplified clearly in the case of border surveillance: secure satellite capacity needs to be used by security actors at the external borders of the EU, e.g. in Greece, Bulgaria or Lithuania. A national satcom system from one country that cannot be accessed by an actor from another country is of limited use to EU border surveillance. This is why 'pooling and sharing' should become a part of the solution, as indicated in the conclusions of the Competitiveness/Space Council in 2014.

Furthermore, the individual users needs from the EU level and from 28 Member States (29 if Norway is included, which has shown a strong interest in the EU GOVSATCOM initiative) are heterogeneous and often unpredictable in terms of scope, capacity, timing and location. Satcom systems can and do serve multiple clients, but can be overwhelmed when many users need peak capacity at the same place and time. Major efficiency gains can be made through economies of scale at EU level. It is an effective way to mitigate the risks, to aggregate the demand, and to better exploit the available resources.

In recent years, the awareness of the EU-dimension of security has led to tangible progress in a broad range of policy domains where EU Member States join forces to achieve a stronger and more efficient impact. The successful military and civilian CSDP missions and operations, EUROSUR for border surveillance, and the setup of security related agencies such as EUROPOL, EMSA, FRONTEX, and ENISA are a case in point. This also means that an important part of the users of GOVSATCOM are already used to operate in an EU framework, even in an essentially national capacity.

2.5. How would the problem evolve, all things being equal?

With the rapidly evolving threat environment, the increasing geopolitical instabilities, and the bolder EU ambitions set out in the EU's Global Strategy for Foreign and Security Policy, this problem of mismatched demand and supply will increase in the future.

The current mismatch will evolve both on the demand and on the supply side. A detailed analysis of the demand today and its likely evolution in the future was performed in three underlying studies: PWC-1 for civilian demand, EDA-EUROCONSULT for military demand, and PWC-2 for the combined demand. The methodologies and the more detailed results are discussed in Annex 4 on analytical methodologies. The use of secure satcom by governmental users will increase in volume and change in nature. In the past, satcom was mainly used for voice communications (narrow band). Today and in the future, the need to transmit large volumes of data, for example high-resolution imagery or real-time video and data is rapidly increasing. In almost all surveillance missions, there is a strong trend to replace piloted aircraft by RPAS systems. Overall, this is a major cost-saving and efficiency gain for the operations. But it does require a robust, continuous communication link for commanding the RPAS and retrieving the data from sensors. For long-range RPAS systems, this can only be provided by satellite communication systems.

Figure 7 shows the expected increase in GOVSATCOM-type demand for the military[25] and civilian[26] users. For the civilian part, the estimation is based on current user demand and their expected future evolution in line with the actual trends in that domain. The PWC-1 study analysed the demand up to 2035, the EDA study analysed the military demand up to 2040. The civilian demand up to 2040 was extrapolated on the basis of the period 2020-2035. Those demand predictions are based on the assumption that a supply-source for EU GOVSATCOM capacity will be available, i.e. that the capacity will not suddenly disappear when the current systems reach the end of their life-time. The projected civilian demand also includes some domains which are not included in the High Level User Needs list of authorized EU GOVSATCOM users. For example, the demand for connectivity during flights is increasing rapidly. Such passenger connectivity is not within the scope of EU GOVSATCOM, because it is neither security-relevant nor managed by governmental actors. The transport part of the overall demand estimate is in any case a very small part (less than 5%).

During stakeholder consultations, some satellite operators have indicated that the civilian estimates from PWC-1 may be on the high side; others however believe they are realistic. They also stressed that the estimates for the military domain are likely to be more accurate, not least because the current and future use-cases and capacity needs are much better established. However, all stakeholders who have been extensively consulted in the GOVSATCOM Expert Group and in various stakeholder events agree that the overall demand will grow considerably, doubling every 5-10 years. It is also likely that the civilian demand for GOVSATCOM will increase more rapidly than the military demand.

[25] Governmental satellite communication (GOVSATCOM) feasibility study, Euroconsult for the European Defence Agency (2017)
[26] PWC-1

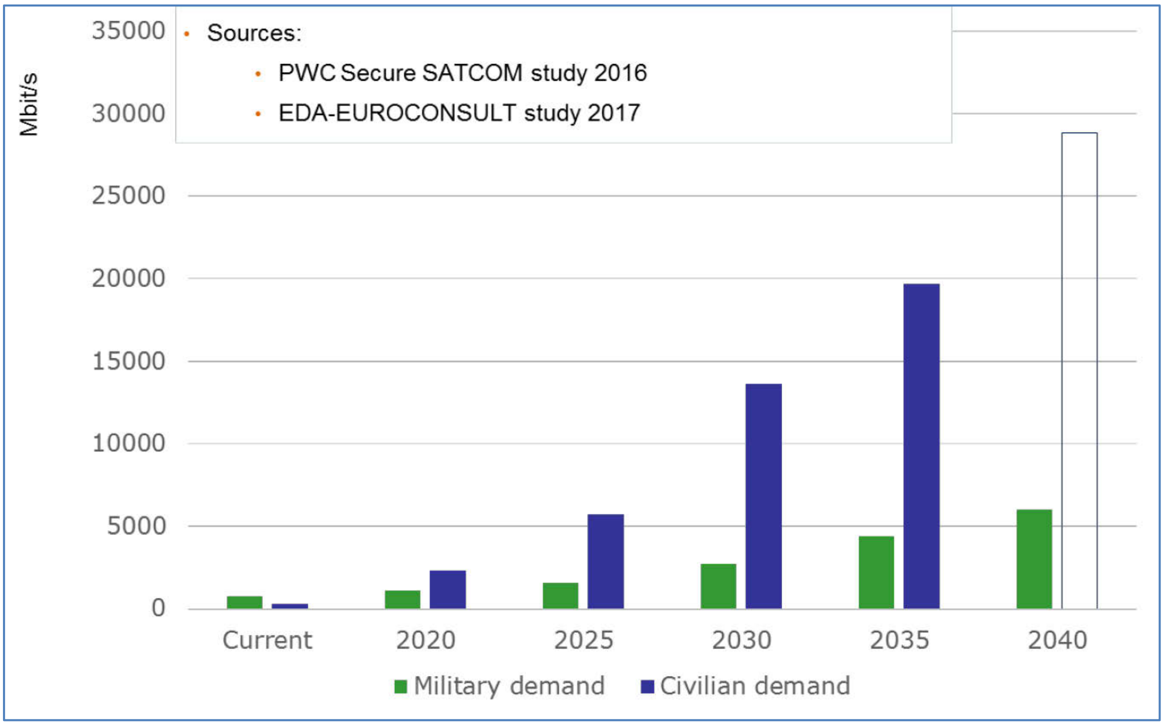


Figure 7 Expected evolution of EU GOVSATCOM-like demand for military and civilian users (Source: PwC analysis). The Civilian demand was analysed up to 2035 in the PWC-1 study (the projection for 2040 is an extrapolation), the military demand was analysed in the EDA-EUROCONSULT study up to 2040.

In addition to the increase in the volume of the demand (see Figure 7), the nature of the demand (see Figure 8 for the current civilian use-cases) will also change. It is expected that the Surveillance and Crisis Management use-cases will expand in the future. Other specific use-cases, such as in the Arctic region, or Machine-to-Machine, will increase substantially.

Commercial and national satcom systems will also change over time. The lifespan of a satellite is approximately 15 years, and investments for new systems are considerable (several hundreds of million euro). This means that satellite operators need to develop their systems for users in 15 years' time, but at the same time the major investments risks drive the use of extensively proven technologies: malfunctioning elements cannot be repaired in space systems. As a consequence, in this sector, the 'Valley of Death' between research and development on the one side and the actual use of innovative technologies in satellite communication systems is considerable. Therefore, even if advanced and innovative technologies making the systems more secure are under development and potentially available (see also Research and Innovation Annex 5), it is not certain that they are actually used in commercial systems.

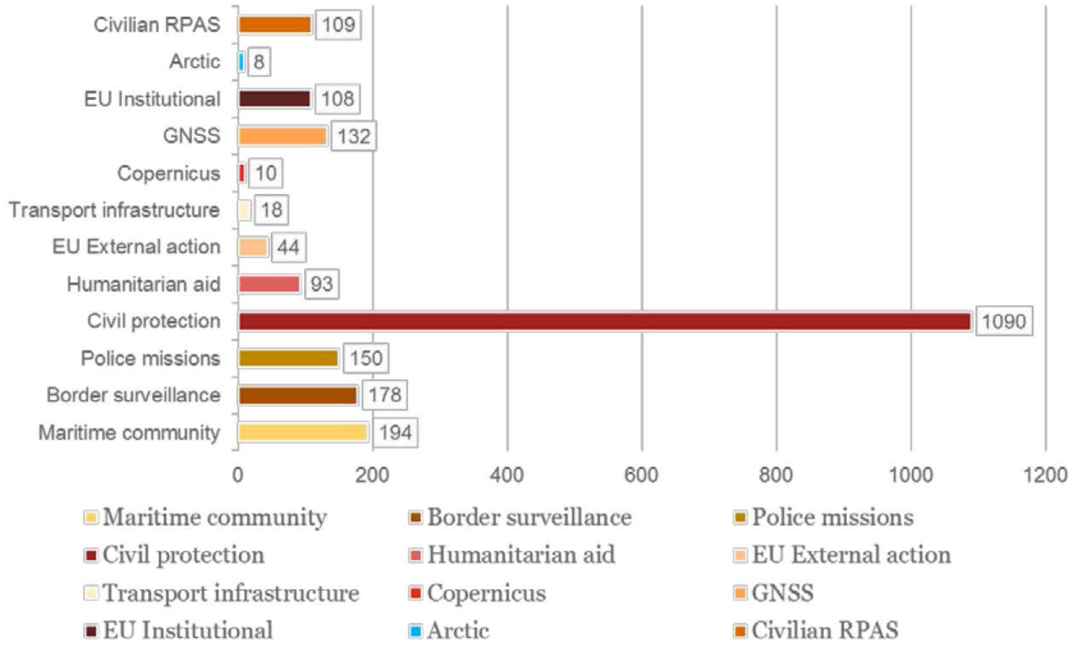


Figure 8 Different current use-cases (in Mbps) for the civilian part (Source: PwC analysis). Those use-cases are expected to evolve, and their proportion may change considerably. For example the use of RPAS[27] will increase dramatically.

2.6. Conclusions of the evaluations of the existing policy

No current policy exists that addresses needs of security actors for secure satcom. However, there is a growing awareness that defence and security also need to be tackled at the EU level to be effective.

3. EU right to act

3.1. Legal basis

EU action would be based on Article 189 TFEU (Title V Research Technology Development and Space), which provides a legal base for the EU to act in space policy matters.

Article 189 TFEU:

1. *To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space.*
2. *To contribute to attaining the objectives referred to in paragraph 1, the European Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space programme, excluding any harmonisation of the laws and regulations of the Member States.*

Article 189 TFEU introduces the right for the EU to act in drawing up a European Space Policy and gives the European Commission a mandate to exercise its right of initiative.

[27] http://www.sesarju.eu/sites/default/files/documents/reports/European_Drones_Outlook_Study_2016.pdf

The EU GOVSATCOM initiative may be established as an EU Space programme to exploit the possibilities of space in the domain of satellite communications, in order to enable and facilitate the implementation of Member States or EU policies related to security of its citizens.

3.2. Subsidiarity

EU actions falling outside exclusive competence have to be assessed in the light of the subsidiarity principle set out in Article 5(3) TEU. Hence, it must be analysed whether the objectives of the proposal could not be achieved by the Member States in the framework of their national legal systems and whether, by reason of its scale and effects, they are better achieved at EU level.

The objectives of the proposed action cannot be sufficiently achieved by the Member States

This initiative will support both EU and Member States' policies, such as security and defence. While some EU Member States own and use communication satellites at national level, no secure satcom services at European level exist today that is accessible for all EU security actors.

No EU Member State – including those owning relevant secure satcom capacity – has the means or the mandate to provide an operational GOVSATCOM service at European level that is open to all Member States security actors and EU Institutions. In addition, the provision of governmental communication is sensitive and requires a level of resilience and trust among the stakeholders which is difficult to achieve by any EU Member State acting alone. Due to the European and even global scale of the problems, there is no possibility to address the issue at the regional or local level.

Action at the EU level is also necessary because part of the security policies and infrastructures to be supported by a GOVSATCOM initiative are already managed at EU level, including the Common Security and Defence Policy. Action at EU level provides added value because action and coordination at EU level will avoid duplication of efforts across the Union and Member States, and between civil and military actors. It will lead to a better exploitation of existing assets, to greater security and resilience, to better coverage, and to new services in the future.

The need for action at the EU level action is confirmed, *inter alia* by the European Council Conclusions of 2013, by the December 2014 Competiveness/Space Council Conclusions, and by the May 2015 Foreign Affairs Council Conclusions. More recently, the Space Strategy proposes EU GOVSATCOM as one of the actions in the domain 'Reinforcing *Europe's autonomy in accessing and using space in a secure and safe environment'.* In its conclusions on "A Space Strategy for Europe", the Competitiveness Council at its meeting on 30 May 2017 "takes note of the intention of the Commission" and "stresses the need to thoroughly assess all possible aspects before issuing such an initiative, including in the ongoing Impact Assessment". The European Parliament report on the EU Space Strategy adopted in September 2017[28] also indicates a strong support for the EU GOVSATCOM initiative.

[28] P8_TA(2017)0323 European Parliament resolution of 12 September 2017 on a Space Strategy for Europe (2016/2325(INI))

The objectives of the proposed action, by reason of its scale and effects, can be better achieved at EU level

On the basis of the findings in previous sections, there are clear benefits from EU-level action over and above what could be achieved by Member States acting alone. The core of EU GOVSATCOM consists of the aggregation of the demand, common EU level security requirements and accreditation, and pooling and sharing of national and commercial resources. The establishment of an EU-level governance that can leverage satcom services for all national and EU security actors will contribute to a more effective and autonomous EU response to risks and threats, ranging from cyber-attacks, natural disasters to more traditional forms of conflicts and instability. Therefore, by reason of effectiveness and efficiency, the establishment of GOVSATCOM can only be achieved at the EU level.

For all security actors, guaranteed access to satcom with an EU-standardised minimum security level will create more security, greater operational effectiveness, less administrative burden and significant economic benefits. It will allow them to act more efficiently in missions and operations which usually carry non-trivial personal and material risks (e.g. CSDP missions in Mali, Somalia, fire fighters, terrorist attacks).

The EU added value will be greatest for the more than twenty EU Member States who currently have no nationally owned satcom infrastructure. However, even for Member States with national capacities, pooling and sharing at EU level will enlarge the coverage in terms of geography, capacity and services, and will therefore have an EU added value.

The European private sector, too, will benefit from the long-term visibility and EU-level security accreditation. The aggregation of the demand will lead to larger volume and longer term contracts, which will decrease the administrative burden of managing numerous small ad-hoc contracts for multiple clients. The long-term visibility, together with harmonized requirements for the EU governmental market, will also strengthen the business case and reduce risks for private operators, in particular in areas where the commercial demand alone is not (yet) strong enough (e.g. Arctic coverage).

Last, but certainly not least, European citizens will benefit directly and indirectly from the enhanced operational effectiveness of the various security actors. EU GOVSATCOM will also support the activities of the EEAS and of the European Humanitarian Actors around the globe.

4. Objectives

4.1. General policy objectives

The general policy objective of EU GOVSATCOM is to ensure the availability of reliable, secured and cost-effective satellite communications services for EU and national public authorities managing security critical missions and infrastructures.

4.2. Specific policy objectives

The specific objectives which seek to address the main drivers of the problem (see Figure 4 EU GOVSATCOM problem tree.

) are:

(1) To overcome the fragmentation of GOVSATCOM on European scale on the demand and supply side; for nationally owned satcom systems, to seek synergies between the civilian and military domains;

(2) To ensure that critical security needs of EU and national governmental users are met by

a) finding solutions which ensure an appropriate guarantee of access to satellite communications;
b) ensuring that solutions are secure and sufficiently robust to ill-intentioned acts to be used by security actors;

(3) To ensure that the solutions provide an appropriate level of European non-dependence in terms of technologies, assets, operations and services. This requires a competitive and innovative European space sector to ensure renewal of systems around 2025.

4.3. Consistency with other EU policies and with the Charter for fundamental rights

The EU GOVSATCOM initiative is consistent with other EU policies and the Charter of fundamental rights. It puts a common tool in the form of secure satellite communications at the disposal of EU and national governmental actors. Those governmental actors are themselves bound by EU, national, and regional law, as well as the Charter of Fundamental rights in all missions and operations where they might make use of EU GOVSATCOM services. None of the potential elements of EU GOVSATCOM would be in conflict with existing EU legislation, or with the Charter of Fundamental Rights.

EU GOVSATCOM, in enhancing the operational effectiveness of security actors, can contribute to safeguarding or strengthening citizens' rights to security (Article 6 Charter of Fundamental Rights) and to diplomatic or consular protection when residing in a third state (Article 46 Charter of Fundamental Rights). EU GOVSATCOM can also lead to a better protection of personal data (Article 8 Charter of Fundamental Rights), because communications via EU GOVSATCOM will provide an enhanced level of information assurance against eavesdropping, spoofing, etc. by third parties.

EU GOVSATCOM is a key strategic tool to support Europe's global ambitions and to lower the associated risks inherent to such ambitions. The level of ambitions regarding a safe and secure Europe, a stronger and more autonomous actor on the global scene have recently been set out in the Commission White paper and the Rome Declaration (both March 2017). The Global Strategy set out in greater detail what is needed to implement a secure, resilient and more responsive Union. Autonomous access to Space and Space operation, in particular satellite communications are listed as tools to enhance European security. In the Space Strategy and the European Defence Action Plan this policy approach is further translated into clear actions in the domain of space, security and defence. The EU GOVSATCOM initiative is one of the important Union level actions which contribute to all three policy areas.

The EU GOVSATCOM initiative is linked to other Union policy domains, such as

- The maritime security strategy
- The EU cyber defence policy framework
- The EU Arctic policy
- Telecommunication policies, in particular for frequencies
- Border management
- Humanitarian aid
- Migration
- Fisheries
- Transport

EU GOVSATCOM will enhance the effectiveness of these policies (e.g. maritime security, Arctic, border management), and is coherent with those policies. *Vice versa*, some other EU policies can affect satellite communications: for example the regulation of the use of specific frequencies for space may affect GOVSATCOM (e.g. Ku band / 28 GHz issue). In order to enhance the synergies and coherence in this context, representatives of the competent Commission DGs have been systematically involved throughout the impact assessment process.

5. Policy options

Four options for EU action, in addition to the baseline, are developed in this impact assessment (see Table 1 for a summary of the options). The baseline option describes the current situation and provides an analysis of the likely evolution in the absence of any EU initiative. The four options for EU action are each described in two phases:

- **Phase 1, roughly from today until 2025**, during which we assume that the space infrastructure of the Member States is stable in the current situation (see also Figure 5).
- **Phase 2, from 2025 onwards,** when many of the existing national assets will reach their end of operational life and will need to be replaced.

This analysis of two phases allows us to take into account the decisions on future space infrastructure investments that need to be made around 2025, as well as their expected impacts.

Underlying elements of options

Several Council conclusions and EP Resolutions[29] have already assessed the problem and outline some solutions, including 'avoiding fragmentation' and 'seeking civil-military synergies'. This policy

[29] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/140245.pdf; Resolution of 8 June 2016 on space capabilities for European security and defence, P8_TA(2016)0267; Resolution of 10 December 2013 on EU Space Industrial Policy, releasing the Potential for Growth in the Space Sector, P7_TA(2013)0534; Resolution of 19 January 2012 on a space strategy for the European Union that benefits its citizens, OJ C 227 E,

guidance and studies by the Commission, ESA and EDA lead to a set of core-elements which underpin all policy options (apart from the baseline).

Common security requirements. Currently, common EU-level security requirements[30] have not been established and/or are not harmonised between different governmental satcom users. Since security does not stop at national frontiers, risks created in one place will affect others, especially if multiple actors work together in operations. The EU GOVSATCOM High Level User Needs document is a major building block and defines the scope, users and general security needs. The Council Political and Security Committee recommended in its endorsement of the High Level User Needs to define common security requirements which can subsequently be used for a security accreditation process. Security requirements will include the definition of the appropriate level of autonomy, as indicated in the High Level User Needs.

Synergies. Today the secure European satcom capacities are not optimally used. Civil-military synergies can be found by aggregating the demand for similar services and security levels, and by coordinating the supply of secure satcom capacities from military, dual-use, civilian and accredited commercial systems.

Economies of scale. The individual needs of users from the EU and 28 Member States are heterogeneous and often unpredictable in terms of scope, timing and location – in particular in the domain of crisis management, civil protection, and humanitarian missions. Satcom systems can serve multiple clients, but can be overwhelmed when many users need peak capacity at the same place and time. Major efficiency gains can be made through economies of scale at EU level. A 'pooling and sharing' demonstration for military users is currently being set-up by EDA in the 2018-2020 timeframe. The aggregation of civilian demand, too, will lead to fewer but larger, longer and more predictable contracts. This would reduce the fragmentation and complexity of contractual overheads for public clients and for satcom providers, leading to lower costs and increased customer leverage, including for the provision of better security features.

Budget implementation and operational aspects (Figure 9**).** In all options, GOVSATCOM will require contractual arrangements with satellite owners to provide capacity and service. The programme will also need to procure the ground infrastructure and operational needed to ensure the effective provision of GOVSATCOM services.

At the operational level, studies from ESA and EDA show that a central 'nerve system' will be needed to seamlessly interconnect diverse users and suppliers in a smart and secure manner. In analogy to a car accident insurance scheme, or taxi company, such systems can only function, optimise the resources and spread risks to reduce costs, if all operational information (e.g. who is a member, where is the accident, how far away is the closest free taxi) is channelled through a central information system. A 'GOVSATCOM Hub' in some form is therefore indispensable to aggregate demand in the unpredictable environment in which typical GOVSATCOM users operate. It would make it possible to combine and link different existing satellite and ground infrastructures into a

6.8.2013, p. 16; Resolution of 7 June 2011 on transport applications of Global Navigation Satellite Systems – short- and medium-term EU policy, OJ C 380 E, 11.12.2012, p. 1.

[30] Security requirements are detailed specifications indicating the level of protection that is needed in the systems and involved entities to mitigate identified risks. Those are more detailed and more technical than the high level user needs.

system-of-systems approach, creating a pooled resource. The Hub would also have to ensure that all EU GOVSATCOM services are delivered in accordance with security and operational requirements, and would keep track of usage, sharing, and operational prioritisation arrangements. To achieve the desired synergies and economies of scale, and to optimise the use of limited resources, such a Hub would represent the operational core of EU GOVSATCOM and would be indispensable, even if all space infrastructure used for GOVSATCOM is owned and operated by national or commercial entities.

In practice the Hub, or two Hubs to ensure operational redundancy, would consist of a secured and protected site with the necessary ICT infrastructure to provide the connections to users and operators. The EU-owned Hub(s) would be built and operated under a contractual arrangement with private or public entities. The precise functions of the Hub(s) and its costs depend on the choice of technology options, on the number and variety of users and providers to which it needs to connect, and – most importantly - on the security requirements.

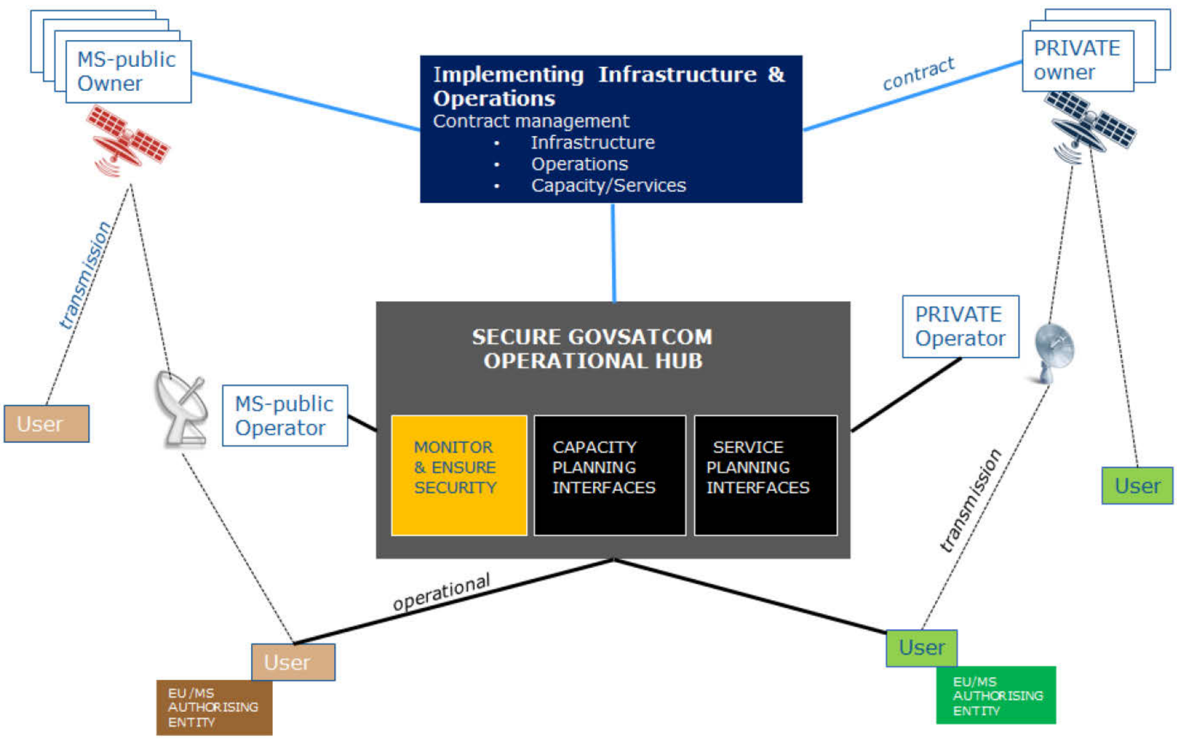


Figure 9 Diagram showing the contractual and operational interfaces required for the GOVSATCOM programme to ensure the provision of secure satellite communication services.

Strategic autonomy and non-dependence is at the core of the EU Space Strategy and the Defence Action Plan, and should also be a cornerstone of EU GOVSATCOM. Civilian and military security operations in and outside the Union can only be truly independent if the necessary key assets and tools are under the control of the EU and Member States.

Strengthening the EU competitiveness and industrial base. European autonomy also requires a strong, innovative and globally competitive industrial base to design, build and operate the secure satcom systems, including space infrastructure, ground segments, network services, and user equipment. This is particularly relevant when gaps need to be filled, when new needs arise, and when existing national systems will be replaced around 2025 and beyond.

Field of possible options and discarded options

The potential field of options is very large if all variables of governmental satellite communications are analysed in detail. For example the type of contract can only cover the supply satcom capacity, i.e. the user takes care of the user equipment. This is usually the case for military operations. On the other hand, a contract may include the provision of satcom capacity, network services and user equipment as an end-to-end service. This is for example the case when an unequipped user temporarily needs a satellite phone in a remote area. In terms of geographic coverage, satcom frequencies, and applications there is a wide variability in needs and solutions.

In the choice and design of the potential policy options, the analysed variables were limited to those which have a strong influence on the governance set-up: what are the main elements needed to make EU GOVSATCOM work, which entities can participate, either as users or as suppliers of capacity, how is compliance with security requirements guaranteed, and what is the role of the EU or its agencies?

A number of options which are theoretically possible have been discarded at an early stage:

EU GOVSATCOM with aggregation of demand, but without security accreditation. This option was discarded because it would lead to a situation where security actors have access to satcom, possibly at a lower price than today, but without covering the common security needs identified in the High Level User Needs. This option is currently implemented by the EDA 'SATCOM market', and is providing an improvement for use-cases where no information assurance needs apply. However, many users have indicated that this solution is insufficient for the increasing number of use-cases which require a higher security level.

EU GOVSATCOM with security accreditation, but without aggregation of demand. This option was discarded because it would not provide a solution for the fragmented demand (leading to high overheads due to multiplication of short and small contract, and insufficient customer leverage). Furthermore, it would still be impossible for users from Member States without national satcom capacity to use the capacity of other Member States in a coherent manner without a multitude of bilateral agreements.

EU GOVSATCOM only for military users or only for civilian users. If GOVSATCOM services would be exclusively provided to military users, the EU would not have a right to act. Exclusive services for civilian users would mean that the obvious civil-military synergies (many military and civilian governmental users have exactly the same needs) would not be used to generate efficiency gains and cost savings. Furthermore, Council conclusions explicitly point to the objective to foster civil-military synergies.

EU GOVSATCOM only for EU programmes and projects (e.g. CSDP, EUROSUR, CISE, ERCC). In many EU programmes related to safety and security, the operational actors in the field are national entities. In addition, irrespective of their affiliation (EU institutions, national or regional bodies), governmental security actors have similar needs. Restricted pooling of the demand over a limited sub-set of those users would not solve the problems of other (national) users, and would needlessly decrease the potential for economies of scale.

EU GOVSATCOM as a mandatory legal requirement for EU and national security actors. Although this would provide a significant potential for economies of scale, it would be disproportional to make the use of secure satcom mandatory via EU legislation.

5.1. Baseline scenario

Under the baseline, no further EU action would take place. The High Level User Needs document could inform national users of the security risks they face, but apart from this awareness-raising function there would be no operational follow-up. The fragmented demand will not be aggregated, security requirements will not be harmonised, synergies between civil and military users, as well as between EU and Member States, will not be achieved. On the supply side, national space assets will be renewed at some stage and the Member States concerned will have to bear all related costs alone. Member States and EU institutions without secure national satcom assets would continue to rely on commercial suppliers (including non-EU providers) to use solutions from third countries such as the US, and/or to live with their deficits.

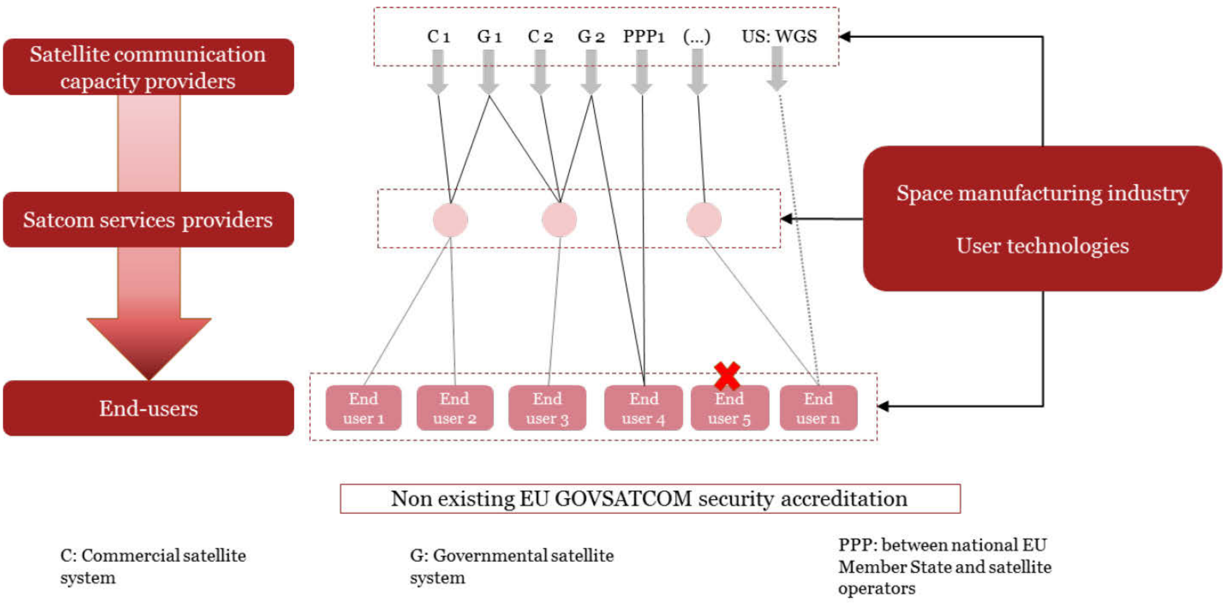


Figure 10 Baseline option

Under the baseline, the demand for secure satcom communications by military and civilian users is expected to increase. Figure 7 shows the evolution of the expected demand, based on the PWC-1 and EDA study. This estimate is based on assessments of current governmental satcom users and their assessment for the evolution. In general, for the same use-case, the demand is expected to increase, because larger data volumes (imaging, video) are expected. In other use-cases the operational tools are changing, for example from piloted aircraft to RPAS, which need satcom to operate. The overall threat levels due to regional instability, cyber-attacks and hybrid treats are likely to increase, too, leading to more risks for security actors using satcom, and ultimately to European citizens.

The offer from commercial satcom operators will evolve with the demands of the global market, but the fragmented EU users will not be able to leverage dedicated solutions, even from European providers. They will be outranked and outspent by larger customers such as major TV broadcast companies, the US Department of Defence, or other international clients. It is likely that more EU Member States will make use of the US governmental solution WGS (as is already the case today for a few Member States).

The analysis of the baseline supply and demand, and its expected evolution over time in the studies by PWC and EDA was done for the current composition of the EU, i.e. including the UK. The UK is an important potential supplier and user of satcom capacity. The UK Skynet system could be one of the six providers of national capacity into the GOVSATCOM pool, and UK private satellite operators would also be relevant providers of capacity. On the demand side, the UK military users have considerable experience and expertise in the use of satellite communications, because of their access to national satellite systems; on the civilian side, the situation is more uncertain. Although UK security actors could be interested in making use of EU GOVSATCOM, their demand could largely be satisfied by their national system. The studies do not specify the volume of the UK potential supply and demand. But it is clear that neither the supply (public and private), nor the demand from the UK is critical for EU GOVSATCOM. There is a sufficient number of other public and private satcom providers in the EU beyond the UK (see Figure 5 and Figure 6) to provide the initial GOVSATCOM pool. The demand for GOVSATCOM services, too, is likely to be highest from security actors from other Member States who do not own national satellite systems. However, the long term experience of the UK in satellite communications for governmental security actors, as well as their know-how regarding a public-private partnership in this domain (Paradigm), would be valuable for EU GOVSATCOM.

5.2. Option 1: Aggregation of demand and using commercial satcom capacity and services

In option 1, the demand is aggregated across the EU and Member States, and across civil and military boundaries. The aggregation could be done per service family (e.g. crisis management, surveillance, diplomatic communications), and competent EU entities could play coordination roles (e.g. EEAS, EDA, EMSA, FRONTEX). The necessary operational, security and accreditation requirements will need to be developed per service family. Only accredited commercial operators would be able to provide the EU GOVSATCOM services for the aggregated customers. The Hub would handle user requests and ensure that the commercial providers provide services to authorised users, within the contractual arrangements. The Hub would in addition implement and monitor the correct application of the security requirements and procedures. The function of the Hub also includes keeping track of the usage in order to either carry out billing procedures (in the pay-per-use scenario) or to ensure compliance with the sharing agreement (if core-capacity is funded from the EU budget). Future infrastructure investments in order to renew existing systems and to fill gaps, would be made and paid by private companies, if and when they see a viable business case.

EU GOVSATCOM should move in step with the demand, and organise the pooling and sharing in an efficient manner. Flexibility is key, as most users require different services. GOVSATCOM should not only focus on capacity, but also on service-management and -access, standardisation, as well as security and governance. The GOVSATCOM hub should incorporate all central functions to organise and manage demand and supply, and implement standardisation, security and governance. This option would offer an adequate service in terms of costs and security, and would allow the industry to respond to evolving user needs.

SATCOM operators views on the Hub (relevant for all policy options)

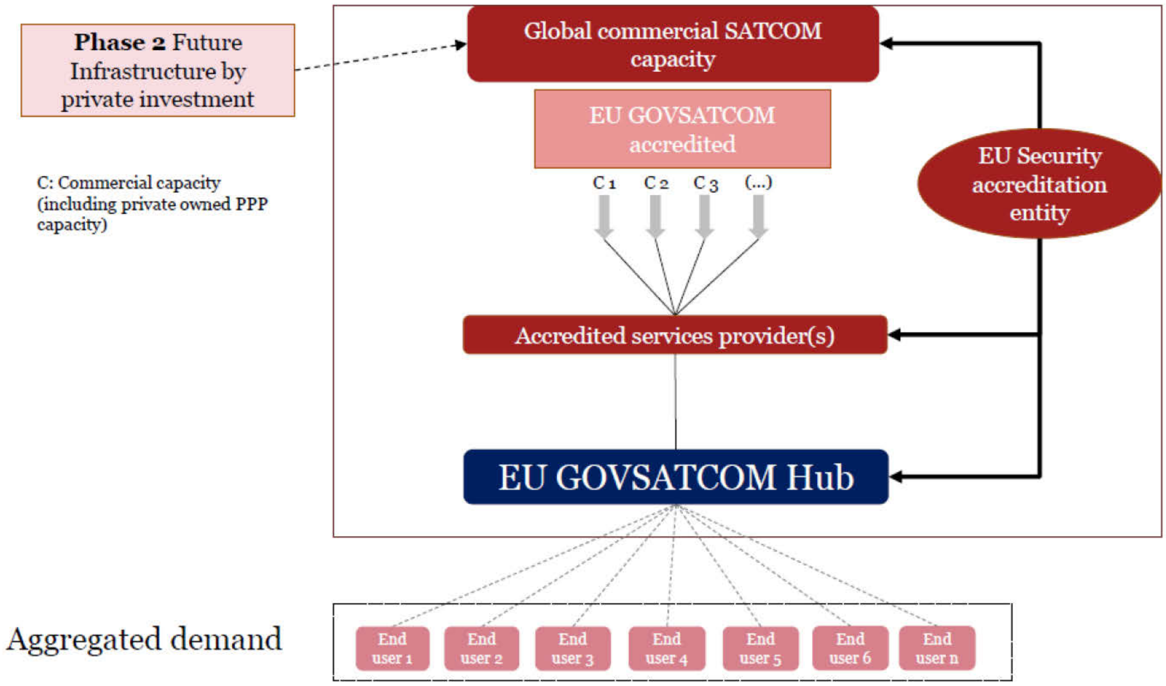


Figure 11 Option 1 Aggregation of demand and using commercial satcom capacity and services

5.3. Option 2: Aggregation of demand and using Member States' national space assets

In option 2, the demand would again be aggregated across the EU and Member States, and across civil and military boundaries. Operational and security requirements would be developed per service family. In contrast to option 1, the aggregated GOVSATCOM demand would be met by Member States' national surplus capacities alone. The security accreditation would be needed for industrial actors, for example if they play a role as service provider, or in the manufacturing process. The function of the EU GOVSATCOM hub is largely similar to option 1, but would need to interact with Member States satellite operators rather than commercial operators. For Phase 2, future infrastructure investments for the renewal of current assets and for 'gap-fillers' are done by and paid for by Member States, if and when they see the need and have then necessary budget available.

This option is in many ways similar to the NATO satcom Pooling & Sharing programme[31], where subsets of NATO Member States jointly provide capacity from their military satcom systems. The programme is governed by a Member States board, and the actual services are delivered by an industrial consortium under NATO contract. The users are exclusively 'authorised' user participating in NATO missions and operations. The users do not pay for their use; the fee for the joint satcom provision is paid from the common NATO budget.

[31] Cf. NATO's satcom post-2000 initiative, http://www.nato.int/cps/en/natohq/topics_50092.htm?selectedLocale=en

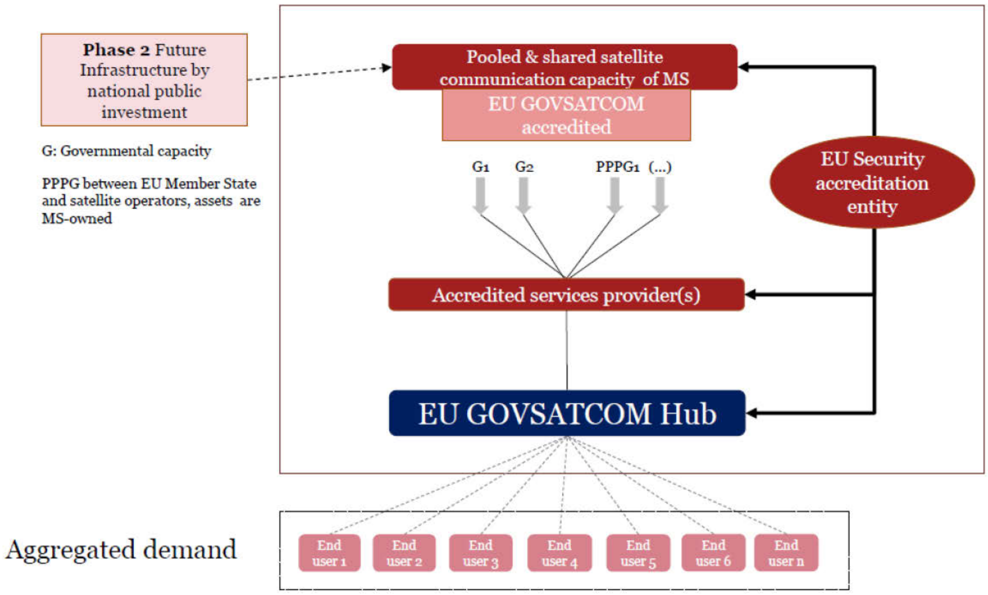


Figure 12 Option 2 Aggregation of demand and using Member States' national space assets

5.4. Option 3: Aggregation of demand, sharing commercial and national capacity, and Public-Private Partnerships (PPP) for future space assets if needed

In this option, during Phase 1 available Member States capacities are supplemented by accredited commercial providers if, when, and where needed (Figure 13a). The EU GOVSATCOM Hub would thus need to combine all tasks from the two previous options, and deal efficiently with multiple users and multiple public and commercial capacity and service providers.

In Phase 2 (Figure 14b), infrastructure investments for the renewal of assets and 'gap-fillers', needed for operational use around 2025, would be made by Member States and/or by the participating commercial entities. Only in cases where these are insufficient, EU-investments would be made via a Public-Private Partnership (PPP). This could take the form of a 'joint' satellite, but most likely it would be limited to a hosted GOVSATCOM payload. In such a PPP, the EU would join forces with private satellite operators/service providers to contribute to the timely development of new space assets. The Union would only pay a share of the total investment cost (at a percentage to be determined), but the private party would develop, procure and operate the satellite and the payload. In return, the EU would have guaranteed access to a proportional part of the capacity, and would pay a pre-agreed lower price for the service. The private operator could sell the remaining capacity on the commercial market. In an alternative PPP-like model, the EU could become a long-term anchor client during the full life-time of the satellite, with a Service Level Agreement (SLA) for services to be developed by private operators, thus reducing the risks associated with developing and using new space technologies. Various PPP-like models are possible and have been tested at national level and in ESA projects (LUXGOVSAT, UK-Paradigm, HISDESAT, and EDRS).

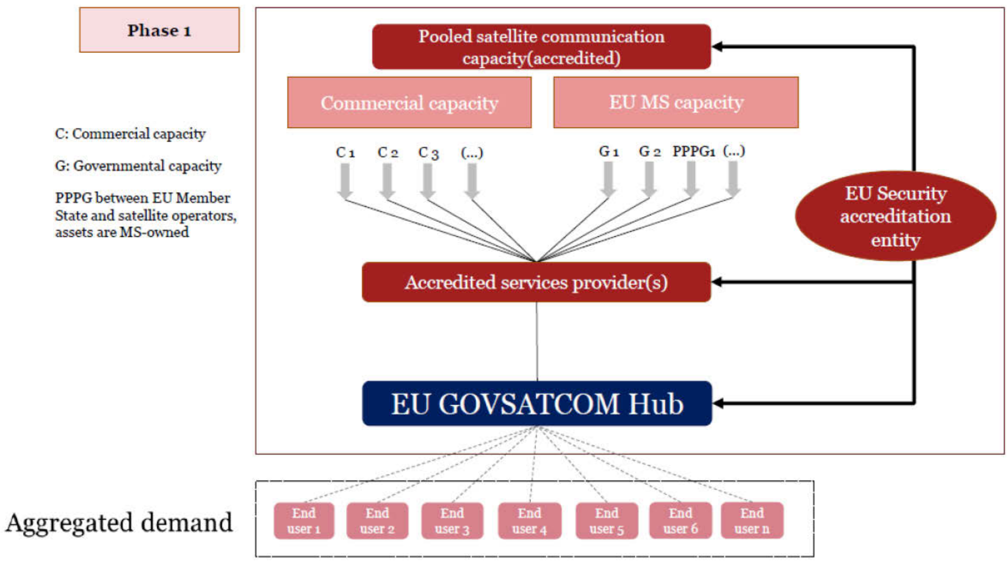


Figure 13a Option 3 Phase 1: Aggregation of demand, sharing commercial.

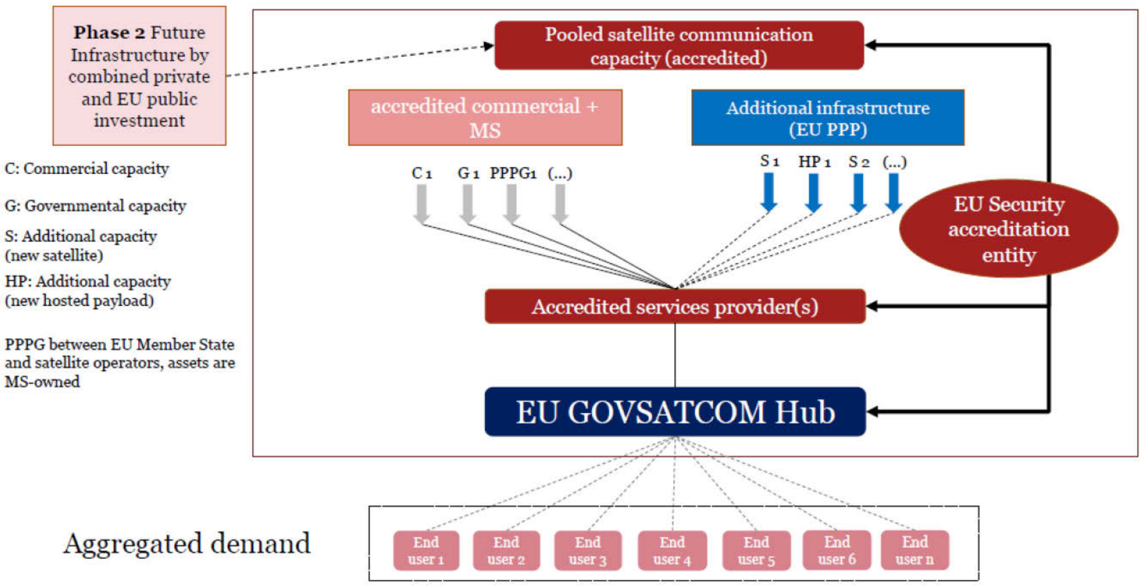


Figure 14b Option 3 Phase 2: Aggregation of demand, sharing commercial and national capacity, and Public-Private Partnerships (PPP) for future space assets if needed.

It is important to note that PPP or SLA solutions are only possible in the satcom domain because there is a functioning commercial market with competitive European private companies. This is not the case in other space domains such as satellite navigation, where an initial PPP approach for Galileo failed.

5.5. Option 4: Aggregation of demand, sharing commercial and national capacity, and using future EU-owned space assets if needed

Option 4 is identical to option 3 for Phase 1 (Figure 13a), where national and accredited commercial assets would be used initially. Similar to Option 3, the EU GOVSATCOM Hub would have to deal efficiently with multiple users and multiple public and commercial capacity and service providers. Beyond 2025 (Phase 2), deficits would be filled by the development of fully EU-owned and -operated space assets instead of a PPP approach. Similar to option 3, EU-owned assets would only be developed if available national or private investments are insufficient. Such space assets could range from the relatively minor parts (i.e. a hosted EU payload, for example a transponder), to EU 'gap-filler missions' where no national or commercial solution exist. An extremely ambitious long-term scenario could even foresee a constellation of satellites providing a truly global EU GOVSATCOM coverage. In this case the entire investment cost of new space infrastructure would have to be borne by the Union, but conversely the capacity can then also be fully used by all the EU GOVSATCOM users, free of further charges. However, the space infrastructure operations and the provision of services would in that case also need to be managed by the Union. This would lead to an additional EU satellite operations centre compared to the previous options.

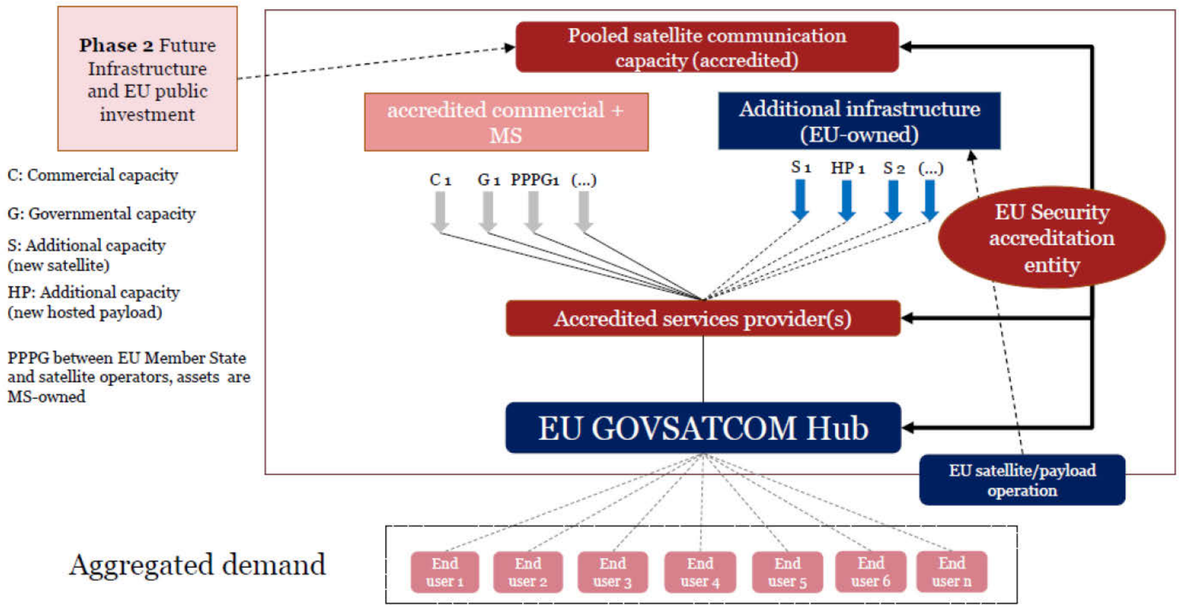


Figure 15 Option 4 Phase 2: Aggregation of demand, sharing commercial and national capacity, and using future EU space assets if needed. Phase 1 of Option 4 is the same as for Option 3, see Figure 12a.

5.6. Characteristics of the different options

The different options are summarised in the table below.

The phased approach means that different decisions need to be taken at different times. The first decision that needs to be taken for GOVSATCOM by the legislators concerns the satellites which will be used to provide the pooled capacity after the start of the program: only private capacity (Option

1), only Member States' capacity (Option 2), or a mix of the two (Options 3 and 4). On the longer term, in preparation for Phase 2, further decisions are needed at around 2022. In the case of Option 1 and 2 no further decisions are needed at this stage at EU level, since the investments for new infrastructure will be left to either private actors (Option 1) or Member States (Option 2). In the case of Option 3 and 4 further decisions are required in the case where the capacity is insufficient to cover the needs. In such cases it may be decided to develop such extra capacity as a public-private partnership, or as EU owned capacity.

One of the differentiators between the options is the ground infrastructure required for their operational management. All options 1-4 need a GOVSATCOM Hub(s). For options 1 and 2 the complexity of the task of the Hub will be slightly less than in Option 3 and 4, because the type of satellite operators with whom the Hub needs to interact is more limited. In Option 4, the required ground infrastructure is considerably more extensive because the EU owned satellites need to be operated from a dedicated satellite operations centre, in addition to the GOVSATCOM Hub.

Table 1 Summary of the characteristics of the different options

Option	**Aggregation of demand (civ/mil, EU/MS)**	**Security accreditation against joint security requirements**	**SATCOM capacity provided by**	**Phase 2 Investment for new space infrastructure**	**EU ground infrastructure needed**
0	No	No	Private (global) National EU MS US WGS	Private (global) National EU MS US WGS	None
1	Yes	Yes	Private (EU accredited)	Private (EU accredited)	EU GOVSATCOM Hub
2	Yes	Yes	MS national	MS national	EU GOVSATCOM Hub
3	Yes	Yes	Private (EU accredited) MS national	Private (EU accredited) MS national EU level PPP	EU GOVSATCOM Hub
4	Yes	Yes	Private (EU accredited) MS national	Private (EU accredited) MS national EU owned	• EU GOVSATCOM Hub • Centre to operate EU-owned satellites

6. Analysis of impacts

The impacts of the baseline and the four options for EU intervention were analysed in the PWC-2 study[32]. Underlying data from various earlier studies were used, including PWC-1 for demand from and identified risks by civilian users, EDA-EUROCONSULT[33] for the current and future military demand, and feasibility studies for different system-of-systems options to cover the military and civilian demand (based on PWC-1). The EDA-EUROCONSULT study relies on two ESA studies,

[32] Study in support of the Impact Assessment of an EU GOVSATCOM initiative, by PWC, 2017, for the European Commission

[33] Euroconsult “GOVSATCOM feasibility study”, 2017, for the European Defence Agency

undertaken by space industry in 2016/2017, which analyse the feasibility, technological and implementation challenges associated with a GOVSATCOM pooling and sharing approach[34].

The first step in the impact analysis identifies the significant impacts, listed in Annex 4. Those can be grouped in different sets of impacts primarily related to:

- **Defragmentation** and its related effects on issues such as process optimisation for users and suppliers and access of users to different satcom capacity, frequencies, and geographic coverage;
- **Security**, primarily in terms of guarantee of access and information assurance;
- **Economy**, such as cost on the long term (up to 2040), impacts on the overall economy such as Gross Value Added (GVA) and employment;
- **SME's;**
- **Competitiveness** of the European industry;
- **Research and innovation;**
- **Environmental and Social impacts.**

These groups of impacts are discussed below to explain how impacts materialise in the domain of secure satellite communications.

6.1. Defragmentation of demand and supply

Aggregating the demand is a feature of all options, except the baseline. The central effect is that user groups are regrouped. Whereas the current user groups are based on national and civil-military boundaries, the aggregation of the demand should lead to a grouping that is based on their actual use-cases and associated similar operational requirements. The High Level User Needs already takes a major step in that direction by distinguishing three main use-case families: Crisis management, Surveillance, and Key Infrastructures including diplomatic communications. Stakeholder consultations and the impact analysis by experts demonstrate the multiple positive effects related to aggregation of demand. Contracts for the procurement of capacity, services, and user equipment are larger and for longer duration. This reduces the cost of doing business for the private sector (dealing with a single knowledgeable anchor customer instead of dozens of smaller ad-hoc customers), and makes it easier and safer for individual users to use satcom. It also reduces the cost of satcom services procured on the commercial market: a 10-years contract for the same service is in the order of 30% less costly than short term contracts.

Additional positive effects is derived from the combination of the aggregation of demand with the pooling of supply and the establishment of a common security accreditation (other common features in all options, except the baseline). Although the security accreditation will initially limit the number of potential providers, it will also ensure that providers are European companies or EU Member States. Therefore, contrary to the baseline, budget spent on EU GOVSATCOM services will benefit EU companies (e.g. space manufacturing companies), will accrue in the European economy (GVA and employment), and will strengthen the EU's autonomy.

[34] ESA ARTES 1: Two studies titled 'Next generation of secure satellite network' by consortia led by Thales Alenia Space and Airbus Defence and Space.

On the supply side, pooling of the surplus satcom capacity from the few supplying Member States (an element of options n° 2, 3, and 4) will lead to a much better use of the existing capacity, and will allow for an optimisation of the usage across the EU in time and in geographic coverage. Member States who offer capacity and services to EU GOVSATCOM will be reimbursed, which will ensure a better return on investment for them.

The impact on 'increased solidarity between Member States' was not analysed specifically in PWC-2, but it is an important impact for all options, except the baseline. Today, the risks to be managed by security actors are not equally distributed: while some MS have a high risk of natural disasters and/or are in charge of safeguarding a difficult external EU border, others are favoured by a much lower risk of natural disasters and are surrounded by other EU Member States. Under all options, the demand aggregation leads automatically to a certain level of risk sharing. In the options 2, 3, and 4 the Member States with spare national capacity make it available to others through EU GOVSATCOM. Therefore these options result in increased solidarity between Member States.

Different EU GOVSATCOM Services and use-cases users will need different geographic coverage. They need different frequencies, depending on conditions (e.g. deployment in dry or rainy areas) and the available user equipment. Services will also have different needs for the actual volume, bandwidth or data rate. For example, for voice-calls, short messages or machine-to-machine (M2M) applications, limited data rates are sufficient, whereas the transmission of high-resolution imagery or live video-streams requires much larger data volumes. The enhanced ability to cover these diverse and evolving needs is therefore an important impact to be examined for the different options.

The EDA-EUROCONSULT-2017 study demonstrated that relying exclusively on nationally owned capacity (option 2) would lead to inadequate geographic coverage and would be insufficient to satisfy the volume and type of demand in the mid-term. This would improve significantly if nationally-owned capacity was complemented by commercial capacity (option 3).

The study also showed that two major shortfalls will persist, even when all currently available public and private capacity is included on the supply side: both the Arctic region and the needs for M2M low data-rate applications cannot be sufficiently covered. It is therefore important to develop an approach that can adapt to new use-cases as they evolve.

6.2. Security

Security impacts generally relate to risks for security actors conducting missions or operations for Member States or the EU (e.g. CSDP, EUROSUR). . The relevant stakeholders for this section of the impact analysis are the satcom users and their governments. The end-users in the field have the ability to assess most of the risks to which they are exposed during their operations. This was analysed in detail in the PWC-1 study. However, the acceptable level of risk is a matter of the responsible governments. The High Level User Needs gives a general indication of the acceptable level of risk for the EU Member States; they have been endorsed by the Council Political and Security Committee in March 2017.

The impacts of the different options can be assessed in terms of how well the different options mitigate the risks identified in the problem tree. This analysis was done in the PWC-2 study and details are presented in Annex 4 (Risk and High Level User Needs-system suitability analysis). The analysis was carried out for general risks addressed in the High Level User Needs, as well as for the specific needs identified per use-case family (Crisis Management, Surveillance, Key Infrastructures). The level of risk mitigation and coherence with expressed needs was analysed for various satellite systems, grouped into three categories of current systems: commercial satellites, national military-type systems, and the intermediate category of GOVSATCOM-like systems (for example currently Athena-Fidus). The analysis provides a semi-quantitative analysis to which extent the different systems are suitable for use according to the High Level User Needs.

This analysis shows the extent to which a GOVSATCOM-like or national highest security (MILSATCOM) system mitigates identified risks when compared to current commercial systems, and thus generates a positive impact for the users. This analysis provides a fair impression of the **current-day risks** depending on the mix of systems that a user decides to use.

The translation of the results of the risk mitigation suitability analysis to the four options is not straightforward. A single EU GOVSATCOM security accreditation (foreseen for all four policy options) would result in a drive for commercial systems to comply with such requirements in order to be able to bid for the large EU contracts. Some commercial systems would thus gradually move towards the GOVSATCOM-like performance in terms of technical security features such as anti-jamming and cybersecurity. However, other user needs, such as assured access and autonomy are linked to the level of control that is highest when a system and all its operational elements are owned or fully controlled by the users, i.e. by Member States governments or the EU.

In broad terms, Option 1 would be closest to commercial satcom systems, while option 2 would be situated in the GOVSATCOM field, including potentially some elements from the highest security national systems. Options 3 and 4 combine in the short term existing commercial and Member States systems, which provides users with access to the higher levels of security features, similar to option 2. In the longer term, in both options 3 and 4 dedicated systems could be developed for the EU GOVSATCOM users, thereby providing the best possible solutions to the expressed security requirements.

The results are summarised in a qualitative manner in Figure 16 for the different security problems that users may be encountered by users during operations, as identified via the problem tree in Section 2.2.

#	Impact	Option 0	Option 1	Option 2	Options 3 & 4 1st phase	Options 3 2nd phase	Options 4 2nd phase
1	Interoperability	=	=	++	=	+	+
2	Effective prioritization of users	=	+	+	+	+	+
3	Adequate and secure geographic coverage	=	=	=	++	+++	++
4	Availability of secure communication links	=	=	+	++	++	+++
5	Time to service deployment	=	=	+	++	++	++
6	Sustainability of the frequency bands allocation	=	=	+	+	+	+
7	Mitigation of theft of sensitive information	=	+	+++	+++	+++	+++
8	Mitigation of ill-intentioned acts	=	+	+++	+++	+++	+++

	leading to degradation of link						
9	Warning of the user in case of information usurpation	=	+	+++	+++	+++	+++
10	Mitigation of cyber-attacks harming the infrastructure	=	+	+++	+++	+++	+++
11	Long term eligibility of the provider (security accredited)	=	+	+++	++	++	+++
12	Operational non-dependence	=	=	++	+	++	++
13	Supply chain (long term) non-dependence	=	=	++	+	++	++

Figure 16 Overview of security related impacts for different options.

Interoperability (#1, the user can use different satellites with the same user equipment) is highest for national systems, because they have been designed to be interoperable, whereas commercial systems have not been designed to that effect.

Significant improvements are visible in mitigation of security risks (#4, #7, #8, #9, #10), guarantee of access (#5, #11), and autonomy of action (#12, #13) in the options where Member States assets are used, because those have already been designed to be used in situations where security risks exist. Commercial satcom providers are likely to develop certain security features over time, if they consider that a viable business-case exists. This leads to an improvement compared to the baseline in option 1 for technology-related security features.

The level of operational autonomy and non-dependence from 3rd countries (#12, #13) is highest in options 2 and 4, because fully owning/controlling infrastructure inevitably provides a stronger level of autonomy than a PPP or service contract. However, a strong institutional role as partner in a PPP (option 3) can stimulate R&D and the industrial competitiveness of the European Space industry, and can thus reinforce EU autonomy in the long run.

The security-related impact analysis demonstrates that option 1 (only commercial providers) is unlikely to provide sufficient improvement for security actors in the short and medium term. On the other hand, option 2 is unable to provide the required geographic coverage and is unlikely to provide the variety of services needed in the different use-cases. Geographic coverage is considerably improved according to the EDA-EUROCONSULT study when national and commercial systems are combined (options 3 and 4), and even better in the longer term when dedicated gap-filling infrastructure is developed.

6.3. Economic impacts

Economic impacts have been analysed in the PWC-2 study in different manners. One of the major impacts of EU GOVSATCOM is the cost of the satcom services, and in some cases the cost of the infrastructure investments (CAPEX) and operational costs (OPEX) needed to enable the services. A second group of economic impacts relate to the broader effects of public investments, such as changes in employment or Gross Value Added (GVA, a measure of economic output). Those have been analysed by econometric input-output modelling.

Cost

The cost analysis was carried out primarily to analyse the effects of different options on the total programme costs between the start of EU GOVSATCOM and the year 2040. Those cost estimates are indicative and cannot be regarded as a firm industrial cost prognosis. It is assumed that all costs in options 1, 2, 3, and 4 referred to below are paid from the EU budget. In the baseline the cost is borne by a combination of Member States and various EU institutions and Agencies, who would continue to procure ad hoc solutions.

The overall costs for the different options have been analysed on the basis of the following inputs and assumptions:

- EU GOVSATCOM Hub: setting up the Hub plus operation costs (estimates based on Euroconsult, 2017), assume a similar sizing as the operational Galileo Security Monitoring Centre. The indicative costs of the Hub are broadly similar for options 1 to 4, based on the assumption that security requirements and construction costs are the main cost drivers and that the slightly varying number of interconnected users/suppliers and the resulting operations costs have a limited impact on the overall budget. Detailed technical specifications and differential cost estimates will require an in-depth technical analysis, based on operational and security requirements, and can thus not be established in this report. The following figures present an indicative estimation:
  - Construction of 2 sites: € 34 M per site
  - Sites operation: € 3 M per site per year
- Service cost (cost of provision for GOVSATCOM-like service), based on (see Annex 4 for details):
  - The combined civil-military estimated demand volume (PWC-1 and Euroconsult-2017), see Figure 7.
  - estimated average price of COM-, GOV- and MILSATCOM per Mbps, with the price of GOVSATCOM as intermediate between COMSATCOM and MILSATCOM
  - The price per Mbps is assumed to decrease with time
- To analyse the effects of additional Phase-2 infrastructure in options 3 and 4 the following investments in space infrastructure were assumed:
  - Option 3 (PPP) 800 M€ EU investment, 50% by the EU, 50% by private companies. It is assumed that 20% of the demand will be covered by the PPP arrangement, at 50% of the regular price.
  - Option 4 (EU owned infrastructure) 800 M€ investment by the EU in the space infrastructure, and 200 M€ investment by the EU in a satellite operations centre. It is assumed that 20% of the demand will be covered by the EU owned capacity, free of further charge.

  Those investments were chosen to be on the high side so that the effects are visible in the cost analysis. In reality a public-private partnership can also be made for a much smaller investment.

The overall costs over the period 2018 – 2040 for the four intervention options and the baseline are shown in Table 2.

Table 2 Overall cost of implementation and operations of EU GOVSATCOM for the first 10 years and from 2018-2040, the ranges of costs are based on estimates of service costs for the different satellite system mixes, taking into account the overall decrease in price of commercial services with time (Source: PWC-2).The cost is expressed in 2017 constant prices, using a social discount rate of 4%.

	Baseline	Option 1	Option 2	Option 3	Option 4
Up to 2028 (M€)	1166	852-1117	1408	1305-1670	2014-2200
Up to 2040 (M€)	3287	2216-2951	4094	3504-4018	3077-3972

Those costs estimates were made on the basis of an important assumption for all options, including the baseline, namely that the total indicative demand for GOVSATCOM-like services (PWC-1 and EDA-Euroconsult 2017) is entirely met. This assumption is made for the sake of the comparison of the costs: that is the only way to compare the costs for the different option on the same basis. For the baseline the cost is currently incurred by the public authorities of the Member States and by Union institutions.

In the real world, the scenarios would probably evolve differently. In the baseline option we know that specific needs of many potential users cannot be met today. In the future, irrespective of the option chosen and implemented for EU GOVSATCOM, there may still be incentives for Member States' to use GOVSATCOM-like services from other sources such as the US WGS or non EU-accredited commercial providers. Moreover, costs and user-uptake depend on the payment model: if the NATO-model is used (where costs are paid in common and Services are provided free of charge to the end-user), it is more likely that the total estimated demand would be satisfied by the EU GOVSATCOM program. If, however, a pay-per-use scheme was used, the incentive for individual users to revert to secure EU GOVSATCOM would decrease due to cost-considerations and high administrative burden. Finally, many current users are bound by contracts with certain duration. It will take some time before they can change from current suppliers to EU GOVSATCOM. Therefore, this report's cost analysis should be used with these caveats: its main purpose is to illustrate the likely medium- and long-term effects of the different elements, and to enable a comparison between the options.

The cost-estimates show that the largest share of the programme budget is used in all cases to procure the services. Option 1 (only commercial providers) is expected to be less costly than the baseline, because the demand is aggregated, leading to a cost reduction of approximately 30%[35]. This cost estimate does not take into account additional new security features that satellite operators may include, which would increase the cost of the service. The figure should therefore be regarded as a minimum cost.

[35] Based on expert consultation with various satcom operators.

Option 2 (Member States capacity only) is likely to be more costly than the baseline, because Member States systems already integrate strong security features, protection and robustness, and are therefore more costly to build and operate than commercial systems.

In options 3 and 4, the cost estimates include infrastructure development as part of a PPP (EU plus industry) or as fully EU-owned infrastructure; both options would only be developed if deemed necessary. This would lead to additional investment costs in the medium term, which would subsequently be offset by the reduction in price of the services (to 0 in the case of fully EU-owned capacity). This effect is similar to the difference between renting a house and owning a house: in the short term, under uncertain conditions, renting costs less and provides flexibility. But buying a house is more cost effective in the long run, especially if the need for housing is stable for a long period of time.

In conclusion, long-term (up to 2040) costs are likely to be in a magnitude range of 2.2 – 4.1 billion euro. In the medium term, the differences are larger because of the investments needed in the first decade to ensure a future-proof solution in the long term. If only considering the first 10 years, the cost to the EU budget is highest for options 3 and 4, because in those cases the investments for additional space infrastructure will be in that period, whereas the financial benefits (lower cost of services) will only accrue in the later stage, in the 15 years (lifetime of satellites) after the investments are made.

Impact on employment and GVA

Jobs and growth (Gross Value Added, GVA) are directly correlated to spending analysed above. The impacts of the economic activities using an input-output approach have been modelled by PWC-2. The WIOD model36 was used to estimate the indirect and induced effects on GVA . The main results are shown in detail in Annex 4. The overall GVA impact is an increase between 2.7 and 5 billion euro. Compared to the total EU economy of about 14 600 billion euro (GDP37) this is an extremely small effect. In terms of employment the analysis shows that the EU GOVSATCOM investment may generate up to 8.000 jobs.

There are many caveats with this type of long-term analysis. The GVA and the employment are proportional to the total cost of services and investments made for secure satcom. There is however an important difference between the baseline and the four GOVSATCOM program options: in the baseline a non-negligible part of the funds is spent on non-EU systems and services (commercial and/or US WGS). With EU GOVSATCOM, almost the entire spending will accrue in the EU economy.

6.4. Impacts on SME's

The impacts of the options on SMEs are generally evaluated as limited. A representative of the major SME association stressed during the Stakeholder consultation that SMEs often do not have access to the same level of information as larger companies. This has in particular been the case in major PPPs

[36] Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", Review of International Economics., 23: 575–605

[37] Eurostat 2015

such as the Single European Sky ATM Research Joint Undertaking (SESAR)[38] or in other large projects (e.g. European Institute of Innovation and Technology, EIIT). When setting up large procurements or PPPs, it is therefore very important to ensure adequate SME access to information. Specific rules enabling further SMEs involvement in the procurement of the EU GOVSATCOM initiative would be beneficial for European SMEs under any option, as it would favour innovation: all stakeholders agree that SME's are essential in this regard. Such rules could for example include a minimum subcontracting volume in major procurements.

6.5. Competitiveness of EU industry

A competitive European satcom industry, including space and user technology manufacturing, is essential for a future-proof and autonomous provision of secure satellite communication services. Satcom operators are the main customer of EU-made satellite systems (~50% of the revenue), and the health of EU space manufacturing as a strategic sector is strongly dependent on the satcom sector. In many space-faring nations, national programmes - often security and defence related - act as anchor customers for their space industry. This is currently not the case for the EU. Industrial stakeholders (cf. workshop 15 June 2017, Expert questionnaire) invariably point to three main policy elements which would enhance the competitiveness of the EU space industry:

- Use the scale of the EU to act as a major anchor customer, and to set common security requirements and specifications for services and space or ground infrastructure;
- Provide long–term (7 or more years) visibility of the services and infrastructure to be procured;
- Rely on the EU supply chain for EU and Member States programmes.

These elements are included in all four policy options. They will lower the uncontrolled risks, and can trigger investments in new technologies and space infrastructure in line with the needs of EU GOVSATCOM, while at the same time improving the competitive position of EU industry towards customers in global markets.

The EU GOVSATCOM security accreditation (included in all four options) is also regarded as positive by the EU space industry: compliance with this 'EU quality label' would also increase the confidence of other potential customers.

A potential concern was raised by satellite operators that EU GOVSATCOM should not distort the currently existing market. This would be the case if the entire supply to EU GOVSATCOM users is provided by Member States capacity (option 2).

Lastly, competitiveness is also strongly positively linked to research and innovation discussed in the next section.

6.6. Research and innovation impacts

As repeatedly stressed during the stakeholder consultations, EU GOVSATCOM is expected to support the European industry and stimulate innovation. The very existence of an EU program would create a supportive framework for research and innovation and for the competitiveness of the European sector more broadly.

[38] Cf. https://www.sesarju.eu/

The main reasons are the programmatic certainty that will accrue from the initiative, which will send a positive signal for investment (including in RDI) in this strategic sector. In particular the pooling and sharing of supply, the aggregation of demand, the existence of an 'anchor client', the development of EU security accreditation, and the creation of the EU GOVSATCOM Hub, as common elements of all 4 considered options, would have strong positive effects on innovation. This is reflected in the broad support of all industrial stakeholders for the initiative.

Moreover, the specific policy objective on providing an appropriate level of EU non-dependence is intrinsically linked to the support of innovation in the sector, since this will be crucial to retain global competitiveness.

As already noted SMEs are essential for innovation. There is a need to ensure that potential PPPs are designed in such a way as to allow better access to SMEs and to ensure that there is enough flexibility for new entrants, while providing sufficient stability to make participation attractive for firms of all sizes.

From several studies (ESA, EDA) and from the expert/stakeholder consultations it is clear that one of the major technology and innovation challenges of EU GOVSATCOM is the development of the smart 'EU GOVSATCOM Hub'. See Annex 5 (provided by ESA) for additional relevant technologies for GOVSATCOM.

Research and innovation is stimulated by investments in state-of-the-art infrastructure, be it the GOVSATCOM Hub, or on the longer-term additional payloads, gap-fillers or satellites to obtain a better global coverage and new services. Technologically challenging objectives stimulate industry to invest in R&D and to innovate, which will subsequently enhance competitiveness on the global market. Option 3 offers the greatest potential to create an environment in which innovation thrives. In the short term, the EU as an anchor-client can stimulate innovation through requests for innovative services. In the longer term, the EU can leverage R&D investment through its partnership with industry for gap-filling infrastructure.

6.7. Environmental and social impacts

Based on the relevant sections of the High Level User Needs document and on the information received during the targeted stakeholder consultation, we expect some modest but nevertheless tangible positive impacts on the environment. All options for EU GOVSATCOM would enhance the operational capacities of actors at the national and the EU level, and would contribute in particular to the more effective monitoring of environmental risks (such as maritime accidents, oil spills, etc.), to the smooth functioning of critical infrastructure (remote supervision of dams, power-stations, etc.), and to the monitoring of the sustainable exploitation of natural resources (fisheries, Arctic, etc.).

In a similar vein, all four options for EU GOVSATCOM would generate direct and indirect social benefits for European citizens. Their safety and security will be enhanced when Police, Military, Border Guards, Civil Protection Services etc. operate more effectively. EU GOVSATCOM will also support more effective EU External Action worldwide, including CSDP operations and humanitarian aid, which will benefit the population in third countries.

However, options 3 and 4 will generate more positive environmental and social impacts by providing better security, geographic and frequency cover, and the highest level of EU autonomy.

7. Comparison of options

7.1. Comparison in terms of effectiveness, efficiency and coherence

The impact assessment including the targeted stakeholder consultations show that the main differences between the four GOVSATCOM options can be summarized in a limited set of major impacts, sometimes with differential effects on the short and long term (Table 3). The impact assessment study and stakeholder consultations also confirm that the different impacts are intricately linked and contain feed-back mechanisms. The comparison below takes a qualitative approach, because this does most justice to the highly complex matter at hand. Although the different stakeholders are surprisingly coherent in their views on the four options, there are some differential preferences for options, related to their position in the overall landscape as shown in Table 4.

Positive impacts related to **defragmentation** on the demand side, are noticeable in option 1 (aggregation of demand), and more importantly in option 2 where in addition to the aggregation of demand, the capacity of Member States with satcom assets is also pooled and shared with all EU Member States. However, the full positive effects due to synergies and scale effects of de-fragmentation are achieved in options 3 and 4, where Member States capacity is combined with commercial capacity. The positive impacts of defragmentation already occur in Phase 1 and continue in Phase 2.

Those synergistic and scale effects are also visible in the users' access to the **widest range of frequencies and the largest geographic coverage**: Both options 1 and 2 have limited positive effects in the first 5 years, in particular for those Member States without access to national or commercial assets. If Member States and private actors decide to develop additional space infrastructure under these options, the frequency and geographic coverage may increase further. But those decisions are largely beyond the influence of the users, especially for users from the EU and from small Member States which are unlikely to develop self-standing space infrastructure at national level. Frequency, flexibility and geographic coverage are best served by option 3 and 4 in Phase 1, because those options enable positive scale effects and complementarities between Member States and private satcom capacity providers from the outset. On the longer term, both options 3 and 4 could foster, if necessary, the development of new space infrastructure, making it possible to enhance the geographic and/or frequency coverage by filling gaps or replacing satellites which have reached their end of lifespan. In option 4 the investment is made entirely from the EU budget, in option 3 through a PPP. This means that for a similar budget, in option 3 the EU budget can leverage a more extensive space infrastructure, and therefore potentially with a larger geographic coverage. This could be particularly relevant for the Arctic region, where a full EU infrastructure may be too costly, but where private actors may see an emerging business case strong enough to justify a combined PPP investment. Therefore, in Phase 2 option 3 has a larger potential than Option 4 to create the best frequency and geographic coverage overall.

Table 3 Comparison of policy options against effectiveness and efficiency criteria differentiated for the short term effects in Phase 1 (< 5 years) and long term effects in Phase 2 (> 5 years).

Option	De-fragmentation		Frequency & geographic coverage		Information assurance including guarantee of access		EU autonomy		R&I & Competitiveness		Cost-effectiveness	
Time	<5	5+	<5	5+	<5	5+	<5	5+	<5	5+	<5	5+
Base	0		0		0		0		0		0	
1	+	+	+	+	+	++	+	+	+	+	+	+
2	++	++	+	+	+++	+++	+++	+++	+	+	=	=
3	+++	+++	++	+++	+++	++++	++	++++	++	+++	++	+++
4	+++	+++	++	++	+++	++++	++	++++	++	++	++	++

Information assurance, including guarantee of access - Seen from the perspective of the user, safe, effective and cost-efficient operations, in particular in cases where ground communication infrastructure is absent or cannot be trusted, require guaranteed access to secure satellite communications with appropriate levels of confidentiality, integrity, non-repudiation, and authenticity.

All options 1 to 4 represent a significant improvement over the baseline, as a consequence of the introduction of the security accreditation process. Security accreditation decisions would be made by an independent Security Accreditation Board on the basis of pre-defined security requirements specific for GOVSATCOM services. This will ensure that an agreed minimum level of information assurance and guarantee of access are always met when a security actor uses the services provided via EU GOVSATCOM, irrespective of the ultimate capacity provider. The current systems of commercial satcom providers (option 1) do not or not yet offer the needed security features, therefore the overall improvement of information assurance is minor in the first 5 years in this option. By introducing enhanced and innovative security features in future systems, and in general by adapting future investments to the security accreditation required for EU GOVSATCOM, the overall level of information assurance may improve with time for option 1. However, those decisions are taken on the basis of the business consideration of individual commercial actors, and not on the basis of public needs or ambitions for the EU to be an effective global actor. All options where Member States systems are used (options 2, 3, and 4) would provide from the outset higher levels of protection against ill-intentioned acts such as jamming. In contrast to commercial systems, Member States systems have been developed specifically with high security standards needed by governmental security actors.

Guarantee of access plays a particularly important role for users: their most frequent and obvious operational problems are related to this. The drawbacks of needing the satcom link for a crisis management operation today, but having to wait for 6 months before the contract is signed are hardly acceptable. Similarly, the risks of delays or denial of service by commercial parties - either' under political pressure from local powers or shareholders, or for commercial reasons if satellite coverage moves to a more profitable area - can hamper or undermine national or EU security operations. Guarantee of access is related to three interconnected elements: the technical means to establish a link and to communicate (access to a communication satellite with sufficient bandwidth and user equipment), the frequency and coverage which has to coincide with the time and place where the user needs the satellite link, and the user's government which must have sufficient control over the system to avoid interruptions or takeovers by hostile parties. EU autonomy is therefore strongly linked to this last element. Guarantee of access is by definition best ensured by owning the full system and by being in control (i.e. paying fully for) its operations. This is the case for systems owned by EU Member States (and/or possibly by the EU in the long run). Therefore, operational guarantee of access is best ensured in options 2, 3, and 4 which rely at least in part on Member States' or EU assets. For Phase 1 the guarantee of access for options 2, 3 and 4 is similar. For Phase 2 options 3 and 4 provide a better guarantee of access because dedicated GOVSATCOM satellite capacity will be developed.

EU autonomy is strongly linked to operational control over the system and its services, but it also has an important long-term dimension. Access to secure satcom capacities and services must be considered in a long-term perspective (a decade or more), because it is one of the indispensable tools to enable the ambitions of the EU as a global actor. To ensure that European security actors still have state-of-the art access to secure satcom in the next decade, new satcom systems and user equipment need to be developed, and satellites need to be launched. This can only be achieved if today's highly competent and competitive EU space manufacturing and launcher industry continues to flourish. It also means that the industrial supply chain, e.g. critical space technologies for such satcom systems, need to be fully mastered by EU industry. In the short term (Phase 1), EU autonomy is thus best served by using systems owned or controlled by EU Member States (option 2, and to a lesser degree option 3 and 4). But in the long run (Phase 2), EU autonomy is only possible if supported by an innovative and competitive EU space industry which both options 3 and 4 will foster. Since 'owning' in option 4 gives more autonomy than 'co-owning' in option 3 (PPP), option 4 could lead to marginally greater EU autonomy than option 3.

Research and Innovation (R&I) is directly linked to competitiveness. During the stakeholder workshop it was highlighted that SME's play a particular role in innovation by taking the risk to integrate new technologies in their products. The European Space Agency programmes and the EU Horizon 2020 programme have played an important role to foster the research and innovation potential of the European satcom and space industry. Co-funding and PPP approaches have proven successful to de-risk innovative concepts and technologies (see also Annex 5), and to maintain and enhance the competitiveness of the EU industry. All options are considered positive in terms of R&I and competitiveness, but the options that include a combination of Member States' and private assets (Phase 1 option 3 and 4) and in particular the option that includes the innovation-leveraging potential of PPPs (Phase 2, option 3) is considered to be most innovation-friendly on the long term, provided that PPPs are setup in such a manner that they are inclusive to SME's.

The cost to the EU budget consists of three parts: a) the costs to set-up the structures necessary to de-fragment the demand and part of the supply (Member States), i.e. the EU GOVSATCOM Hub; b) the cost of the capacity and services for EU GOVSATCOM users (authorised EU and Member States security actors), and c) in Phase 2 the investments in new infrastructure to renew systems or to fill gaps (option 3 and 4). The cost analysis was carried out for a long period, up to 2040. The cost of satcom services per Mbps is likely to be lower for option 1 (commercial capacity only) than for option 2 (national capacity only), because Member States systems have been specifically developed for use by security actors. They contain security features and have a certain level of robustness, but are therefore more costly to develop and operate. Initially, options 3 and 4 would be most cost-effective overall, because high-security users (e.g. CSDP missions) could use the pooled capacity of Member States, whereas users with lower security requirements could use the security level provided by accredited commercial satellite operators. Such a combination of commercial and Member States capacity would also allow users to continue to use their user equipment, i.e. there would not be an immediate need to change existing operational procedures for users, making those options also the most cost-effective for end-users. In Phase 2, industry could participate in option 3, and could co-finance in a PPP potential future investments, manage the operations of this space infrastructure, and sell part of the excess capacity on the commercial market. Satcom services would thus be available to the Union at reduced cost. In Phase 2, option 4, the Union would carry the full investment cost for gap-fillers in the long run, and would manage and pay for the satellite operations. The Union could in that case use the full satellite capacity for free. Option 4 requires a considerably higher initial investment from the Union than option 3. For the same level of EU investment, option 3 could lead to a wider range of space infrastructure that would better correspond to the widening range of use-cases in terms of frequency and geographic location. Therefore option 3 is considered to be more cost-effective overall than option 4 (more services per EU budget euro).

Stakeholders commonly agree with the problem definition (fragmentation, lack of secure satcom, guarantee of access and autonomy). They have indicated clearly in the various bilateral meetings and contributions and in plenary stakeholder events that all proposed options are significantly better than the baseline. Satellite operators pointed out that the options with the lowest risk of market distortion are the ones where the solution also relies on commercial satellite capacity (options 1, 3, and 4). Users have a preference for options 2, 3, and 4 where Member States capacity is included, because this provides the highest level of security and guarantee of access. However, users have also stressed the importance of having access to a range of services (frequency, location, security level, user equipment), so that they can tailor the solution to the particular mission or operational needs. This view is shared by Service providers, who can offer integrated, tailored, 'turn-key' end-to-end satcom solutions with different components (satcom capacity, equipment, installation and maintenance, training, etc.) for various users. The importance of a wider range of satcom capacity solutions (options 3 and 4) was also highlighted by the user equipment manufacturers. They also pointed out that on the longer term options 3 and 4 could lead to an EU standardised waveform[39], which would allow for enhanced interoperability. Space manufacturing industry had no particular preference for either option, but did point out that option 3 (with PPP) would provide the most conducive environment for innovation in the sector and hence for the overall competitiveness of the EU space sector. SMEs agree with this reasoning, but warn that from experience (e.g. SESAR, EIT-KIC) such PPPs or other form of structural long-term partnerships between the EU and industry can lead to a closed-shop effect: i.e. SME's have no timely access to information and are largely excluded from participation. All aspects considered stakeholders have a pronounced preference for options 3 and 4, valuing the combination of commercial and Member States capacity and the two stage approach. If asked to choose between those two, stakeholders have a slight preference for option 3

[39] The waveform is the characteristic of the radio wave used, to which both the satellite and the user equipment need to be tuned

(PPP), valuing the flexibility (users) and the positive impacts on innovation and competitiveness (industry).

Table 4 Comparison of the preference for different options as expressed by the different stakeholder groups.

Option	User	SATCOM Operator	Service provider	Space manufacturer	User equipment manufacturer	SME's
Base	0	0	0	0	0	0
1	+	++	0	+++	+	++
2	++	-	0	+++	+	++
3	++++	+++	++	++++	+++	+++
4	+++	+	+	+++	+++	++

Finally, taking all impacts into account, options 3 and 4 clearly provide more positive impacts than the others. Options 1 and 2 lead to sub-optimal outcomes: option 1 provides insufficient security guarantees, and option 2 is unlikely to provide sufficient frequency and geographic coverage. The difference between option 3 and 4 is relatively small and only discernible in Phase 2. Option 4 would lead to marginally higher EU autonomy, while option 3 is more cost effective on a 10 year time-scale. Furthermore, option 3 is likely to have the best impacts on research, innovation and competitiveness. Industry and users have a preference for option 3.

7.2. Preferred option

The preferred option is option 3: Aggregating demand, sharing commercial and national capacities and services, and using PPPs for additional space assets if needed.

In Phase 1 (for the purpose of the analysis, about the first 5 years), the demand will be aggregated across EU and national, and across civil and military boundaries. The EU GOVSATCOM capacity will be procured (via service level agreements) from Member States with national systems and spare capacity, and from commercial European satcom and Service providers. Any system used in EU GOVSATCOM will have to undergo a security accreditation process, based on the security requirements to be established with the Member States NSA's in 2018/2019. The security requirements may lead to different security levels for different services, for example high security level for crisis management operations outside the EU, and lower security level for disaster management interventions within the EU. A smart operational planning and management system, the Hub, is needed to interconnect the users and suppliers, namely the various operations centres of the different satellite systems. This is called the EU GOVSATCOM Hub.

The benefits of GOVSATCOM (lower cost per service, guaranteed access, and secure services) accrue to the highest extent when the widest range of relevant users is included and all secure satellite solutions are pooled, i.e. option 3. If the EU budget for GOVSATCOM is insufficient to cover the full demand for services (estimated at 100-150 M€/year) both the user groups and the providers will have to be limited. The effect will be that the economies of scale (larger and longer contracts) and risk spreading (e.g. coverage of natural disasters, crisis management) will not fully materialise. This means that the cost per service will go up and that the beneficial effects for EU industry (longer term certainty by the EU as anchor customer) will not materialise. For those potential users who can in that case not be served by GOVSATCOM (e.g. national public authorities, EU programmes such as

Border Management, depending on the choice of priority users) it means that substantial cost-reductions and equal access across the EU to secure and guaranteed satellite communications will not materialise. This will affect the security actors from Member States without national satellite communication systems most, depriving them of access to essential tools to carry out their missions and operations. If in Phase 2 additional space assets are deemed necessary on a European scale around 2025 and beyond, this could be implemented via an arrangements between the Union and private parties such as European satcom operators. Several examples of successful public-private partnerships already exist at national level, for example Paradigm in the UK, HISDESAT in Spain, or LuxGovSat in Luxemburg. ESA is using a similar approach to leverage innovation in projects, for example in the approach taken by the European Data Relay System on a Copernicus satellite. In satellite communications this is tried and tested concept that has been used variably for limited investments, such as hosted payload on a satellite, and to larger investments of full satellites. The investment cost for the public party ranges from ten million euro to several hundred million euro.

Option 3 has the advantages that it:

- Provides appropriate and differentiated levels of security, guaranteed access, European autonomy, plus significant overall benefits for citizens;
- Provides the highest level of defragmentation (demand and supply, between Member States systems and between national and commercial systems), as well as derived benefits such as simplification of procedures, or common (security) standards;
- Provides the best geographic and frequency coverage for the diverse military and civilian use-cases, and most flexibility for users to use their preferred user equipment;
- Does not distort the commercial satcom market, but rather makes it possible for the EU to act as an anchor customer;
- Provides more cost-effective services as a consequence of the built-in competition between different capacity providers, and the potential partial investment from the EU in the development of new space assets through shared investment with the private sector where appropriate;
- Stimulates R&D and leverages innovative technologies by sharing the technology risk through a public-private partnerships for future space assets;
- Remains overall cost-neutral when compared to the baseline-option, while providing considerable added value for all stakeholders.

This optimised option can only bring the full benefits if the EU GOVSATCOM capacities and services are free of charge to the core users in the EU and Member States. This model is successfully implemented in NATO, and contrasts positively with unproven pooling & sharing models on a pay-per-use basis which would generate substantial financial and administrative complexity for all participants. On the basis of the above, option 3 qualifies as the best option. However, since it partly relies on commercial decisions to develop new future gap-filling infrastructure there is a potential risk that industry will not see a sufficiently strong business case to justify its participation in a partnership with the Union. If such a situation would materialise, a decision could be taken to move to an EU-owned system (option 4). This would however require a slightly different set-up and governance of GOVSATCOM, because it would then have to assume the risks of launching, owning, and operating this space infrastructure.

7.3. Subsidiarity and proportionality of the preferred option

The preferred option makes it possible, through the staged and flexible approach, to limit the actions of the Union exclusively to those necessary, where actions by the Member States or by private actors do not provide appropriate solutions to the identified problems. In the initial stage it relies on existing Member States and private satellite systems, and only adds the EU level Hub as infrastructure investment. The EU Hub provides the link, or 'glue', between the private and Member States systems, and enables the separate systems to work in concert to provide appropriate solutions to all authorized users. This role as linking agent cannot be replaced by any of the other private or national actors: it can only be fulfilled by the EU, with an EU budget that is proportional to the task.

Equally, any future EU decision to develop gap-fillers would be preceded by a gap analysis to ascertain that such infrastructures will not be developed at Member States level, nor by eligible private actors. The public-private partnership approach also ensures that EU action does not distort the existing commercial market.

Aggregation of the demand will group use-cases already implemented at EU level (CSDP, border & maritime surveillance) and national use-cases. For national users, the individual Member States need to define their authorised users before they can engage in EU GOVSATCOM, similar to the Galileo mechanism for PRS, with the Competent PRS Authority in each Member States. This will ensure that the service provision by EU GOVSATCOM is strictly limited to those national users for whom there is a clear EU added value recognised by the Member States.

8. Implementation aspects, monitoring and evaluation

8.1. Implementation aspects

Principles and initial actions to be taken:

- EU GOVSATCOM Security requirements to be established by a competent Security Committee, taking into account both civilian and military requirements.
- Detailed user- and operational requirements for specific EU GOVSATCOM services to be established with end-users, possibly with the help of thematically competent EU Agencies (e.g. EMSA, FONTEX), EEAS as responsible for CSDP missions, and EDA.
- The analysis of the user- and operational requirements will make it possible to aggregate the demand across the EU, regrouping and translating user demands into coherent service needs. This will enable the establishment of the Service Portfolio and drive the specifications for the Hub.
- Staged implementation to allow for flexibility and constant adjustment to evolving demand and needs. Three stages can be envisaged:
    - Build-up phase 0: includes development of the Hub;

    - Phase 1: Delivery of operational services, aggregation of demand, pooling & sharing existing capacity;
    - Phase 2 (if necessary): Development of additional space infrastructure through PPPs.
- Modularity, to allow staged approach and to prevent oversized procurements (risk of creation of de-facto monopolies and/or technology lock-in).
- Flexibility and modularity are key to adjust to situations where the EU budget is insufficient to cover the full expenses of needed capacity and services, for example by limiting the number of users, or by limiting the services provided.

Phase 1: The following build-up actions should be carried out in the first 2-3 years**:**

- Developing operational and security requirements;
- Technical systems studies for the Hub, parallel studies to maintain open competition;
- Design, testing and development of the Hub, if needed in two separate locations;
- Demonstration services for different user groups;
- Establishment of a sharing arrangement between users of satcom capacity;
- Training of users and testing of user equipment;
- Road mapping/gap analysis for future user needs and planned Member State and private systems developments, identifying potential current and future gaps;
- Development of a shared approach for user equipment.

Depending on how fast this build-up phase is carried out, and how stringent the security requirements for the Hub are, the approx. budget for Phase 0 is estimated to be between 60 and 100 M€, with the largest part for the development of the Hub.

The provision of operational services through the EU GOVSATCOM system will start as soon as the Hub is operational. Operational services could be delivered with an estimated cost between 100 and 150 M€/year, including the operation of the Hub. The cost for operational services is relatively constant because increasing demand is compensated by decreasing costs per volume. During this phase, preparatory technical studies could establish whether and which additional space infrastructure or capability is needed. If Member States and/or commercial satcom providers make the necessary investment decisions to fully cover the evolving user needs, no further EU investments would be required and phase 1 would continue indefinitely. If gaps persist, Phase 2 could be envisaged.

The main risks in Phase 1 are related to the development and initial operations of the Hub, since this is the only GOVSATCOM infrastructure in this phase. The technical and security specifications of the Hub, including the question of whether one site is sufficient or two separate sites are required, and the breakdown of the cost of the Hub can only be established with the security and operational requirements.

Other risks in this phase relate to the supply of capacity and services. GOVSATCOM requires a sufficient number of Member States and private providers willing to enter into contractual arrangements with the Commission. It will take some time to acquire all necessary capacities and services, and some gaps might eventually persist. On the user side, the initial demand and its evolution over time will be unpredictable; in order to ensure an appropriate guarantee of access, a certain level of overcapacity will be required. To mitigate such demand-side risks it will be essential to maintain (contractual) flexibility to adapt to changes and to maintain possible spare capacities in reserve for future use.

The overall risk of cost-overruns is limited: security and operational requirements will be clearly established from the beginning, infrastructure development is only a relatively small part of the overall budget, and both the service provision and the number of authorized users can be tightly controlled.

Phase 2 If in the course of Phase 1 a detailed analysis of future supply and demand shows that the current approach is insufficient to cover the evolving demand, the decision may be taken to develop additional space infrastructure or capability through one or several PPPs or PPP-like arrangements. Depending on the gaps that need to be covered by EU investments, the EU budget envisaged could be up to 400 M€. It is not possible at this stage to foresee the exact PPP costs and arrangements that would be put in place. This depends on the nature and scope of the gaps that needs to be covered, on the necessary space infrastructure, and on private parties' willingness to engage in such a PPP. The results of a detailed analysis to that effect will be needed in 2022 to provide a solid factual basis in which those decisions can be taken.

Contractual and operational aspects, service interactions with users, as well as research & development are envisaged to be managed by agencies, for example EDA, GSA, SATCEN, or, specifically for space R&D activities, by ESA.

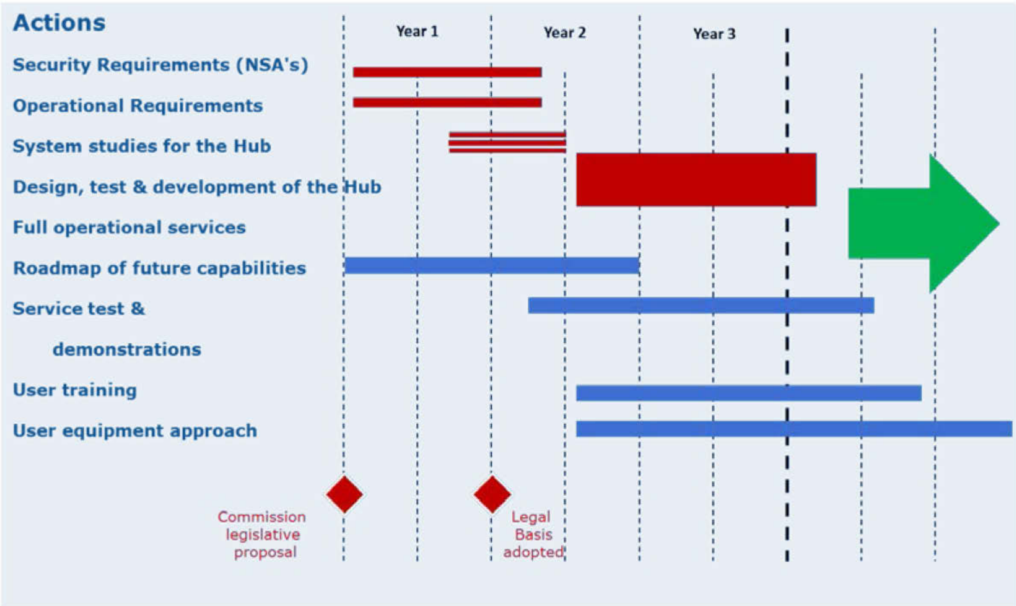


Figure 17 Diagram indicating the relative timing of the different actions needed during the build-up phase.

Brexit and European third countries

One of today's unknown factors in the implementation of EU GOVSATCOM is the effect of BREXIT. Several of the important commercial European satcom operators are indeed headquartered in the

UK, albeit with subsidiaries or branch offices on the 'continent'; many also strong links to the US. The UK has a strong space manufacturing industry, and is one of the current EU Member States owning satcom systems. The UK also has a long-standing experience with a PPP approach in this domain (Paradigm). These UK capabilities could be an asset to EU GOVSATCOM. In return, an inclusion in a future EU GOVSATCOM program would have positive effects on the UK industry, too. A BREXIT scenario with no UK involvement in EU GOVSATCOM on the demand and supply side would reduce the pool of available satcom capacity, services and know-how, and would have a negative impact on UK industrial actors. Whether and under which conditions third countries (Norway, Switzerland, and in the future the UK) can participate in EU GOVSATCOM is a sensitive political issue that will require careful consideration by the EU legislator and the countries concerned. Norway has already expressed a strong desire to participate in a similar manner to the other EU space programmes, and could provide valuable financial and/or operational assets, in particular for the Arctic.

8.2. Operational objectives and monitoring indicators for the preferred option

Operational objectives will be set for each phase (0, 1, and 2) with associated Key Performance Indicators (KPI's). The KPI's will be defined on the basis of operational and security requirements, and will be monitored by the Commission, supported by a Comitology Programme Committee. Major decisions (e.g. security and operational specifications, service definition, sharing arrangements, implementation of PPPs) may be implemented though Implementing Acts if foreseen in the Regulation.

For Phase 0, the main KPI would consist of operational readiness indicators related to the completion of the actions listed above.

For the operational phase 1, KPI's would relate to the provision of services through EU GOVSATCOM and to what extent those services are consistent with the expressed user requirements:

- Number missions and operations supported by EU GOVSATCOM;
- Number of different satellite systems linked to EU GOVSATCOM;
- Time to provision of satcom link in the case of crisis management;
- User satisfaction.

8.3. Practical arrangements of the evaluation

Technical evaluation will take place in a systematic manner for each major milestone leading to the establishment of procurements, infrastructure (Hub, possible space infrastructure) or operational services. A Commission-led board consisting of major stakeholders and independent advisory experts (ESA, EDA, other agencies) would be an appropriate mechanism.

In the first years an evaluation of the future user needs and of the planned private and Member States satcom systems will be required to establish if, when and where gaps exist that might be covered with a PPP approach.

Once an operational stage is reached, a continuous user feed-back mechanism should be implemented.

The EU GOVSATCOM programme needs to be evaluated by the Commission as part of standard mid-term MFF arrangements.

9. Annexes

9.1. Annex 1: Procedural information

9.1.1. Identification

Lead DG: DG GROW - Internal Market, Industry, Entrepreneurship and SMEs

Agenda planning/Work programme references: Agenda planning, Commission Work Programme 2017: 2017/GROW/02

9.1.2. Organisation and timing

The EU GOVSATCOM initiative was validated for the Commission Agenda Planning on the basis of the mini-roadmap procedure on June 21st 2016, and subsequently included in the Agenda Planning and in the Commission Work programme as a major initiative for Q4 2017.

The EU GOVSATCOM initiative was included in the Letter of Intent of President Juncker's State of the Union 2016 (14 September) under Priority 4: A deeper and fairer internal market with a strengthened industrial base.

The Inception Impact Assessment was published on Commission website on October 18th 2016.

The pre-existing Inter Service Group GOVSATCOM User Group was transformed into the GOVSATCOM Impact Assessment Steering Group (IASG), with participation of SG, SJ, BUDG, CNECT, DIGIT, HOME, ECHO, MARE, MOVE, EEAS, and JRC, RTC and HR-SECURITY joining in 2017. The IASG met seven times, first on September 19th 2016, and the final meeting took place on July 25th 2017. During the final IASG meeting the final draft Impact assessment Report was endorsed.

The Draft Impact assessment Report was submitted to the Regulatory Scrutiny Board on 24 August 2017.

9.1.3. Consultation of the Regulatory Scrutiny Board

The Regulatory Scrutiny Board (RSB) of the European Commission assessed a draft version of the present impact assessment and issued its opinion on 29/09/2017. The Board made several recommendations. Those were addressed in the revised IA report as follows:

RSB Opinion	Adjustments in the IA Report
(1) Problem definition The report does not provide enough	

justification and information on the initial and essential phase of this initiative (establishing the EU GOVSATCOM Hub).	
The report should further substantiate the need for creating an EU Hub against other options for aggregating user demand.	The GOVSATCOM Hub is part of the solutions. From preliminary analysis by ESA and EDA it is clear that a central operational system is indispensable to aggregate the unpredictable demand, optimise resources, and spread risks. The notion of the Hub is introduced first in the discussion on the different options (p. 32). The concept of the Hub and further options are substantiated with Figure 9 and in Chapter 5 for the different options.
The report should also better explain the specificities of the GOVSATCOM market characterised by imperfections arising from fragmented supply and demand from individual Member States, particularly smaller ones.	New section in paragraph 2.1 on - overall SATCOM market and history of public-private links. - regarding the 'EDA satcom Market' project we try to prevent confusion in terminology. - state clearly that in the GOVSATCOM domain a 'market' does not exist In section 2.2. Problem driver 1: Fragmentation of supply and demand: - added '... and security actors from individual EU Member States, especially the smaller ones, do not have the buying power to leverage tailored solutions from commercial operators.' - added comparison to insurance sector, where the same effect of defragmentation leads to resource optimisation.
The report should make a clear distinction between possible problems related to the level of security of communications, and the availability of sufficient communication capacity when needed.	Systematic distinction between security critical missions and operations (e.g. crisis management), which require access to satcom at any time/place, and security-critical information exchange, requiring protection against interception, intrusion etc. In section 2.2: **guarantee of access** and availability of sufficient capacity for unpredictable needs are extremely important. In section 2.2: the list of problems encountered by security actors is split into 1) Guarantee of access and availability and 2) Information Assurance:
(2) The baseline does not describe how the UK's departure from the EU affects demand for and supply of services or possible additional consequences.	
The baseline should explain the assumptions it makes about the UK participation. It also needs to clarify to what extent the success of this initiative would depend on the participation of the UK.	A section was added in paragraph 5.1. (Baseline option) to explain the role of the UK in the current supply and demand. From the (qualitative) analysis it is clear that the success of GOVSATCOM does not critically depend on the participation of the UK.
(3) Options and choice of options **The structure of the options and criteria for their comparison are not sufficiently clear. As a result, the report does not clearly support the choice of the preferred option.**	
Make a clearer distinction between the choices to be made in phase 1 (covering options 1 and 2 and also the first phase of options 3 and 4) and in phase 2 (second phase of options 3 and 4). For phase 2, the report should clarify which decisions the legislators already needs to take now and why.	In the introductory section of Chapter 5 (Policy Options) a section was included explaining the two phases and the rationale for using those two phases in the analysis of the options. A new section has been added (5.6) summarising the characteristics of the options and the nature and timing of the decisions that need to be made.
The report needs to explain better the precise scope/tasks of the Hub and the related costs for all its dimensions (i.e. instrument to match demand and supply; system to connect different users; role	In Chapter 5 (page 32, under Underlying elements of options) the section on the contractual and operational aspects has been expanded, with a separate diagram (Figure 9) to explain the role of the Hub as the central operational entity ensuring

of joint procurement office; responsible for the billing system/sharing agreement; role to check usage and performance, responsible for checking security accreditations; governance of Hub by Commission/agency). The report should also clarify possible different roles and dimensions of the Hub under different options. Where choices need to be made on the organisation of the Hub, the report should present the various options.	the provision of GOVSATCOM services. In each option the function of the Hub is summarised. In the new section 5.6 the differences between the options in terms of ground infrastructure (Hub) are summarised and compared. The scope and tasks of the Hub are described at the level of current knowledge, based on the studies by ESA and EDA. The precise technical tasks and related costs of each of its functions can only be established after systematic technical analysis of the operational and security requirements and system engineering studies, as explained in section 6.3 and 8.1 (Implementation aspects). The intention is to carry out three parallel system engineering studies in order to allow for sufficient competition in potential Hub solutions.
With regard to phase 2, the report needs to elaborate further the criteria and the reasoning for choosing between options 3 and 4.	Changes in Table 3: Coverage already + for Phase 1 (for have not's) Changes in the text to consistently highlight effects in phase 1 and phase 2. New section at the end of section 7.1.
In the comparison of options, it should explain how the security dimension is operationalised through elements such as security accreditation, guarantee of access, EU autonomy etc.	In section 7.1 an additional explanation of the security accreditation process is introduced.
(4) Risks in Phase 2 **The report does not analyse the various risks related to a potential implementation of phase 2, such as possible cost overruns and the risk of creating too much capacity.**	
The report should be more explicit about various risks: - the uncertainty of the future demand for GOVSATCOM, - possible cost overruns, - the willingness of Member States to participate, - the willingness of commercial actors to participate in the envisaged PPP.	Sections on the various risks are included in section 8.1
The report should provide details on the justification and operation of the PPP arrangement in phase 2. It should detail its risks and what would make the case for full public ownership 3 and operation.	At the end of section 7.2 a section has been added to explain that moving from option 3 to 4 is possible, but would mean changing the nature of GOVSATCOM. In section 8.1 – Phase 2 a section was added to explain that the detailed nature of a PPP cannot be established today, but needs to be the result of a detailed analysis around 2022.

9.1.4. Evidence and sources used for the IA

The main sources used in this Impact assessment are:

PWC2 - PwC study for the European Commission, **2017 (ongoing).** *Study in support of the impact assessment of an EU GOVSATCOM initiative*.

PWC1 - PwC for the European Commission, **2016**. *Satellite communication to support EU security policies and infrastructures. https://publications.europa.eu/en/publication-detail/-/publication/92ce1a30-0528-11e6-b713-01aa75ed71a1*

EDA-EUROCONSULT Study - Euroconsult for the European Defence Agency, **2017**. *Governmental satellite communications (GOVSATCOM) feasibility study.*

ESA Studies, by industry consortia led by ADS and TAS, **2017**. *Next generation secure satellite network "SECURESAT"*

HIGH LEVEL USER NEEDS - *High Level Civil Military User Needs for Governmental Satellite Communications* (Council Doc. 7550/17 LIMITE of 22.03.2017), endorsed by the Political and Security Committee of the Council of the European Union on 29 March 2017.

9.1.5. External expertise used for the IA

European industrial actors provided extensive expertise on a wide range of matters related to satellite communications.

The **European Defence Agency**, and in particular the Project Team satcom and its Member States Representatives provided expertise regarding the various defence related aspects of GOVSATCOM. An important part of this expertise was channelled to this impact assessment through the EDA-Euroconsult study that was finalised in early 2017.

The **European Space Agency** Directorate of Telecommunications and Integrated Applications provided extensive expertise regarding space and ground systems involved in satellite communications, technology development and industrial matters. ESA provided input on the basis of own expertise and on the basis of the two ESA 'SECURESAT' industrial studies conducted in 2016/2017. The ESA inputs are summarised in Annex 5.

The European Commission Expert Group on Governmental Satellite Communications, consisting of experts nominated by the EU Member States and a observers from Norway, EDA and ESA. Five meetings of this expert group were held during the course of the EU GOVSATCOM impact assessment, building on the results of earlier meeting.

18 experts covering the range of different stakeholder communities participated in the workshop on June 14th at the European Commission premises, and filled in the extensive questionnaire regarding assumptions on the baseline option and its future development, and the various impacts of the 4 options.

The **EU Agencies EMSA, FRONTEX** provided expertise on maritime and border surveillance and the use of RPAS.

The **EEAS Crisis Management and Planning Directorate** provided extensive expertise regarding operational aspects of CSDP civilian and military missions and operations.

9.2. Annex 2: Stakeholder consultation (Synopsis Report)

Background

The EU GOVSATCOM inception impact assessment (I.I.A.), published by the Commission in late 2016[40], recalled the context and the problem definition of the initiative, stressed that action at the EU level was necessary, and suggested Article 189 TFEU as legal base.

MS seemed to be largely unaware of the I.I.A. Industry and their respective Associations had spotted the I.I.A. early on, but reached a consolidated position only later. Stakeholders' reactions to the I.I.A. are thus incorporated in their positions expressed throughout the consultation, and in particular at the industry workshop (15.06.2017) and the high-level meeting with MS (06.06.2017), as well as in their respective written inputs.

Consultation methodology and approach

Regarding the stakeholder consultation, the I.I.A. recalled that studies and the first consultation initiatives had already been carried out in 2015 and 2016 with various institutional and industrial actors. In April 2016, the Commission had set up a Group of MS' experts to provide advice and feedback for the further elaboration of the EU GOVSATCOM initiative. This Group has notably supported the establishment of the high level civil-military user needs document[41], which aggregates in a comprehensive manner the generic needs and expectations of EU GOVSATCOM users, and thus covers an important aspect of the stakeholder consultation.

The I.I.A. also identified the EU GOVSATCOM stakeholders, and defined the consultation strategy. An open public consultation on the Space Strategy in early 2016 had already addressed some related issues. The I.A.A. confirmed that no further self-standing public consultation would be conducted since the subject was security-sensitive and deserved a level of understanding of security needs and risks which could not be shared with the public.

With regard to the Commission's four general principles governing the consultation of stakeholders, the essential requirements have been met:

(1) Participation: within the constraints of a non-public, targeted consultation, all relevant stakeholders were aware of the initiative and could provide timely inputs. We involved them from the early stages of the process, and addressed the EU level, MS and industry in various "plenary formats", including the Commission's internal inter-service Group, Council Space Working Party and MS Experts Group, as well as through Industrial Associations. All stakeholders had the opportunity to provide feedback if they so wished. We carried out bilateral discussions and received written contributions. The high-level meetings were respectively attended by all interested MS and by a representative cross-section of industrial actors.

[40] http://ec.europa.eu/smart-regulation/roadmaps/docs/2017_grow_002_govsatcom_en.pdf, dated 18.10.2016
[41] Council Doc. 7550/17 LIMITE of 22.03.2017

(2) Openness and Accountability: we explained the policy options under consideration at an early stage, and invited stakeholders' specific feedback which was used to further elaborate the baseline scenario, the hybrid options and the preferred option.

(3) Effectiveness: Building on earlier studies and consultations which laid the groundwork for the decision to announce a legislative proposal in the Commission's Work Program 2017, we consulted stakeholders at a very early stage, from the publication of the I.I.A. in late 2016 onwards. Stakeholders were also systematically consulted by PWC for the I.A. Study.

(4) Coherence: We consulted the Commission-internal Impact Assessment Steering Group (IASG), including on methodology, stakeholders, policy options, and the PWC Study. We informed this group regularly on the milestones, initial results and final outcome. The Group endorsed DG GROW's approach and expressed satisfaction with the outcome of the I.A.

Who was consulted?

Governmental users are the main EU GOVSATCOM users and therefore main stakeholders. The regular meetings of the Experts Group thus covered an essential part of the consultation. Since April 2016, the Group has met 8 times to elaborate the high-level civil-military user needs and to cover other relevant topics including the requirements for the potential EU GOVSATCOM use cases (cf. I.A. Report). Finally, it also provided feedback during the PWC I.A. study, and commented on the pre-final draft.

In line with the I.I.A., additional consultations were launched to target specific stakeholder groups. These consultations were carried out as part of the I.A. study, during bilateral contacts with MS' authorities and industrial actors.

The main focus of this targeted consultation was on MS and Industry:

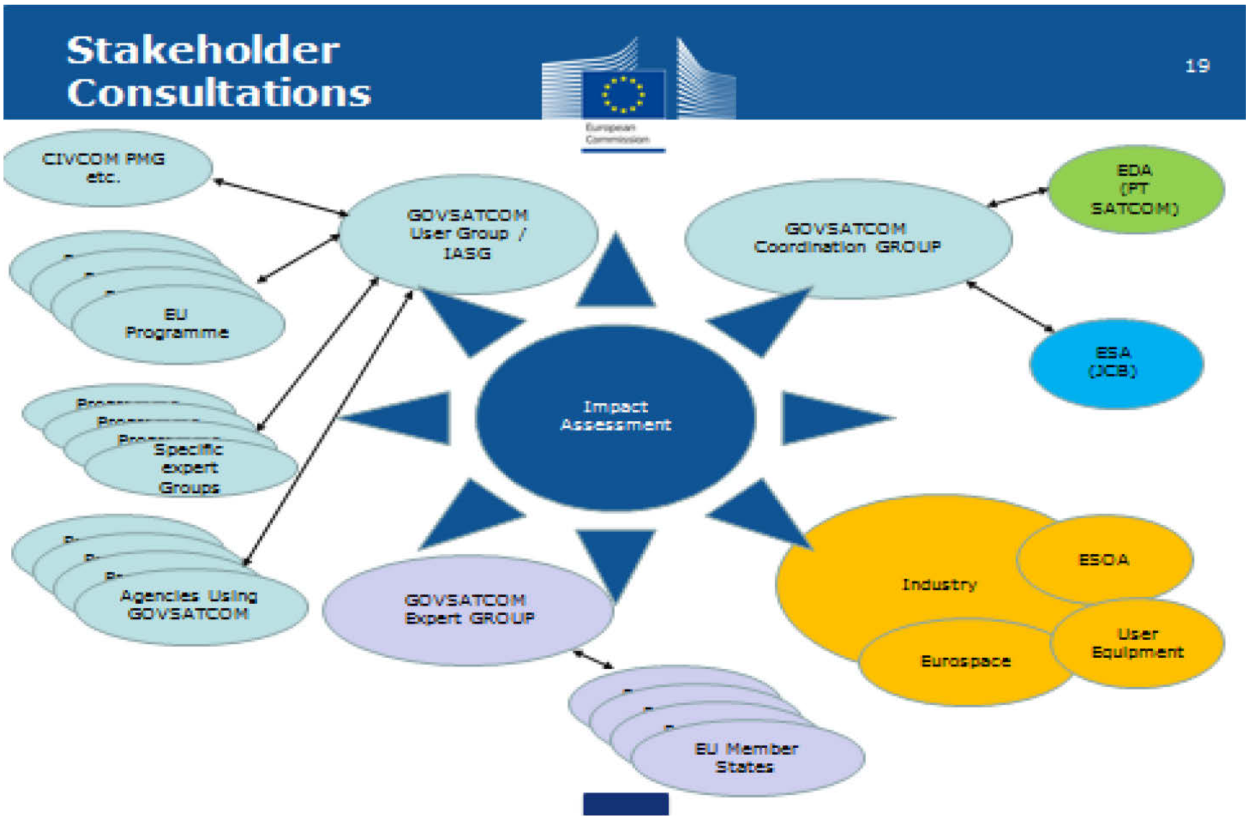
- MS were consulted in their double function as potential providers of governmental satcom capacities and as future users of EU GOVSATCOM. In bilateral discussions in Brussels and in MS' capitals, we discussed with the interested national administrations (including line-Ministries, Military forces and potential civilian users) their experiences and capacities, their current and future national needs, and their expectations with regard to an EU initiative.

- On the side of industry, all relevant domains were covered from satellite operators and service providers to satellite manufactures and SMEs. We reached out to individual enterprises and to the relevant industrial associations ESOA (Satellite Operators), Eurospace (Manufacturers) and SME4Space (SMEs).

Together, the Commission, ESA, EDA and the EEAS form the EU GOVSATCOM Coordination Group; its main aim is to ensure coherence, complementarity and coordination between the respective activities. In this forum we regularly consulted EDA, EEAS and ESA as stakeholders on all aspects of the planned initiative.

Finally, the Commission-internal inter-Service Group, which later morphed into the Impact Assessment Steering Group (IASG), brought together the various line-DGs and associated Agencies who might be affected by the EU GOVSATCOM initiative. We presented our evolving proposal, gathered feedback on the operational challenges and requirements, collected information on commercial solutions, and refined our proposals accordingly.

The following figure provides a visual overview of the stakeholder consultation.



Main results of the stakeholder consultation

The targeted stakeholder consultation culminated in two major events: a) a high-level meeting with EU MS; and b) a widely advertised workshop with industry, which brought together some 80 representatives of the various sectors concerned. In both events, the hybrid policy-options were presented which had been adapted to incorporate stakeholders' initial comments. Both meetings delivered the necessary feedback for the I.A. Process.

High-Level meeting with MS and Observers

This non-public meeting with MS at Senior Management level also included representatives from the EEAS, the EU Military Staff, the Civilian Planning and Conduct Capability. EDA, ESA and Norway participated as observers. The discussions were based on a non-paper by the Commission Services which described the impact assessment process and the policy options under consideration.

In a short introduction, the Commission informed on the state of play and the next steps. EDA and ESA gave a succinct overview of their ongoing satcom work, and expressed support for the Impact Assessment. ESA stressed that satcom was a vibrant and competitive commercial market that should not be distorted, and that EU GOVSATCOM offered significant opportunities to support

European R&D and the industrial competitiveness. PPPs were a proven tool to efficiently share market- and technology-risks. EU GOVSATCOM could act as an anchor client, and provide a powerful stimulus for renewing existing satcom capacities and for filling gaps.

MS appreciated that the Commission, EEAS, EDA and ESA continued to work hand-in-hand on this critical issue. The subsequent discussion was structured around the 7 key questions of the non-paper:

- When asked whether MS shared the analysis of the problem and the overarching objectives of the initiative, several interventions expressed explicit support for the problem analysis and for the principle of an EU initiative to provide a modular, step-by-step solution based on existing satcom assets. Interventions also generally supported the overarching objectives. One MS underlined the need to guarantee the EU's strategic autonomy, based on European technologies and capacities. EU GOVSATCOM could also help to compensate competitive handicaps caused by the *de facto* closure of major third countries' markets to international competition. Other salient points were the need to tackle the security aspects in a timely manner, and to define the overall systems architecture and Services' requirements. Several interventions confirmed the increasing civilian and military needs for guaranteed access to secure satcom. Some suggested using existing national surplus capacity as a starting point, while others proposed the integration of adequate commercial or PPP capacity from the outset. Some interventions suggested to start with providing secure satcom capacities to EU institutions and Agencies only, while others stressed the need to cover MS' needs from the outset. Norway confirmed its interest to participate in an EU initiative.

- Regarding the issue on whether and how to aggregate the existing demand across the civil and military spectrum, and across the EU and national boundaries, one intervention stressed the need for a civilian EU GOVSATCOM solution under civilian control, without recourse to national military satcom assets. One other MS underlined that the EU GOVSATCOM initiative should federate civilian and military demands. It should also rely on MS' and commercial satcom assets and capacities, build on ESA and EDA work, focus on gaps and missing links, and put in place hybrid solutions on a permanent basis.

- When asked whether MS agreed with the pooling and sharing of national surplus satcom capacities, and whether they would provide or use such capacities, several interventions explicitly supported the Pooling & Sharing approach, stressing the advantages of immediately available assets and 'quick wins'. Several MS with national assets or capacities reaffirmed their willingness to make them available for an EU solution, under conditions still to be defined. Other MS without national assets confirmed their interest as users. Some MS underlined that national assets should not be the only solution; EU GOVSATCOM should also include other solutions including EU ownership and management. The EU GOVSATCOM objects, systems architecture, and governance needed to be defined in detail. Some MS suggested starting with national assets, and with EU institutions and Agencies as primary clients. Others reaffirmed that national assets should only be one component of a more comprehensive solution - the EU should 'think big' from the outset. One MS recalled the need to tackle possible frequency and spectrum issues in the International Telecommunication Union (ITU) context. There was a broad agreement on the need to speedily identify available national surplus-capacities and their likely evolution in the coming years, as well as the specific present and future user- and service-requirements. Based on the outcome of this analysis, a strategic approach was needed to fill possible gaps through 'future-proof' solutions. Differentiation along different security requirements could be an option. Several interventions stressed that national capacities alone might possibly satisfy short-term needs, but will not be sufficient in the long run. Some of the gaps (e.g. Arctic) are already known.

- Regarding the set up and operation of the EU GOVSATCOM hub, the following salient points were made: one should seek inspiration from existing solutions in EU Space programs such as Galileo, Copernicus or Space Surveillance and Tracking (SST); an in-depth systems study was necessary before addressing operational practicalities; the design of the hub and its governance will depend on the nature of capacities used; cost-efficiency and the capacity to cater for all needs should be the decisive factor.

- Regarding the long-term financing of EU GOVSATCOM capacities, incl. the renewal of existing space assets, the filling of gaps, or the provision of global coverage, most interventions agreed that the EU Budget should pay for the EU GOVSATCOM usage by EU institutions and Agencies. Some also argued that EU GOVSATCOM should become a full-fledged, budget-financed EU Program. Others suggested leveraging the market to the extent possible in the short-term, to explore co-financing by MS and commercial actors, to look into what ESA could do on innovation and R&D, or to address the long-term issues later. No clear picture emerged on the long-term financing options and the renewal of existing assets: One MS stressed that EU GOVSATCOM should not be detrimental to existing EU Space Programs, and should not change the priorities of the current and future MFF. There should be no substantive budgets in the start-up phase, and no automatic transition to a costly fully operational program. Another MS advocated that, on the contrary, there should be no interruption after the build-up phase; the EU needs to address future challenges now. One MS suggested not to dodge the difficult financing issues, and proposed that not all elements would have to be paid from the same source. Another MS underlined that a systems study was necessary, but that this study should build on strategic objectives and politically agreed levels of ambition for the EU; one MS said regarding the long-term renewal that the EU should only become active if commercial suppliers cannot deliver. One MS suggested addressing the user needs and the technology / competitiveness angle, the latter was clearly an EU responsibility. EU GOVSATCOM Services should not distort competition. EDA suggested an early start and a gradual, step-by-step approach to build confidence as soon as the guiding principles were agreed; EEAS, supported by ESA and some MS, drew the attention to the need to also address the (dedicated) EU GOVSATCOM Ground Segment from the outset, so as to efficiently aggregate supply and demand, and to inject innovation.

In conclusion, the meeting was very useful to clarify the respective expectations, priorities and possible red-lines of MS. The close cooperation between the Commission, EDA, and ESA was appreciated, and several MS called for a political steer and coordination by the Commission. The meeting demonstrated a broad emerging consensus on the European dimension of the underlying problem and on the need for a European solution.

MS' written contributions following the high-level meeting

MS who required more time for internal coordination later provided written contributions. Most inputs reiterate the nuanced but overall supportive statements of the high-level meeting; one MS expressed a sceptical attitude towards the EU GOVSATCOM initiative. This MS regards the high-level user needs document as a basis for a political discussion, but does not consider it to be a sufficient foundation for an operational program. The country criticises the lack of stringent quantitative forecasts on the future evolution of demand and supply, and questions the existence of a capability gap on the basis of existing EDA, ESA and Commission studies, in particular for civilian users and applications at the national and EU level. The country also criticizes the exclusive focus on satcom. While it supports the general pooling & sharing approach and civil-military synergies, it underlines that military requirements should not serve as justification for civilian procurements. They consider that they cannot comment on detailed issues regarding policy options, governance, and financing of EU GOVSATCOM. Regarding the EU GOVSATCOM hub, the country favours an SST-model and insists on assets and capabilities remaining under national control; national users should pay for the capacity and services they require. The renewal of space assets, too, should remain exclusively a national responsibility, and the country formally excludes the procurement of EU satellites.

Workshop with industrial stakeholders (Brussels, 15.06.2017), and subsequent written inputs

Institutional User perspective

Relevant European Agencies and Services, including EMSA, the EEAS and EDA, gave a short presentation and developed their respective vision on EU GOVSATCOM.

European Maritime Safety Agency (EMSA)

Remotely Piloted Airborne Systems (RPAS) complement Maritime surveillance activities by bridging the gap between different types of sensors and platforms. Secure satcom are indispensable to enable communications of RPAS beyond radio line of sight. Existing commercial satcom capacities do not offer suitable costs-effective solutions, the current satellite throughput and user data rate do not meet the performance requirements and satcom beams are not necessarily directed to maritime areas of interest. EU GOVSATCOM could bring more capacity over areas of interest, and secure civilian RPAS' command & control- and payload-links at a more reasonable cost by pooling demand and increasing satellite capacity. However, in case of dual use applications, possible prioritisation issues between civilian vs. military users may occur and need to be addressed, guaranteeing continuity and availability of service. Furthermore, military requirements may lead to a different and heavier cost structure. EMSA also pointed out the high-level needs for satcom terminals in maritime RPAS missions: they should be small, light-weight and should be able to operate with multi-frequency bands (Ku/Ka).

European External Action Service (EEAS)

Communication capabilities are of critical importance for all missions supported by the EEAS Civilian Planning and Conduct Capability (CPCC). Between 2008 and 2015, most civilian CSDP missions used ad hoc communications- and satcom solutions, with different contracts, different standards and different performance- and security-levels. Since 2015, most of the civilian (and non-executive military) CSDP missions are now procuring satcom services via the EDA satcom market. The EEAS hopes to implement GOVSATCOM solutions by 2021. Several specific features are expected, such as ground segment standardisation and supply chain, total control of expenses, synergies between military and civilian CSDP missions, high availability and deployment's speed, technical support, and improved security including non-localisation of terminals in the field and anti-jamming.

European Defence Agency (EDA)

The EDA recalled the Ministerial Steering Board decision of November 2013 for a GOVSATCOM roadmap, in collaboration with MS, ESA and the Commission. EDA undertook a feasibility study to evaluate the different Information Exchange Requirements (IER) for CSDP-, national defence-, and civilian missions. The study demonstrated an increasing need for more secure satcom solutions and guaranteed access; this mid-level demand is currently not satisfied by commercial satcom providers, and cannot be met in cost-effective way by MILSATCOM. GOVSATCOM key drivers are performance, security and assured access for all users. The study has highlighted the benefits of a pooling and sharing approach, which is currently being implemented in an EDA demonstration project.

Industry Association perspective

EMEA Satellite Operator's Association (ESOA)

The importance of secure communications is increasing. Fragmentation of existing satcom offers is a natural consequence of diversity in user needs and allows flexibility for an evolving market. Experience shows that existing user communities have established relationships over time that give them control and autonomy over their procured solution. The EU GOVSATCOM initiative should not seek to replace existing practices that work well, nor introduce an unnecessary level of bureaucracy. It should leverage Europe's satcom strengths to extend best practices to MS who currently do not make significant use of them and ensure that future innovation from the private sector is not stifled. One size does not fit all, and the EU GOVSATCOM program should complement public solutions with both public and private experience.

SME4SPACE

SME4SPACE expressed its interest in and support for the EU GOVSATCOM initiative, but requested more information so as to better assess the impacts on SMEs. Information should be shared directly with SMEs, who should not be dependent on prime contractors. The procurement of space assets (Space and Ground segments) is complex as it combines space requirements, security obligations and consortia rules. Procurement rules should be simplified to enable more flexibility and SME participation. Furthermore, small PPPs should be considered for specific sub-system, to enable SMEs to lead PPP projects.

Satcom operators' panel discussion

A panel of major satellite operators discussed the EU GOVSATCOM policy options and impacts. The current commercial capacity was deemed sufficient and planned evolutions would cover increasing future demand for bandwidth and new applications. EU GOVSATCOM should move in step with the demand, and organise the pooling and sharing in an efficient manner. Regarding the policy options, satellite operators stress the need for flexibility as most users required different services. Option 1 would work best, in particular in combination with other options. EU GOVSATCOM should not only focus on capacity, but also on service-management and -access, standardisation, as well as security and governance. A single portal from which different users could procure adequate solutions would best achieve the policy objectives. Existing satcom terminals should be utilised to enable cost efficiency. Option 2 has drawbacks, and needs to be combined with other options. National MILSATCOM services and terminals are expensive, and the defence-driven architectures cannot provide the level of flexibility that users expect and that commercial satellite operators can provide. The EU GOVSATCOM hub should incorporate all central functions to organise and manage demand and supply, and implement standardisation, security and governance. This option would offer an adequate service in terms of costs and security, and would allow the industry to respond to evolving user needs. In all options, the planned aggregation of demand will generate new commercial opportunities and stimulate business activities for the entire industrial value chain. Option 4 was not recommended, as the evolving commercial capacities, together with the EU as an anchor-client or partner in a PPP, could in all likelihood cover all potential gaps.

In summary, option 3 was considered to be the best approach. It was deemed crucial to define the appropriate level of governance, security and standardisation early on. Satcom was a mature market: open competition, based on compliance with single, EU-wide security standards, was key to avoid market distortions or other negative impacts on satellite operators; security requirements should not be artificially raised in order to maintain broad competition. Streamlined European security standards could create new commercial opportunities beyond the EU and stimulate R&D. Any pricing imposition by the EU was considered detrimental to operators. Competition and innovation would automatically lead to lower prices.

Public-Private Partnership (PPP) models for EU GOVSATCOM

Hisdesat presented its cooperation with the Spanish MoD to highlight the benefits of PPP solutions which offer greater operational flexibility: since investments are made by the private party, the public sector does not have to deal with ownership, management and maintenance issues and avoids capital expenditure which could increase public deficits.

Service Providers' perspective

Two European service providers agreed that the pooling and sharing approach of EU GOVSATCOM should be encouraged, if it offered the necessary flexibility. A modular, sequenced program would optimise the use of available European resources. EU GOVSATCOM should enable a flexible planning, a secure hybrid network management, and the efficient orchestration of demand and supply of capacities and services. Equipment and tools should be security-certified. A PPP option would maximise the cost-effectiveness.

Space- and ground-segment manufacturers’ perspective

The panel expected EU GOVSATCOM to stimulate innovation and competitiveness, and to increase technology awareness by end-users. Space manufacturers are evolving in an increasingly competitive global environment. The European governmental satcom market had not yet reached the critical size necessary to trigger sustained market growth. Governmental satellites represented only a small part of the accessible market for European manufacturers. Non-European competitors benefitted from strong national support, including cross-subsidies and support for R&D. EU GOVSATCOM should support the competitiveness of European industries, and should be designed with a modular architecture, providing a wide range of solutions for all user needs. Various levels of security-accreditation should be considered. Manufacturers would eventually benefit from all 4 policy options insofar as they all triggered new demand for hardware. But option 3 with a focus on bridging the service gap might be the economically most efficient model. A shared procurement and manufacturing approach by MS and the EU would stimulate innovation and allow the development of standard-setting EU technology solutions.

GOVSATCOM research and innovation

The panel of ESA experts covered the topics of ground segment architecture, feasibility studies on the space segment, optical satcom including Quantum Key Distribution (QKD) and EDRS evolution, and the approach to technology & product development and future projects. Panellists stressed the opportunities which EU GOVSATCOM offered for the development of key strategic assets and innovative solutions, and their incorporation into operational services. ESA also underlined the importance of pooling and sharing, as the aggregation of satcom resources and solutions made them both more appealing for users and created more business opportunities for the industry.

Key-findings from PWC's Impact Assessment Study with regard to stakeholders' positions

Several experts representing the key stakeholder groups provided their structured views on the initiative, via a questionnaire, to assess the impacts of each policy option with respect to the baseline, both in the short and long term.

Two policy options present the highest scores for additional social and economic impacts: options 3 (EU GOVSATCOM as an extended capacity through Public Private Partnership) and 4 (EU GOVSATCOM as an extended capacity through EU-owned infrastructure) present the best impact scores in the short- and long term. Stakeholders were almost unanimous to highlight the efficiency and flexibility of a phased implementation, keeping the options open to adapt the operational phase and the future evolution of the program on lessons learnt during the initial build-up phase. Relying initially on existing commercial and governmental satcom assets would also demonstrate the benefits and added value of the initiative build confidence and attract new security users.

9.3. Annex 3: Practical implications of the initiative for the affected parties

MS will be affected in different ways depending whether they own satcom capacity or not. MS who own satcom capacity can, if they wish, make surplus capacity (i.e. not used for national operations) available through EU GOVSATCOM against a fee. All MS, also those who do not own satcom capacity will be able to make use of secure and guaranteed satcom services through EU GOVSATCOM for their authorised users. MS will need to spend less for access of their security actors to secure and guaranteed satcom.

The end-users of secure satcom are governmental actors involved in missions and operations which require secure and guaranteed means of communication, even under circumstances where usual ground based communication lines are absent (remote areas, maritime domain), where they have been destroyed (natural disasters, crisis situation), or where they are under the control of, or can be influenced by, untrusted entities. End-users will need authorisation from their EU MS to make use of EU GOVSATCOM services. For many end-users EU GOVSATCOM will enable their access to secure and guaranteed European satcom services. For end-users from MS who already own satcom capacity there will be little direct change, but they can benefit from an enlarged offer in terms of capacity, services, and/or frequency and geographic coverage. If they engage in a joint mission or operation with other EU MS's they can be certain that all parties have equal access to secure satcom.

End-users will be able to continue to use the user-equipment (terminals) that they have used before, because option 3 combines both commercial and MS capacity and services. The only exception is the case where users were using a satcom system that has not been security accredited for EU GOVSATCOM (usually a third country system, or a private system from a third country entity). In such cases the end-user MS still has the choice to use such a non EU GOVSATCOM system, but the contractual and service arrangements will in such a case not take place through EU GOVSATCOM.

End-users will also be affected because they will no longer need to prepare individual contractual arrangements with satellite operators. The end –users will have access to different services depending on their specific use-case and associated operational requirements. For example: an EU GOVSATCOM crisis management service, or an EU GOVSATCOM RPAS service.

Satellite operators will be affected because they can only participate in EU GOVSATCOM after a security accreditation process. Once they have been accredited, their contractual arrangements will be made with EU GOVSATCOM rather than with individual end-users (aggregation of demand).

Citizens will be indirectly affected because governmental security actors who carry responsibility for the security and safety of European citizens (inside and outside the EU) have better access to secure means of communication, an essential tool enabling them to carry out their work effectively.

9.4. Annex 4: Analytical models used in preparing the IA

Significant impacts analysed in this impact assessment:

Economic impacts

- Overall Costs
- Impact on employment from investment
- Impact on GVA from investment
- Impacts on business' market share and comparative advantage in an international context

Impacts derived from the problem tree (mainly based on risks to operations):

- Systems are interoperable with other satcom and terrestrial networks
- Possibility to prioritise users and level of guarantee for the prioritisation
- Absence of communication links due to inadequate coverage of the area
- Use of non-secured communication links due to absence of appropriate satcom
- Use of non-secured communication links due to bandwidth bottleneck
- Absence of communication links due to delay for service deployment
- Signal interruption due to bands saturation
- Use of non-secured communication links
- Sensitive information theft
- Mission interruption or degradation due to ill-intentioned acts
- Awareness of the user in case of information usurpation
- Risk of cyber-attacks harming the infrastructure
- SATCOM services are interrupted because provider is non-eligible
- Supply from non EU countries is interrupted
- Capacity / service provision from non EU countries is interrupted

Other impacts:

- Impacts on increased solidarity between MS
- Costs of doing business and administrative burden for private sector
- Impacts on the cost in the satcom supply chain
- Effects on SMEs
- Competitiveness of the EU space industry on the global markets
- Process optimisation for suppliers of secured satcom and equipment
- Process optimisation for users of secure satcom
- GOVSATCOM-like bandwidth capacity to be provided
- Ability to face threats in the future
- Affordability of satcom services
- Confidence in European space and ground infrastructure supply and renewal
- Guaranteed access to satcom
- Setting up and operating the EU GOVSATCOM Hub
- Stimulation of innovation and research
- Costs of doing business and administrative burden for public sector
- Impact on frequency allocation and orbital positions

Risk and system suitability analysis.

The PWC2 study analysed the suitability of three current categories of satcom systems (Commercial, GOVSATCOM-like, and Military systems) for EU GOVSATCOM users, by assessing the extent to which they comply with the High Level Civil-Military User Needs (High Level User Needs). Figure 18, Figure 19, and Figure 20 show the results for the use-case families of Crisis management, Surveillance, and Key Infrastructures.

In general, there is a marked improvement of the suitability index (0 unsuitable, 100 is fully suitable, in green in the figures) when moving from commercial systems to GOVSATCOM-like systems. The difference between GOVSATCOM-like systems and military systems is minor for the needs expressed by potential EU GOVSATCOM users in the High Level User Needs.

The information from this current-day suitability analysis was used to analyse the extent to which in the policy options would be suitable to the security needs as expressed in the High Level User Needs.

High Level User Needs			Commercial		Governmental		Military	
			Suitability score	Standard deviation	Suitability score	Standard deviation	Suitability score	Standard deviation
4. Risk acceptance	4.1	Assured Access	60	18	80	11	80	0
	4.2	Jamming and Interference	40	25	60	42	80	2
	4.3	Interception and intrusion	30	23	80	0	80	0
	4.4	Space operations	80	9	80	4	90	5
	4.5	Cybersecurity risks	30	23	80	0	80	0
	4.6	Geolocation of User Terminals	40	22	90	10	80	0
	4.7	Dependence on third parties	60	11	70	12	80	12
5. Information assurance	5.1	Security accreditation	30	23	50	35	70	8
	5.2	Confidentiality, Integrity and non-repudiation of transmitted	40	22	80	6	80	0
	5.3	User Access	70	17	90	6	80	0
	5.4	Control and Prioritization of GOVSATCOM services	70	14	70	3	80	15
	5.5	GOVSATCOM "link status" service (LSS)	40	22	80	6	80	0
6. Common needs	6.1	Interoperability and standards	60	24	70	18	60	0
	6.2	Terminals needs	50	25	30	21	10	19
	6.3	Frequency and Orbit allocation	80	15	100	6	100	0
	6.4	Training and Concept of Use	90	7	90	7	80	0
7. Specific needs: crisis management	7.1	Governmental users benefiting from the Service						
	7.2	Mission location, area and communication path	50	16	60	2	60	0
	7.3	Supported communication services	60	42	100	0	90	12
	7.4.1	Specific application to be supported - Telemedicine	70	40	100	0	100	0
	7.4.2	Specific application to be supported - Logistic / administrative	40	50	60	0	60	0
	7.4.3	Specific application to be supported - Welfare	20	34	50	58	60	53
	7.5	Time Constraints	70	16	80	4	90	5
	7.6	Terminal needs	20	31	40	47	40	37
8. Specific needs: Surveillance	8.1	Governmental users benefiting from the Service						
	8.2	Mission area and communication path						
	8.3	Supported communication services, platform, terminal type						
	8.4	Mission Location						
	8.5.1	Time Constraints - Near real time						
	8.5.2	Time constraints - Permanent coverage						
	8.6	Terminal needs						
9. Specific needs: key infrastructure management	9.1	Diplomatic Networks and Humanitarian Aid						
	9.2	Space infrastructures						
	9.3.1	Aviation - ATM						
	9.3.2	Aviation - Global Flight Tracking						
	9.4.1	Land transports - Rail traffic management						
	9.4.2	Land transports - intelligent transports systems						
10. Specific use cases	10.1	Specific user needs related to the Arctic Region	60	22	70	0	70	4
	10.2	Remotely Piloted Aircraft Systems (RPAS)	20	23	60	42	70	0
	10.3	Machine to Machine (M2M) and low data rate applications	10	18	50	30	60	0

Figure 18 Risk and system suitability analysis for the Crisis Management use-case family. A suitability score of 100 means that this need is entirely covered, or the risk entirely mitigated. In grey user needs which are not relevant to this use-case family (Source PWC2).

High Level User Needs			Commercial		Governmental		Military	
			Suitability score	Standard deviation	Suitability score	Standard deviation	Suitability score	Standard deviation
4. Risk acceptance	4.1	Assured Access	60	18	80	11	80	0
	4.2	Jamming and Interference	40	25	60	42	80	2
	4.3	Interception and intrusion	30	23	80	0	80	0
	4.4	Space operations	80	9	80	4	90	5
	4.5	Cybersecurity risks	30	23	80	0	80	0
	4.6	Geolocation of User Terminals	40	22	90	10	80	0
	4.7	Dependence on third parties	60	11	70	12	80	12
5. Information assurance	5.1	Security accreditation	30	23	50	35	70	8
	5.2	Confidentiality, Integrity and non-repudiation of transmitted	40	22	80	6	80	0
	5.3	User Access	70	17	90	6	80	0
	5.4	Control and Prioritization of GOVSATCOM services	70	14	70	3	80	15
	5.5	GOVSATCOM "link status" service (LSS)	40	22	80	6	80	0
6. Common needs	6.1	Interoperability and standards	60	24	70	18	60	0
	6.2	Terminals needs	50	25	30	21	10	19
	6.3	Frequency and Orbit allocation	80	15	100	6	100	0
	6.4	Training and Concept of Use	90	7	90	7	80	0
7. Specific needs: crisis management	7.1	Governmental users benefiting from the Service						
	7.2	Mission location, area and communication path						
	7.3	Supported communication services						
	7.4.1	Specific application to be supported - Telemedicine						
	7.4.2	Specific application to be supported - Logistic / administrative						
	7.4.3	Specific application to be supported - Welfare						
	7.5	Time Constraints						
	7.6	Terminal needs						
8. Specific needs: Surveillance	8.1	Governmental users benefiting from the Service						
	8.2	Mission area and communication path	70	8	70	0	70	4
	8.3	Supported communication services, platform, terminal type	30	22	80	0	80	0
	8.4	Mission Location	70	13	70	0	70	4
	8.5.1	Time Constraints - Near real time	70	28	80	4	70	0
	8.5.2	Time constraints - Permanent coverage	90	8	80	4	90	5
	8.6	Terminal needs	20	31	50	54	50	47
9. Specific needs: key infrastructure management	9.1	Diplomatic Networks and Humanitarian Aid						
	9.2	Space infrastructures						
	9.3.1	Aviation - ATM						
	9.3.2	Aviation - Global Flight Tracking						
	9.4.1	Land transports - Rail traffic management						
	9.4.2	Land transports - intelligent transports systems						
10. Specific use cases	10.1	Specific user needs related to the Arctic Region	60	22	70	0	70	4
	10.2	Remotely Piloted Aircraft Systems (RPAS)	20	23	60	42	70	0
	10.3	Machine to Machine (M2M) and low data rate applications	10	18	50	30	60	0

Figure 19 Risk and system suitability analysis for the Surveillance use-case family. A suitability score of 100 means that this need is entirely covered, or the risk entirely mitigated. In grey user needs which are not relevant to this use-case family (Source: PWC2).

High Level User Needs			Commercial		Governmental		Military	
			Suitability score	Standard deviation	Suitability score	Standard deviation	Suitability score	Standard deviation
4. Risk acceptance	4.1	Assured Access	60	18	80	11	80	0
	4.2	Jamming and Interference	40	25	60	42	80	2
	4.3	Interception and intrusion	30	23	80	0	80	0
	4.4	Space operations	80	9	80	4	90	5
	4.5	Cybersecurity risks	30	23	80	0	80	0
	4.6	Geolocation of User Terminals	40	22	90	10	80	0
	4.7	Dependence on third parties	60	11	70	12	80	12
5. Information assurance	5.1	Security accreditation	30	23	50	35	70	8
	5.2	Confidentiality, Integrity and non-repudiation of transmitted	40	22	80	6	80	0
	5.3	User Access	70	17	90	6	80	0
	5.4	Control and Prioritization of GOVSATCOM services	70	14	70	3	80	15
	5.5	GOVSATCOM "link status" service (LSS)	40	22	80	6	80	0
6. Common needs	6.1	Interoperability and standards	60	24	70	18	60	0
	6.2	Terminals needs	50	25	30	21	10	19
	6.3	Frequency and Orbit allocation	80	15	100	6	100	0
	6.4	Training and Concept of Use	90	7	90	7	80	0
7. Specific needs: crisis management	7.1	Governmental users benefiting from the Service						
	7.2	Mission location, area and communication path						
	7.3	Supported communication services						
	7.4.1	Specific application to be supported - Telemedicine						
	7.4.2	Specific application to be supported - Logistic / administrative						
	7.4.3	Specific application to be supported - Welfare						
	7.5	Time Constraints						
	7.6	Terminal needs						
8. Specific needs: Surveillance	8.1	Governmental users benefiting from the Service						
	8.2	Mission area and communication path						
	8.3	Supported communication services, platform, terminal type						
	8.4	Mission Location						
	8.5.1	Time Constraints - Near real time						
	8.5.2	Time constraints - Permanent coverage						
	8.6	Terminal needs						
9. Specific needs: key infrastructure management	9.1	Diplomatic Networks and Humanitarian Aid	30	22	30	21	10	19
	9.2	Space infrastructures	30	21	60	42	80	2
	9.3.1	Aviation - ATM	30	23	60	42	80	2
	9.3.2	Aviation - Global Flight Tracking	10	18	60	0	60	0
	9.4.1	Land transports - Rail traffic management	30	23	60	40	80	2
	9.4.2	Land transports - intelligent transports systems	30	23	50	35	60	0
10. Specific use cases	10.1	Specific user needs related to the Arctic Region	60	22	70	0	70	4
	10.2	Remotely Piloted Aircraft Systems (RPAS)	20	23	60	42	70	0
	10.3	Machine to Machine (M2M) and low data rate applications	10	18	50	30	60	0

Figure 20 Risk and system suitability analysis for the Key Infrastructure use-case family. A suitability score of 100 means that this need is entirely covered, or the risk entirely mitigated. In grey user needs which are not relevant to this use-case family (Source: PWC2).

Cost analysis

The overall cost of implementation and operation of the EU GOVSATCOM programme for the different options was analysed in PWC2. The cost was broken down in the building of the EU GOVSATCOM Hub, the cost of operational services, and the cost of additional space infrastructure around 2025. The service costs (**Error! Reference source not found.**) is the largest part of the full cost over the full period of analysis (2018-2040). A sensitivity analysis was performed by varying the basic pricing assumptions within reasonable ranges of uncertainty (see PWC2 for details).

The sensitivity analysis resulted in cost ranges, expressed for two periods: 2018-2028, and for 2018-2040 (see Table 2).

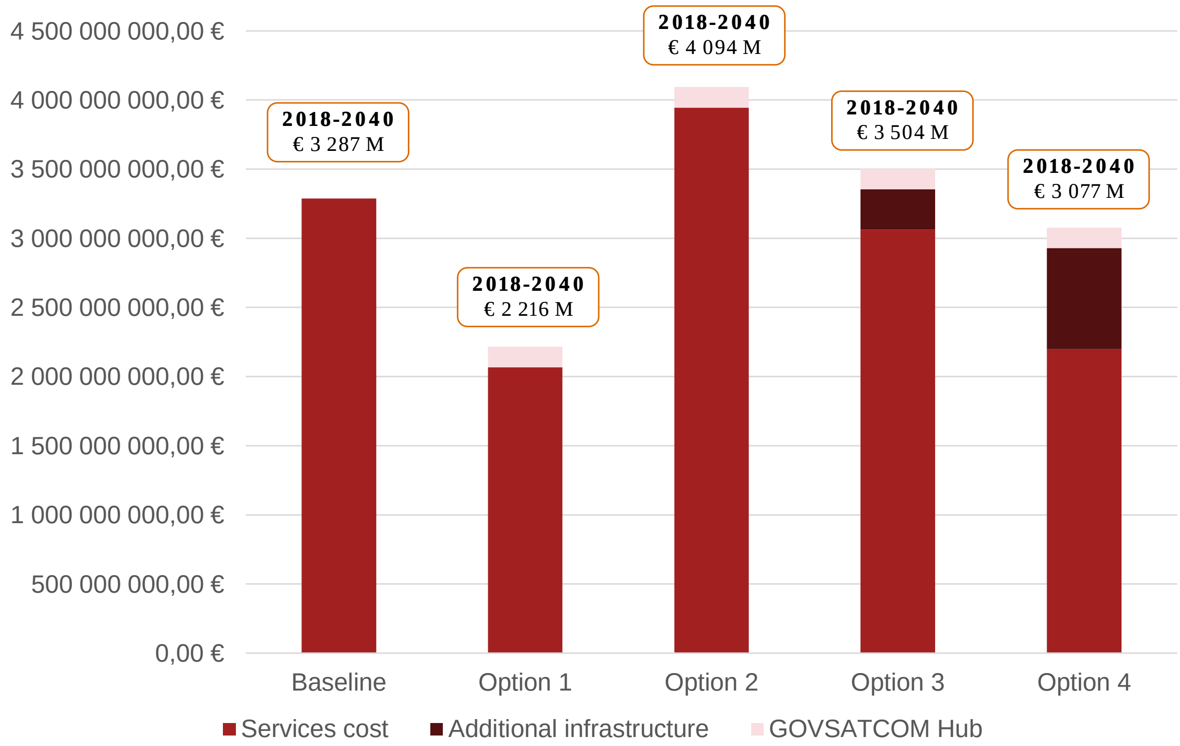


Figure 21 Cost estimates of the baseline and four options, using the basic configuration assumptions outlined in PWC2, for the full period from 2018 to 2040. The cost is expressed in 2017 constant prices, using a social discount rate of 4%.

Employment and GVA

The effects of EU GOVSATCOM options on the GVA and employment were analysed in the PWC2 study (see Figure 22 and Figure 23), based on econometric Input/Output modelling. See PWC2 for details on the methodology.

The results show that the GVA and employment effects are minor compared to the overall EU economy.

	Impact of Hub (€ M)		Impact of satcom (€ M)		Total indirect and induced impacts (€ M)		Overall impact (€ M)
	Indirect	Induced	Indirect	Induced	Indirect	Induced	
Baseline			3,097.15	897.50	3,097.15	897.50	**3,994.64**
Option 1	143.83	58.52	1,947.35	564.31	2,091.18	622.83	**2,714.01**
Option 2	143.83	58.52	3,716.57	1,077.00	3,860.40	1,135.52	**4,995.92**
Option 3	143.83	58.52	2,885.79	836.25	3,029.62	894.77	**3,924.40**
Option 4	143.83	58.52	2,070.43	599.97	2,214.26	658.50	**2,872.76**

Figure 22 Estimated impacts on GVA of different options 2018 to 2040 (Sources: PwC analysis)

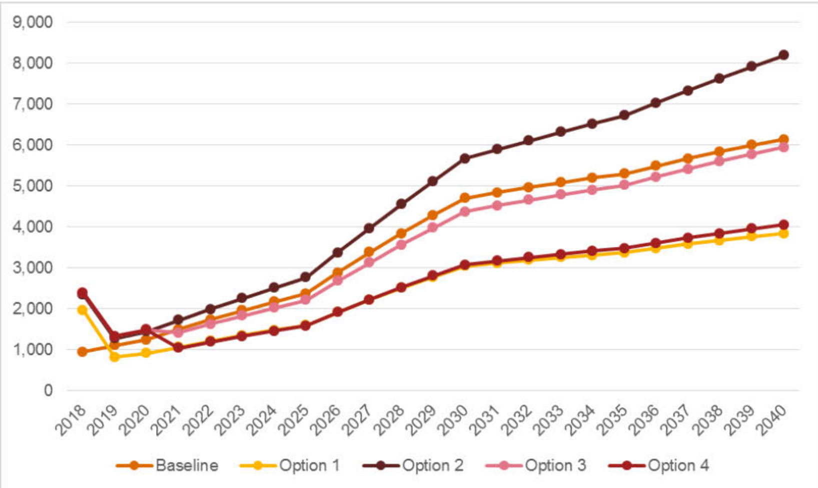


Figure 23 Jobs created by investments in the creation of the EU GOVSATCOM Hub and satcom services (Source: PwC analysis)

Other impacts analysis, based on expert questionnaire

For impacts which could be assessed with the available data from PWC1, and the economic analysis in PWC2 a dedicated questionnaire was developed. Impacts such as the cost of doing business, effects on innovation, competitiveness of EU industry, complexity of the Hub, were addressed here (see PWC2 report for the actual questionnaire and the detailed results). The questionnaire also included several questions which have been analysed in the risk and suitability analysis (ability to face threats, guarantee of access), so those serve as a cross-check of the same impact measured with different methodologies.

The summary of the results of the questionnaire is shown in Figure 24. Overall the most positive impacts are recorded for options 3 and 4, in particular for the 2nd phase. The question regarding the Hub was included to obtain a first assessment of the complexity (and therefore cost) of the Hub. Higher complexity was recorded as a more negative score. The results show that there are only marginal differences in the complexity of the Hub between different options (phase 2 of option 3 would require the most complex Hub). For differences between different stakeholder groups the details are presented in the PWC2 study.

Assessment Methodology	Impact	Option 1		Option 2		Option 3		Option 4	
		Ph1	Ph2	Ph1	Ph2	Ph1	Ph2	Ph1	Ph2
Stakeholder Consultation	Process optimisation for suppliers of secured SATCOM and equipment	0.0	1.5	0.5	1.0	2.0	3.0	2.0	3.0
	Process optimisation for users of secure SATCOM	1.0	2.0	2.0	2.0	2.0	3.0	2.0	3.0
	Costs of doing business and administrative burden for private sector	1.0	1.0	0.0	0.0	2.0	2.5	2.0	2.0
	Costs of doing business and administrative burden for public sector	0.0	1.0	1.0	1.0	2.0	3.0	2.0	3.0
	GOVSATCOM-like bandwidth capacity to be provided	-1.0	1.0	1.0	2.0	2.0	3.0	2.0	3.0
	Ability to face threats in the future	0.0	1.0	1.0	2.0	2.0	3.0	2.0	3.0
	Guaranteed access to SATCOM	1.0	1.0	1.0	2.0	2.0	3.0	2.0	3.0
	Affordability of SATCOM services	1.0	1.0	0.0	0.5	2.0	3.0	2.0	2.0
	Confidence in European space and ground infrastructure supply and renewal	1.0	1.0	2.0	2.0	2.0	3.0	2.0	3.0
	Setting up and operating the EU GOVSATCOM Hub	-1.0	-1.0	-1.0	-1.0	-1.0	-2.0	-1.0	-1.0
	Impacts on the cost in the SATCOM supply chain	1.0	1.0	0.0	0.5	1.0	2.0	1.0	3.0
	Competitiveness of the EU space industry on the global markets	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.5
	Effects on SMEs	0.5	0.5	0.5	1.0	1.5	2.0	1.5	2.0
	Stimulation of innovation and research	1.0	1.0	1.0	1.0	1.5	2.5	1.5	2.0
	Impact on frequency allocation and orbital positions	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0

Figure 24 Results of impact analysis for Economic and various impacts aggregated and shown on a Likert scale, based on questionnaire of 18 experts.

9.5. Annex 5: Research and Innovation areas relevant to EU GOVSATCOM (provided by ESA)

EU GOVSATCOM is situated in the context of a largely commercial market of satellite communications in Europe. This market is highly dynamic and is undergoing significant change. It sees in particular the emergence of

- new services including the Internet of Things,
- new entrants promoting mega-constellations,
- 5G next generation of mobile networks including the integration between ground and space communications infrastructures and services,
- Optical space communications, and
- Very High Throughput Satellites (VHTS).

EU GOVSATCOM therefore distinguishes itself from other European space programmes, which are more defined in an institutional context, largely in absence of market. It consequently faces a double challenge

- to respond to European security needs of governmental users of satellite communications as defined in the High Level User Needs,
- at the same time to not distort the market, but to benefit from and provide support to the competitiveness of European satcom industry.

To stimulate the market rather than to distort it, the EU GOVSATCOM R&I actions - while centred on GOVSATCOM - may allow industry to also respond to a national and global market. With this in mind, competitiveness can be addressed on two levels

- throughout the operational phase with EU GOVSATCOM as anchor customer to the European satellite service industry, and
- during the build-up, implementation and replenishment phase in providing support to R&I actions to ensure cost-effective state-of-the-art services.

The EU GOVSATCOM role as anchor customer, e.g. with commitments towards industry via Service Level Agreements can also be a significant stimulus to Public-Private-Partnerships with industry in support to R&I and service evolution.

R&I including industry involvement might address three lines of action, i.e.

1. TECHNOLOGY: Future preparations, advanced technologies up to TRL level 4/5 and subsequent product developments up to flight readiness, required to ensure the technological evolution of the industry in ground segment as well as space segment, in particular as regards
    a. security-related technologies,
    b. technologies required for increased European non-dependence/critical technologies,
    c. supporting technologies.
2. SERVICES: Service developments shall support
    a. the introduction and consolidation of security-related services as identified by the EU GOVSATCOM High Level User Needs,
    b. demonstrations in a user context and in particular for civilian users,
    c. IOV/IOD actions to demonstrate technology developments as performed under 1. above
3. SYSTEMS: Implementation of planned and future ground and space systems, including innovative features of
    a. the EU GOVSATCOM Hub and
    b. planned and future ground and space segment implementations at European level (e.g. gap-fillers) and at national level (e.g. augmented to include GOVSATCOM research and innovation).

Technology Development:

EU GOVSATCOM may address the following technology developments of direct relevance to secure satcom:

- Secure and robust satellite communications such as advanced coding, modulation and cryptography; key management solutions; anti-jamming; secure TM/TC including secure hosted payload solutions. These developments shall be performed for the ground segment as well as space segment and in a European certification scheme to be defined and established together with accredited entities,
- Optical communications, including Quantum Key Distribution, Inter-satellite links including data relay solutions, optical feeder links and including user terminals (satellite, RPAS, HAPS, ground),

EU GOVSATCOM might furthermore address technologies required in support to increased European non-dependence required for satellite platform, payload and ground system, including critical technologies.

EU GOVSATCOM might also address the following supporting technologies:

- Flexible phased array antennas providing multi-beam and beam-forming capabilities, digital signal processing, SW-defined Radio, and related flexible payloads programmable in response to changing needs such as capacity flexibility and geographic coverage and distribution of traffic,
- Ground segment technologies for satellite control systems, mission planning systems, user terminals including multi-satellite and multi-band support and for beam hopping, and in support to the different security levels required by the different EU GOVSATCOM services and user categories

Service Element:

EU GOVSATCOM may address service developments in support to all High Level User Needs, including direct involvement of users and with emphasis on civilian users. This should include Pooling & Sharing demonstrations and IOV/IOD actions, in particular on services enabled by new technology developments such as ground segment, RPAS, optical communications or Internet of Things. Service development should include an element of awareness building and outreach.

System Implementation:

EU GOVSATCOM may support R&I as integral part of the implementation of planned and future space systems, in the ground segment and in the space segment

- GROUND SEGMENT: The main R&I action in the ground segment, and considered as one of the first required R&I actions, relates to the implementation of the EU GOVSATCOM Hub(s) and Anchor Ground Segment in support to Pooling and Sharing of GOVSATCOM assets (national, commercial, European). This shall include topics such as interoperability between the Hub(s) and the ground segments, control and mission planning systems of diverse GOVSATCOM assets; implementation of network functions for virtualisation of resources and dynamic routing of user requests to assets; protection of user data and planning data in the system; accounting functions; operations concept; data and service model; end-to-end security concept; certification of implementation.
- SPACE SEGMENT: During the EU GOVSATCOM build-up phase, R&I actions can support innovations in secure satcom system developments already planned by industry. This may allow to make these system developments GOVSATCOM-ready, e.g. in partnership with industry and in synergy with suitable industry developments such as
    - already considered or on-going constellation implementation activities for LEO constellations and Arctic constellations, e.g. to include a GOVSATCOM type communications P/L as part of a multi-mission concept
    - already considered or on-going optical space communications implementation activities for data relay, including to RPAS,
    - planned satellite-based air-traffic management solutions
    - future implementation for 5G and of Very High Throughput Satellites.

  A possible future implementation phase may include gap-filler implementations in partnership with industry. It may benefit from longer term technology developments initiated under Technology R&I, i.e. to achieve the required TRL levels when required.

  The implementations typically include dedicated R&I elements specific to a partnership project, e.g. a secure hosted payload. They may furthermore benefit from technology R&I performed outside the project, e.g. cryptography solutions.

9.6. Annex 6 List of acronyms and definitions

ADS: Airbus Defence & Space

ATM: Air Traffic Management

CISE: Common Information Sharing Environment

CPCC: Civilian Planning and Conduct Capability

CSDP: (EU) Common Security and Defence Policy

Department of Defence: (US) Department of Defence

EFCA: European Fisheries Control Agency

EMCDDA: European Monitoring Centre for Drugs and Drug Addiction

ERCC: Emergency Response Coordination Centre

EDA: European Defence Agency

EDRS: European Data Relay System

EMSA: European Maritime Safety Agency

ESA: European Space Agency

ESOA: Europe Middle East Africa (EMEA) Satellite Operators Association

ESPC: European satcom Procurement Cell

EUROSUR: European Border Surveillance System

GEO: Geostationary Earth Orbit

HLUN: High Level User Needs

HTS: High Throughput Satellite services

ICAO: International Civilian Aviation Organisation

ITU: International Telecommunication Union

INTCEN – EU Intelligence and Situation Centre

LEO: Low Earth Orbit

Mbps: Megabit per second

MEO: Medium Earth Orbit

MILSATCOM: Military satellite communication

MRCC: Maritime Rescue Coordination Centre

MS: (EU) Membre State

M2M: Machine-to-Machine communications

OCG: Organized Crime Groups

PPP: Public Private Partnership

RPAS: Remotely Piloted Aircraft System

SATCOM: Satellite communication

SLA: Service Level Agreements

SME: Small and Medium Enterprise

TAS: Thales Alenia Space

WGS: Wideband Global satcom