EU-CIVCAP

Preventing and Responding to Conflict: Developing EU CIVilian CAPabilities for a sustainable peace

Report on dual-use technologies

Deliverable 2.4

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Summary of the Document

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Abstract	This report sheds light on how dual-use technologies can contribute to EU efforts in civilian conflict prevention and peacebuilding. This research performs an empirical analysis of the selected dual-use technologies owned by EU Member States, namely satellites and Remotely Piloted Aircraft Systems (RPAS). By examining the use of these technologies in the context of CSDP missions and operations, the study aims to provide an assessment of their possible use in current and future EU conflict prevention and peacebuilding missions.
Keywords	• Dual-use technologies • Conflict prevention • Peacebuilding • Satellites • RPAS

TABLE OF CONTENTS AND FIGURES

LIST OF ACRONYMS

CIVCAP	Civilian Capabilities
CMO	Crisis Management Operations
CPCC	Civilian Planning and Conduct Capabilities
CSDP	Common Security and Defence Policy
DEVCO	Development and Cooperation
DG	Directorate General
DRAC	Drone de Reconnaissance Au Contact
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
ECHO	European Civil Protection and Humanitarian Aid Operations
EDA	European Defence Agency
EDAP	European Defence Action Plan
EEAS	European External Action Service
EU INTCEN	European Union Intelligence and Situation Centre
EU SatCen	European Union Satellite Centre
EUAM	European Union Advisory Mission
EUCAP	European Union Capacity Building Mission
EUFOR	European Union Force
EULEX	European Union Rule of Law Mission in Kosovo
EUMC	European Union Military Committee
EUMM	European Union Monitoring Mission in Georgia
EUMS	European Union Military Staff
EUNAVFOR	European Union Naval Force
EUPOL	European Union Police Mission
FAF	French Air Force
HR/VP	High Representative – Vice President
IED	Improvised Explosive Device

ISAF	International Security Assistance Force
ISR	Intelligence, Surveillance and Reconnaissance
KET	Key Enabling Technologies
KFOR	Kosovo Force
MALE	Medium Altitude Long Endurance
MINUSMA	United Nations Multidimensional Integrated Stabilization Mission in Mali
MoU	Memorandum of Understanding
MUSIS	Multinational Space-based Imaging System
OAT	Operational Air Traffic
OCCAR	Organisation for Joint Armament Co-operation
ODF	Operation Deliberate Force
OPLAN	Operational Plan
ORFEO	Optical and Radar Federated Earth Observation
OUP	Operation Unified Protector
PADR	Preparatory Action on Defence Research
R&D	Research and Development
R&I	Research and Innovation
Rista-Ew	Reconnaissance, Intelligence, Surveillance, Target Acquisition – Electronic Warfare
RPAS	Remotely Piloted Aircraft Systems
SAMRO	Satellite Militaire de Reconnaissance Optique
SAR	Synthetic Aperture Radar
SDTI	Système de Drone Tactique Intérimaire
SPOT	Système Probatoire d'Observation
TA	Target Acquisition
UAV	Unmanned Aerial Vehicles
UNSCR	United Nations Security Council Resolutions
VHF/UHF	Very High Frequency/Ultra High Frequency
WP	Work Package

EXECUTIVE SUMMARY

Although dual-use technologies might appear to be the exclusive domain of military experts, in fact they permeate every person's daily life. The most common dual-use technology is the internet; originally developed for military purposes, it has revolutionised our means of communication. Despite the significance, implications and possible uses of dual-use technologies in European Union (EU) conflict prevention and peacebuilding, this topic still lacks proper attention from EU institutions and key stakeholders.

This study identifies which dual-use capabilities can be exploited for the purposes of conflict prevention and peacebuilding. It analyses and assesses the dual-use capabilities of selected Member States (MS) and offers recommendations for how they can contribute to EU efforts in undertaking civilian conflict prevention and peacebuilding tasks. In this report, dual-use technologies are defined as *tools and equipment with an innate or potential application for civilian and military use, whose character depends on human mental structures, and on the social networks in which they are developed or used.*

The EU has followed two parallel tracks on the development of dual-use technologies, linked to the latter's possible different (benevolent or malevolent) uses. After its initial approach, which led to the securitisation of this issue and a focus on the control of dual-use technologies exports, over the past decade the EU has encouraged research into dual-use potentials to simultaneously promote economic growth and support Europe's defence industry.

The report first examines the EU's political strategy on dual-use technologies by focusing on EU official documents. The analysis reveals that satellites and Remotely Piloted Aircraft Systems (RPAS) are the two dual-use technologies in which the EU is seeking to enhance its research efforts the most. In fact, the political willingness to develop satellites and RPAS, as articulated in various Council Conclusions (European Council, 2013, 2016, 2017), has been accompanied by practical actions through the deployment of research funding opportunities, as illustrated by the European Defence Action Plan (European Commission, 2016). However, there is a lack of coordination among the different EU institutions and agencies, and this may result in the duplication of projects. Moreover, the report points towards a sort of hybridisation of European research, with the increasing interconnection of the civilian and military sectors.

In the second part of this report, the study focuses on the capabilities of four Member States – France, Germany, Italy and Sweden – to provide the reader with a comprehensive indication of when, why and how the selected dual-use technologies have been used for conflict prevention and peacebuilding missions and operations within and outside the EU framework. The analysis indicates that MS own a significant number of RPAS and have developed common projects on satellites under the EU SatCen umbrella, also revealing a frequent deployment of such assets in military missions. On the civilian side, while satellites have been used to support civilian Common Security and Defence Policy (CSDP) missions in some cases, RPAS have not

been used on these, mainly for political reasons. The lack of use of these technologies particularly in CSDP missions such as EUMM Georgia, EUAM Ukraine and EULEX Kosovo represents a missed opportunity. We argue that dual-use technologies could have been exploited in CSDP missions, namely for supporting border management, restoring public order and conducting investigative tasks.

As discussed in the report, both satellites and RPAS have the potential to contribute to EU conflict prevention and peacebuilding activities. The report identifies the extent to which the two devices may contribute to intelligence, surveillance, border assistance, force and population protection, and other similar tasks (see also Annex). Enhanced exploitation of dual-use technologies would not require much investment, as most assets are already owned by MS; nevertheless, other serious issues would need to be considered. The political implications of using such technologies particularly in EU missions emerge at both the local level, where the host state’s consent for the use of such technologies is needed, and at the MS level, where, for instance, German and Swedish cases have flagged concerns about privacy and data protection. Moreover, what is needed from the EU is a policy on the application of dual-use technologies in conflict prevention and peacebuilding – a policy that must achieve complementarities and synergies between military and civilian assets. Drawing on this analysis, the report includes seven policy recommendations and considerations.

<u>Policy recommendations and considerations</u>

1. **The EU should continue to promote inter-institutional funding opportunities to avoid a duplication of effort and spending.** Particularly, future projects awarded under the EDA defence research framework should follow the dual-use approach.
2. **A clear EU policy on how to use dual-use technologies in conflict prevention and peacebuilding activities is urgently required.** Such a vision is necessary to avoid politicising the matter and to ensure proper coordination among the EDA, Horizon 2020 programmes, and other upcoming EC initiatives such as the European Defence Industrial Development Programme.
3. **The EU should coordinate programmes launched through the European Defence Fund (EDF) funding stream with the strategic planning of the European External Action Service (EEAS).** The EEAS should couple and complement the efforts of EDF through the funding of related training activities for police and other law enforcement agencies, to ensure that security actors exploit the interoperability of dual-use systems.

4. **The EU should take advantage of the potentiality of satellites and RPAS in conflict prevention and peacebuilding by supporting the pooling and sharing of activities (both among MS and within CSDP missions), and by standardising procedures.** Particularly, synergies and exchanges of capabilities between military and civilian missions should begin in situations where military and civilian staff already work side by side, for example in the Sahel region. Moreover, the pooling and sharing of RPAS devices in civilian conflict prevention and peacebuilding could start with older models that are still operating (Harfang and RQ1, for instance), but are about to be replaced by newer models in the military sphere.

5. **Based on Amendola's base model, the EU should develop specific training models on military-civilian cooperation in the field of dual-use technologies.** This model should also be integrated into a revised EU training policy.

6. **The capabilities of EU SatCen, which bridges functions between EU institutions and MS and between existing and future military-civilian earth observation systems, should be further explored and enhanced** to facilitate access to earth observation data to address needs related to security and defence in the EU.

7. **In relation to the development of the Copernicus programme, there is a need to establish adequate data dissemination policies** that fulfil the needs of the EU's security and defence community.

1. INTRODUCTION[1]

Among the technologies that can be exploited for conflict prevention and peacebuilding activities, dual-use technologies are gaining attention in scholarly and technical debates. Dual-use technologies are already part of our everyday lives; for example, the internet was initially conceived for military use by the Defense Advanced Research Projects Agency (DARPA), a United States (US) government agency within the Department of Defense. It was only subsequently adapted for civilian application. Born as spin-offs of military projects, dual-use technologies are now developed in both the military and the civilian domain and operate in a vast range of fields, from biology to security. The EU has demonstrated a clear interest in these specific technologies. For instance, the European Defence Action Plan (EDAP) developed in 2016, and the subsequent European Defence Fund launched in 2017, both have clear dual-use implications.

This report lies within the scope of EU-CIVCAP's Work Package 2, whose aim is to assess EU Member States' (MS) capabilities for conflict prevention and peacebuilding. This deliverable draws on the empirical assessment conducted in Deliverable 2.1 (De Zan *et al*., 2016) and lays the foundations for the forthcoming Deliverable 2.5 on the pooling and sharing of capabilities.

The report begins with a literature review on the term 'dual-use'. It then turns to the analysis of strategic and operational documents issued by EU institutions and agencies, including the EU Council, European Commission (EC), European External Action Service (EEAS) and European Defence Agency (EDA). The analysis of these documents serves as a basis for the identification of the two dual-use technologies that better fit the scope of the deliverable: satellites and RPAS. The report subsequently focuses on the assets owned by selected MS, France, Italy, Germany and Sweden, and, in the last section, discusses and suggests the possible use of satellites and Remotely Piloted Aircraft Systems (RPAS) for conflict prevention and peacebuilding operations, with a focus on their possible employment in CSDP missions. The report is based on official documents, open source materials, in-depth interviews with key policymakers, practitioners and academics, and secondary literature.

[1] The authors wish to thank Dr. Nicoletta Pirozzi and Dr. Alessandro Marrone (both Senior Fellows at IAI) and Dr. Virginia Fernandez Arguedas (Project Officer of the Capability Development Division and in the Copernicus Unit at the EU SatCen) for their valuable inputs and the content editing of the final version of the paper, and Mr. Andrea Aversano Stabile (Junior Researcher at IAI) for the layout formatting.

2. DEFINING DUAL-USE TECHNOLOGIES IN CONFLICT PREVENTION AND PEACEBUILDING

The Oxford English Dictionary refers to dual-use technologies as any "(technology or equipment) designed or suitable for both civilian and military purpose" (Oxford, 2017). However, when looking at official international organisations documents, there appears to be a lack of consistency in the definition of the term; in a guidance document the World Health Organization recognises that "Several definitions have been put forward, but there is no commonly agreed understanding as to what constitutes dual-use research" (World Health Organization, 2010, 69).

In the context of disarmament and the control of Weapon of Mass Destructions (WMP), the United Nations (UN) does not even define dual-use technologies in the many United Nations Security Council Resolutions (UNSCR) dedicated to them.[2] As for the EU, the first definition appeared in the Council Regulation 428/2009, in which the EC describes "dual-use items" as "items, including software and technology, which can be used for both civil and military purposes" (European Commission, 2009, 3). In another official document, the EC Directorate General (DG) Growth defines dual-use products as "services and technologies that can address the needs of both defence and civil communities" (DG Growth, 2014, 8).

While there is a common view on the general meaning of the term, such as the possibility to use a certain item for military and civilian purposes, there are different understandings of it. To help frame a better definition of dual-use technologies we could look at the two words forming the expression.

Concerning the word "technology", a first definition useful for this study is the following one by Autio and Laamen (1995, 12):

> "Technology comprises the ability to recognise technical problems, the ability to develop new concepts and tangible solutions to technical problems, the concepts and tangibles developed to solve technical problems, and the ability to exploit the concepts and tangibles in an effective way".

This definition does not reduce the concept of technology to a certain physical item or defined timeline, and thus does not exclude the possibility of *exploiting* different solutions to technical issues. Furthermore, as argued by Torchia and Nonino (2007, 396), the majority of innovations are not determined by the discovery of something new and original, but are more the result of further combinations of already known materials and technologies.

Regarding "dual-use", the concept can be linked to various terms: dual-use market, dual-use purpose, dual-use capabilities, dual-use biological research, dual-use projects, and of course dual-use technologies. In this context, it is necessary to define the distinctive characteristics

[2] In particular, see Resolution 1540 (2004) and the follow ups, Resolution 1673, 1810, 1977.

of dual-use technologies. They may have an innate or potential dual capacity. According to Enger (2013, 18), "dual-use technology refers to the case when there is an intention to change the initial (military or civilian) application of a technology. Multi-use technologies can become subsequent dual-use technologies, but only if the application is different from its origin". This understanding seems to focus excessively on the potentiality side. As part of the latter, the in-house process can be added, within the organisation or a state, or the outsourcing process (licensing, joint-venture, spin-off with or without the intervention of a state/facilitator) (DG Growth, 2014).

Another useful distinction to better define the term dual-use technology is the dichotomy between permanent or temporary application. As reported by Pustovit and Williams (2010, 19),

> "Technologies are not a priori either military, civilian or both. Their character depends on human mental structures, and the social grids in which they are developed or used. The duality is perceived to be a characteristic of human attitudes toward other people and the environment. As such, it can periodically appear or disappear in different forms mirroring human nature and social relations."

In the same vein, Cowan and Foray (1995) support the idea that dual-use technologies are not *a priori* just military or civilian, or both, but that their characteristics depend on the environment in which they are developed. The permanent vs temporary dichotomy for Galev (2003, 3) also depends on "its social network to appear or disappear its potential duality".

In light of this literature review, this report will use the following working definition of dual-use technologies: *Dual-use technologies are tools and equipment with an innate or potential application for civilian and military use, whose character depends on human mental structures, and on the social networks in which they are developed or used.*

This working definition seems to be particularly useful in the context of conflict prevention and peacebuilding, whereby civilian and military capabilities are supposed to cooperate through the whole conflict cycle, because it emphasises the role of people and social networks in deciding the use of this potential/innate duality.

2.1 THE EU'S APPROACH TO DUAL-USE: BETWEEN CONTROL AND RESEARCH

In order to understand the importance of different approaches to dual-use, it is worth recalling Evans' (2008, 4) observation that "Different views on what is a dual-use technology represent different views of the problem that the actors involved are trying to solve". The EU's approach to dual-use technologies has followed two parallel tracks (control / research) depending on the contextual drivers. Among these, the deepening of the EU's attention to dual-use technologies has been mainly fostered by security and economic factors.

An early approach led to a securitisation of the issue and was connected to efforts to control the export of sensitive tools and items that could have a dual-use application through strong legislation. In May 2009, through the Council Regulation (EC) No 428/2009, the EU firmly set up a "Community regime for the control of exports, transfer, brokering and transit of dual-use items" (European Council, 2009). This regulation describes in detail the kind of items that cannot be exported and transferred out of the Union for security reasons. It was the first EU official document in this regard and shows an early negative approach to dual-use technologies: they were mainly seen as potential risks for international security.

Moreover, there is also the realisation on the part of the EC that trade in dual-use items can have a strong impact on national economies. This is well presented by DG Growth which, in October 2014, published the document "EU funding for Dual-Use – a practical guide to accessing EU funds for European Regional Authorities and SMEs". With this document, the Commission clarifies the opportunities and eligibility rules for dual-use projects funded by EU instruments such as Europe's programme for small and medium-sized enterprises - COSME, Horizon 2020 and the European Structural and Investment Funds (DG Growth, 2014).

After a first definition of dual-use technologies, the document details why getting involved in the dual-use field is beneficial for both private companies and public authorities. Companies can extend their product range, upscale their production, become more resilient to economic crises in one or the other sector, become more innovative and more collaborative with other companies, even if smaller in size. Public authorities at the regional level can foster innovation and improve their domestic economy; state authorities can foster innovation and realise savings through increasingly efficient expenditure. As a result, the encouragement to push companies to enter the dual-use market is evident. Finally, the document lists EU funding opportunities for European companies.[3]

Alongside the EC, the EDA has also shown a strong commitment to research regarding dual-use technologies, which is considered beneficial for security and defence. One of the main EDA activities, in cooperation with the EC, is to "identify the areas of mutual benefit, coordinate the research work and develop activities to promote areas of research with strong

[3] These opportunities have since evolved with the European Defence Fund.

civil-military synergies". In particular, the EDA is committed to identifying and supporting dual-use Key Enabling Technologies (KETs), which are "the building blocks of advanced products and underpin traditional, high-tech European value chains" and are "essential for the defence systems of today and the future" (European Defence Agency, 2017).

The first public document on dual-use released by EDA was the 2013 "Factsheet on European Structural Funds for Dual-Use Research". The document communicates dual-use opportunities to relevant stakeholders and describes how EDA supports MS to access available the Union's resources for research and innovation, with a focus on technological and industrial priorities identified at EU level. The document starts by considering that the economic crisis has had a negative impact on defence budgets with direct consequences and repercussions for the economy in general, as the defence industry has proven to be a "driver for growth and jobs". Nonetheless, "since technology is increasingly dual in nature, there is considerable potential for synergies between civil and defence research" (European Defence Agency, 2013).

The Commission's 2014 Communication "Towards a more competitive and efficient defence and security sector" already stated that: "Within Horizon 2020, the areas of Leadership in Enabling and Industrial Technologies including the KETs and Secure Societies (Societal Challenge), offer prospects of technological advances that can trigger innovation not only for civil applications, but also have a dual-use potential" (European Commission, 2014). In this framework, the Executive Agency for Small and Medium-sized Enterprises (EASME) launched its study to analyse and identify possible synergies between the list of innovation fields and previous work done under the 7th Framework Programme by MS or EDA.

The following figure is a recap of the documents on dual-use technologies issued by the EU and sums up the differences and similarities in the positions held by various actors.

Figure 1. Documents and position of EC and EDA on dual-use technologies. Source: Authors.

Finally, during the last quarter of 2016, the EC proposed an innovative policy document, the EDAP (European Commission, 2016), aiming, *inter alia*, at the establishment of a European Defence Fund (EDF). DG Growth will be responsible for the implementation of the Action Plan, by focusing on three priorities:

- Set up an EDF to support investment in joint research and development of defence equipment and technologies. The Fund would include a “research window” to fund collaborative research in innovative defence technologies and a “capability window” as a financial tool to allow participating MS to turn the results of the Research and Development (R&D) programmes into collaborative procurement programmes.
- Foster investment in SMEs, start-ups, mid-caps and other suppliers to the defence industry to promote EU co-financing of productive investment projects and the modernisation of defence supply chains.
- Strengthen the Single Market for defence to help companies operate across borders and help MS get the best value for money in their defence procurement.

The "research window" is particularly relevant for this study. The Commission proposed EUR 25 million for a Preparatory Action on Defence Research (PADR) as part of the 2017 EU budget and envisages that this budget allocation will reach a total of EUR 90 million by 2020. The Commission mentioned its intention to fund collaborative research in innovative defence technologies such as Unmanned Aerial Vehicles (UAV), satellites, electronics, metamaterials, encrypted software or robotics (European Commission, 2016).

The EU's first pilot project in the field of defence research was launched in October 2016. This pilot was seen as a way to test and assess certain governance aspects with a view to the PADR, and the EDA capacity to act as an executive agency to implement research projects in the defence field. The three selected projects ('Unmanned Heterogeneous Swarm of Sensor Platforms', 'Inside Building Awareness and Navigation for Urban Warfare' and 'Standardisation of Remotely Piloted Aircraft System Detect and Avoid') for a total budget of EUR 1.4 million started in the first quarter of 2017.

The above illustrates the path towards a sort of hybridisation of European research with the increased connection of the civilian and the military sectors. However, the implications and possible exploitations of dual-use technologies in conflict prevention and peacebuilding still lack proper attention by institutions and stakeholders, which means that there is still no clear vision of how to use these technologies. Such a vision is necessary to ensure proper coordination when it comes to dual-use technologies and their use in the framework of the CSDP, including EDA activities, Horizon 2020, PADR, and upcoming EC initiatives such as the European Defence Industrial Development Programme.

For example, the EDF aims to provide a strong economic and growth impetus, but its implications for the conflict prevention and peacebuilding sector are also evident: programmes launched with EDF funding should thus be coordinated with the strategic planning of the EEAS in order to create synergies. The EDF is expected to finance projects on defence research that can include dual-use technologies, with a strong potential for the interoperability of military systems with those of police and security forces, law enforcement and border control agencies. The EEAS, DG Growth and EDA (the latter two being responsible for the EDF implementation) could jointly propose the promotion of inter-force table-top exercises, including both police and military officers.[4]

Finally, in the context of CSDP and with relevance for conflict prevention and peacebuilding, the European Council has expressed the need for the development of satellite capacities; RPAS; research; and the use of dual-use technologies. Accordingly, in its Conclusions of 19/20 December the European Council states three fundamental points: a need to increase the effectiveness, visibility and impact of CSDP; a willingness to enhance the development of capabilities; and the need to strengthen Europe's defence industry. The second point is especially relevant for this deliverable, as the European Council particularly welcomes two main possible dual-use research topics: RPAS and satellite communication. On the first, it put forward some development for RPAS in the 2020-25 timeframe with a programme for a next-

[4] A table-top exercise involves key personnel discussing simulated scenarios in an informal setting. These kinds of exercises can be used to assess plans, policies, and procedures.

generation European Medium Altitude Long Endurance (MALE) RPAS; the establishment of a European RPAS user community; closer initiatives on regulation and appropriate funding for R&D activities (European Council, 2013). This willingness of the European Council to foster investment in the dual-use research has been reiterated throughout the years, as seen in the Council Conclusions of 18 May 2017, which again stresses the need to develop civilian capabilities through the promotion of civil-military cooperation to maximise the CSDP response.

3. DUAL-USE TECHNOLOGIES IN CONFLICT PREVENTION AND PEACEBUILDING

The second part of this study focuses on the question *"How dual-use technologies can improve EU conflict prevention and peacebuilding?"* by assessing two main assets owned by Member States: satellites and RPAS. These two dual-use technologies have been selected for three main reasons:

1) The frequency of reference to the selected dual-use assets in EU documents. EU institutions and agencies have shown a strong commitment to research and their potential implementation.
2) Clear dual-use implications and possibility of exploitations with regards to conflict prevention and peacebuilding.
3) Ownership and past use of these technologies by MS in the context of conflict prevention and peacebuilding.

The choice of the four MS to be considered follows the criteria adopted in the deliverable 2.1 (De Zan et al., 2016):

1) The relevance of civilian capabilities owned and/or being acquired by a country, at national level or through multinational cooperation, in particular at European level;
2) The contribution to major CSDP missions since 2003 (when the first-ever CSDP mission was launched) in terms of personnel and/or assets;
3) The possibility to conduct more in-depth research thanks to consortium members' networks of contacts among relevant experts and stakeholders.

The first two criteria, related to civilian capabilities, constitute the main rationale for the selection of these countries. The third variable complements the overall methodological approach. A qualitative approach has been adopted and semi-structured interviews were conducted with key experts and stakeholders at institutional level for each case study. The analysis of the case studies will be complemented by the analysis of capabilities at the EU level conducted in other work packages (WPs), in order to ensure the quality and overall coherence of the EU-CIVCAP project as a whole.

4. SATELLITES – PRELIMINARY CONSIDERATIONS

Space imaging techniques were developed during the Cold War, and the first systems were purely military. The first dual practices resulted from two developments, namely the end of the Cold War and the end of the US-Soviet hegemony within the area of satellite earth observation in the 1980s (Kries, 1998). To claim that the dual-use of satellite systems began as military systems, later opening up to civilian commercial use would be to simplify the subject. In reality, the above-mentioned hegemonic disruption was created by the launch of the French satellite Système Probatoire d'Observation de la Terre (SPOT) in 1986 (Paradiso, 2013). The development of SPOT (built on the research drawn from the military programme Satellite Militaire de Reconnaissance Optique (SAMRO)) stopped in 1982, for various reasons: financial; technical performance not meeting military requirements; and a change in France's political climate at the time. The SPOT1 was launched by the French Space Agency and the company Spot Image was created to promote and commercialise its images. As such, Spot Image became the first non-American private company in the world to commercialise satellite imagery with a resolution of 10m (Kolovos and Pilaftis, 2015).

During the 1990s and early 2000s, public funding for Space R&D programmes decreased, while private R&D was stimulated. Paradiso (2013) relates this trend to the dual-use policies developed during the same period, as a response to this decrease of public spending on R&D.

Part of earth observation satellite technologies and their commercialisation falls under the Council Regulation (EC) No 428/2009 "Community regime for the control of exports, transfer, brokering and transit of dual-use items". In Europe (and in the US) government agreement is needed to launch and operate satellites and to commercialise satellite imagery (European Council, 2009).

There are clear advantages in applying a dual-use approach to the space sector. As stated recently by the Commission in the Space Strategy for Europe communication: "Although some space capabilities have to remain under exclusive national and/or military control, in a number of areas synergies between civilian and defence can reduce costs, increase resilience and improve efficiency" (European Commission, 2016).

Usually, dual systems are based on equal platform and different services. A platform is the combination of all the hardware necessary for the system to operate, including the satellite itself and ground segment components such as controlling and receiving stations, automatic imagery processing centres, etc. The difference in the services on earth observation satellites is normally based on either the resolution provided or the availability of the service, the latter including functions such as shutter control, blackout or prioritisation. The service is therefore potentially limited to the commercial distribution under given circumstances. The type of limitation varies from system to system but they could be categorised by resolution and availability.

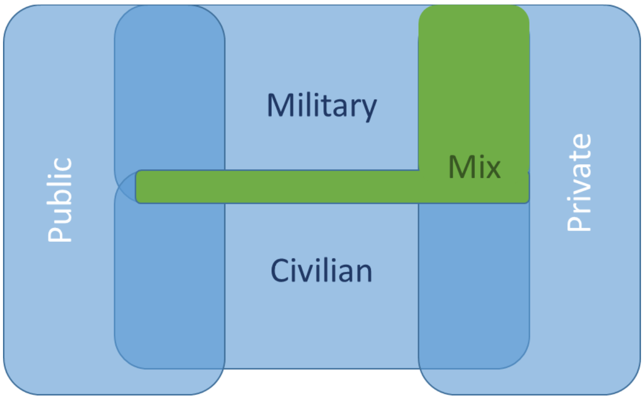
Regarding resolution, the imagery is not distributed commercially to the full ground resolution of the satellite. Not only is the imagery resampled to a lower resolution, but the full potential resolution is also classified information and therefore cannot be known by the public. Nevertheless, with the current capacities to put payload into low earth orbit, the best theoretical resolution is 13cm for optical satellites orbiting at 550km (and 25cm is a more realistic estimate of the best possible resolution). Lower altitudes would allow for improved the resolution but at the cost of other characteristics of the mission (lifetime, swath (the strip of the Earth's surface from which geographic data are collected), etc.).

Moreover, limitations to commercial distribution can be applied to the availability of the data. There are several mechanisms that are used to this aim:

- Shutter control: this implies that commercial distribution is temporarily or completely halted over a certain area. For example, the US exercised shutter control on Digital Globe products over Afghanistan (Norris, 2011).
- Prioritisation: another mechanism that may limit the commercial availability is the prioritisation of acquisitions. For example, COSMO SkyMed includes a Crisis Mode that prioritises a given area over others. A satellite has a number of possible acquisitions during a single pass. A commercial request on a given area may therefore be cancelled because its acquisition enters into conflict with a high priority area.
- Black list of areas: certain areas or countries may trigger a dissemination control upon request of a given resolution. For instance, the Kyl-Bingaman Amendment prohibits American companies from collecting or disseminating high-resolution satellite imagery of Israel, and TerraSar-X acquisition could be refused depending on the sensitivity level and area.
- Delay: another means of controlling dissemination is to release imagery for commercial distribution after a certain delay. Naturally, any delay in the dissemination of a freshly acquired image may have implications for a specific analysis, making the image /analysis irrelevant for its purpose. As the satellite owner(s) / stakeholder(s) are supposed to be responsible for defining the applicable data distribution policy and the services offered, a double classification could be defined for the dual-use concept: public/private and civilian/military (Bosc, 2015). By combining these two criteria four type of funding are possible: a) civilian-public, b) civilian-private, c) military or d) mixed (other combinations) (see Figure 1).

Figure 2. The dual-use of government and commercial satellite imagery

Source: EU SatCen



With the exception of case c) (pure military funding), in which satellites are usually used only for military intelligences purposes, the other funding schemes are more complex and have to be studied case by case. In practice, most of the satellites stem from mixed funding and are subject to dual-use.

Dual systems may serve different communities that otherwise would not have guaranteed access to specific data. Nevertheless, adequate data governance for such systems are of utmost importance to ensure access and avoid limitations that could hamper the use of earth observation data in, for example, the area of conflict prevention and peacebuilding.

4.1 EUROPEAN SATELLITE COOPERATION

4.1.1 EU Institutions

Satellites are used frequently for control purposes in the area of foreign policy. The processed data obtained from these, embodies an example of products continuously employed by international foreign policy actors in control activities closely related to the civil-military domain. In this context, the EU, through its CSDP, has relied heavily on these instruments in the last ten years in the performance of Crisis Management Operations (CMO) to prevent conflicts. Therefore, while the infrastructure used during the deployment of the missions are enclosed in the military dimension, the downstream services offered can be labelled as civilian.

Given the importance of satellite products and services for the CSDP, the EU institutions as a whole have fostered close cooperation with all the Member States and other international bodies promoting Research and Innovation (R&I) initiatives in this area. This cooperation has been driven by the EU Satellite Centre (EU SatCen), defined by Paradiso as the "joining link between commercial and EU civilian space programmes for Earth Observation, on one side, and EDA and other security and military users on the other" (Paradiso, 2013).

EU SatCen products and services span the wider field of crisis management and peacebuilding, supporting different civilian and military CSDP missions and operations and providing support to the variety of bodies within the EEAS (EU Military Staff, EU INTCEN, etc.) through reliance on commercial satellites for acquiring imagery. Governmental satellites are activated upon a case-by-case basis.

The EU SatCen has a long history of supporting CSDP missions by providing geospatial intelligence (GEOINT) and related services, as defined by its mission set out by the Council Regulation (Official Journal of the European Union, 2014). Recently, it supported EU NAVFOR Med Operation Sophia and EU Monitoring Mission in Georgia (EUMM Georgia) by providing on-demand GEOINT products and services. In the case of EUNAVFOR Med, the support consisted of the surveillance and assessment of human smuggling and trafficking networks, while for EUMM Georgia the delivered services included analysis of imagery reporting on important infrastructure and activities in the region. In the past, SatCen has also supported the following missions (non-exhaustive list):

- EUFOR Althea (from 2005): products related to border monitoring.
- EUFOR DR Congo and Lebanon (from 2006): damage assessment, support to evacuation routes, large area analysis and support for possible deployment of EU/UN forces.
- EUFOR Chad/RCA (from 2007): production of IDP (Internally Displaced Persons) maps and value added products such as Population Monitoring.
- EULEX Kosovo (from 2008): analytical reports over several Border Crossing Points.
- EUTM Uganda (from 2010): a feasibility study to identify a suitable location for a landing strip for MEDEVAC purposes.
- EU NAVFOR Somalia/ATALANTA (from 2010): monitoring of known pirate operating bases and anchorages along the Somali coastline and the searching for militia groups inside suspect towns.

In compliance with the objective of improving the use of European governmental imagery for fulfilling its mission (including the support to EU agencies and institutions working within the area of conflict prevention, peacebuilding and CSDP), EU SatCen regularly organises a Governmental Imagery Forum, strengthening ties with EU MS that may provide such data to the SatCen. By having access to both commercial and military satellite systems, SatCen can mitigate the limitations while using the commercial systems only, as seen in section 3.

SatCen also serves as a training centre in its domain, delivering training on Imagery Analysis and on the elaboration and use of GEOINT products, to military as well as civilian staff from Member State authorities and institutions, EU institutions, missions and operations, and international organisations. However, a report produced within the EU-CIVCAP project on Technological Shortcomings in Early Warning and Conflict Analysis (Berglund & Bruckert, 2017), stressed the importance of users of GEOINT products being properly trained and informed about the potential added value of such products in the area of conflict prevention and peacebuilding.

In addition to the above, the SatCen has participated in the development and evolution of the Copernicus Programme, which is a civilian EU programme coordinated and managed by the EC for the establishment of a European capacity for Earth Observation. To fulfil this goal, Copernicus is served by six types of dedicated satellites - the Sentinels, from 1 to 6 - and several contributing missions, consisting of existing commercial and public satellites. The data obtained from these satellites is processed and transformed into value-added information, which is streamlined through the six thematic Copernicus services: Atmosphere, Marine, Land, Climate, Emergency and Security (Copernicus, 2017).

The Copernicus service for security applications supports EU policies in the three key areas, namely border surveillance, maritime surveillance and support for external action (SEA). The objective of this latter is to “assists the EU by providing decision-makers with geo-information on remote areas with difficult access, where security issues are at stake”. It also assists third countries in situations of emerging or certified crisis, and to prevent global and trans-regional threats having a destabilising effect (Copernicus, 2018).

Among the nine product types offered, aiming at covering diverse user needs, three of them (Road Network Status Assessment, Critical Infrastructure Analysis and Crisis Situation Picture) are of particular interest to describe the environment of military or security operations. These outputs could reveal themselves as very useful in support of operations where it is difficult or not possible to send surveillance or RPAS. The use of RPAS can be problematic in some crisis or conflict areas, since they can be considered intrusive, and hence, operators of such systems have to have the consent of the authorities on whose territory it wants to operate. Furthermore, RPAS have to be operated following aerial navigation rules and can be easily jammed or destroyed (Berglund & Bruckert, 2017).

The community of users within Copernicus SEA is mainly composed by the Member States and the EEAS structure, as well as by the European Commission department and services (e.g. DG DEVCO and DG ECHO) and authorised external organisations (e.g. UN). The level of classification of the products delivered corresponds to “Unclassified”. Therefore, even if the service is designed in principle to serve civilian CSDP missions, it could also be used to support military CSDP operations. The Copernicus security services usually make use of Very High Resolution imagery, provided by commercial operators, in order to detect and identify objects of sub-metric size. Guaranteed and responsive access to imagery is of utmost importance, this could be achieved, for example, through flat-rate subscriptions, negotiated at EU level, to an easy-to-operate platform. Furthermore, it is relevant to explore possible access to Member States’ future defence governmental systems to establish possible dual-use synergies.

In addition, every user can request an ad-hoc solution considering that a crisis could require a tailored solution due to their changing and evolving nature. For this reason, the Copernicus SEA portfolio can be updated by introducing new products through the SEA Service Evolution component activities and following the procedures established by the EC, involving the Copernicus User Forum and Copernicus Committee.

Having access to both commercial and governmental geospatial intelligence data, the EU SatCen could be considered as a bridge between governmental and commercial use of space assets and hence facilitating the dual-use of geospatial data and its derived products and services.

4.1.2 EU Member States

In line with cooperation on dual-use satellite technologies at EU level, it is interesting to mention the Multinational Space-based Imaging System for Surveillance, Reconnaissance and Observation (MUSIS) international programme that includes France, Italy, Belgium, Germany, Greece, Spain, Poland and Sweden. This programme was developed for the common provision of space-based capabilities surveillance, reconnaissance, intelligence and earth observation operations for the armed forces of the participating states (Kolovos and Pilaftis, 2015). MUSIS started out ambitiously as a multinational programme, classified as a Category B one by EDA in 2009, to ensure the continuity of the participating countries' systems, such as Helios and others described hereinafter. However, due to the sensitivity of the information to be shared and the technical complexity of the project, some difficulties arose among MUSIS partners to agree on a common ground infrastructure (Paradiso, 2013).

In May 2011, in order to pave the way for other collaborative initiatives, France and Italy signed a Programme Decision for the management by the Organisation for Joint Armament Co-operation (OCCAR) of the Preliminary Definition phase of the MUSIS Federating Activity programme. As shown by this example and in view of the above-mentioned constraints, the programme seems to have run at a slower pace for the last years, with only two concluded bilateral agreements between France and Germany and France and Italy (Defense Industry Daily, 2014), limiting the potential case studies for this research to only a few countries.

France developed a dual system of common military and civilian budget, called Pleiades, composed by two electro-optical satellites and managed by the CNES (Kolovos and Pilaftis, 2015). With the first launch of Pleiades in 2009, built on the basis of the SPOT programme, the objective was to provide optical high-resolution panchromatic and multispectral imagery with more than 250 acquisitions per day and per spacecraft. Spot Image developed its ground segment and commercialised part of the images, while another part of the image acquisition was reserved for defence purposes. During the last four years, Pleiades imagery has been increasingly used at the European level, contributing to EU SatCen's operational capacity. The tri-stereo capability of the Pleiades & Spot 6 / 7 sensors has provided an additional enhancement to EU SatCen's analytical capacity (EU SatCen, 2017).

Italy, through Telespazio and the Ministry of Defence, provides Synthetic Aperture Radar (SAR) capabilities thanks to the four satellites COSMO-SkyMed. This mission is an example of mixed funding (commercial/governmental) capable to generate classified material, which is currently ordered and downloaded by EU SatCen in an easy, secure and fast manner. In this way, it has been possible to establish a link between the EU SatCen and IT authorities enhancing its practical and operational capabilities.

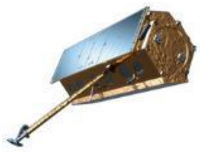
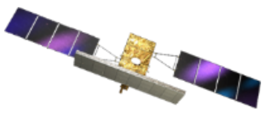
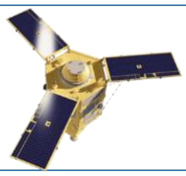
As seen in the brief summaries of the state-of-the-art of satellites in France and Italy, both countries were studying and developing a dual system in the same timeframe. For this reason, the two nations decided to cooperate in order to avoid duplications and the outcome of this collaboration was an intergovernmental agreement, named Optical and Radar Federated Earth Observation (ORFEO), signed in 2001. Thanks to this initial common roadmap, the two nations could create Earth observation capabilities for dual-use applications with both SAR technology and optical sensors, based on the COSMO-SkyMed and Pleaides constellations (ESA, 2017).

Germany has put in place the SAR-Lupe, a system based on five synthetic aperture radar satellites. Similarly to the Italian case, a connection between the German ground segment and EU SatCen has become fully operational and it is used to place requests and download sensitive imagery. In addition, several advancements related to declassification and reliability improvements were presented to broaden the use of SAR imagery. Moreover, through an agreement reached in 2002 between Germany and France, SAR-Lupe and Helios II started to work jointly by using both optical and radar capabilities. Lastly, it has been decided that SAR-Lupe will be replaced by the new SARah system comprising three new radar satellites and an optical one and is expected to be effective in the coming years.

The Swedish space sector is mainly civilian; it has fostered a serious commitment to the European Space Agency (ESA) and has participated in all the projects sponsored by the agency in remote sensing applications. The state-owned Swedish Space Corporation has three main business operations; operation and development of the space base Esrange, technology development through subsidiaries, and advanced space services in the form of accessing and processing satellite data. Sweden is currently largely dependent on the purchase of data from other countries' satellites since Sweden’s own satellite capacity is very limited. It participates to the SPOT programme (SNSB, 2017), and in 2005, the Swedish National Space Board (SNSB) signed a cooperation agreement with the CNES for the participation in the Pleaides programme. This agreement acted as a forerunner for successive agreements concluded by the French centre with the Spanish Instituto Nacional de Técnica Aeroespacial, with the Austrian Space Agency and with the Belgian Science Policy Office (ESA, 2017). In the specific domain of Security, Sweden claim to work in strict collaboration with other Member States and with the EC through the Copernicus programme (SNSB, 2017). With the evolution of the different Copernicus Services, Sweden will have better access to satellite imagery data, particularly within the area of Security and Defence.

Figure 3. European Dual-use systems

Source: EU SatCen.

Satellite		Description	Spatial Resolution
TerraSar-X		It is a common venture by German Aerospace Centre and EADS Astrium GmbH. TerraSar-X offers VHR SAR imagery. The commercial exploitation is carried on by Infoterra GmbH. This system was designed with the dual-use mission in mind. TerraSar-X works in constellation with PAZ system (see below).	25 cm (Staring SpotLight mode)
Cosmo-Skymed		It is an Italian VHR SAR system developed by the ASI and the Italian MoD. The system was designed as a dual-use mission able to produce classified material (E-Geos, 2016).	1 m (Spotlight mode)
Pleiades		Pleiades is the French system developed by CNES after SPOT. It offers optical sub-metrical resolution.	50 cm

As seen, cooperation has taken place both between member states on bilateral and multilateral level, as well as on intergovernmental and/or supranational level within the Copernicus programme. As shown, such cooperation is not always straight forward; collaboration between states can be somehow delicate, especially in the area related to security and defence. Nevertheless, the case study shows that cooperation between states is a major driver in order to launch satellite programmes, and that smaller states have to rely on cooperation either bilaterally or within international and European frameworks, in order to have access to satellite imagery data. The Copernicus programme and the EU SatCen constitute further assets for such states, as they give guaranteed and equal access to their products and services and possible future developments. In contrast to this, states developing their national space programmes could possibly consider cooperation on supranational level as a duplication of efforts or as a possible risk of loss of control of their assets. Nevertheless, the case studies above show that most national space programmes in fact are joint venture between various states and hence it can be deducted that common efforts of resources allow to build solid and sustainable satellite programmes.

The EU SatCen, maintaining a constant dialogue with its users within the EU Member States and different EU institutions and agencies, could be seen as a hub for an efficient and secure exploitation of satellite data and distribution of geospatial intelligence products and service, serving both the EU Member States and European actors within the civil-military area of CFSP and CSDP and beyond.

5. RPAS - PRELIMINARY CONSIDERATIONS

Firstly, a terminology note is in order. In this study, the preferred term is that of RPAS rather than UAV because the latter can be defined as remote-controlled aircrafts that do not need a pilot on board, while RPAS is the more comprehensive term for a 'system' comprising the entirety of the vehicle that flies, the ground-based controller, and the communication connection that links the two. The term drone is also commonly used, despite the negative connotations acquired after the US operations that led them to be identified with targeted bombing.

RPAS are commonly known for their use during various operations in the Afghani and Iraqi theatres, mainly but not exclusively by the US. RPAS are one of the most notable examples of dual-use technologies developed for military purposes that later operate as civilian assets. Originating from the military domain, RPAS allow armed forces to perform intelligence, surveillance and reconnaissance (ISR) tasks, from the tactical to the strategic level. For example, by hovering over a certain area for many hours, RPAS provide commanders with continuous surveillance of enemy positions without putting personnel at risk.

In recent years, thanks to the large-scale commercialisation of a variety of platforms, different kinds of RPAS have been launched on the market and basic flying models can be bought for a few hundred euros. The below chart (Figure 3) shows the variations on the usage of drones by US military and the civilian global estimation from 2002 to 2014. While their first operational deployment occurred in 1995 during Operation Deliberate Force (ODF) in Bosnia, their flight hours have grown exponentially through military operations in Iraq and Afghanistan, until Operation Unified Protector (OUP) over Libya in 2011. Although their use diminished between 2012 and 2014, it has increased again recently.

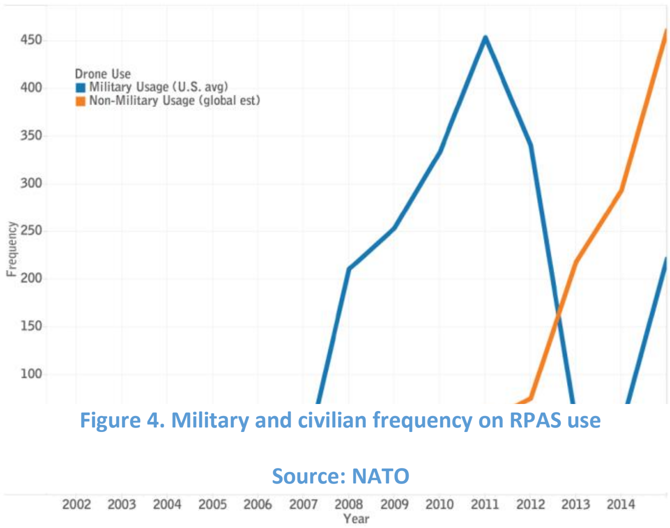


Figure 4. Military and civilian frequency on RPAS use

Source: NATO

RPAS can be classified according to their altitude and endurance features. This study follows the official NATO classification, widely used among experts and practitioners because it presents a picture of the full range of systems. The figure below summarises the existing types of RPAS, which is a useful classification for this study because it shows the categories of micro-RPAS, less known than others but still useful in conflict prevention and peacebuilding contexts.

Figure 5. NATO's RPAS classification

Source: NATO

Class	Category	Normal Employment	Normal Operating Altitude	Normal Mission Radius	Primary Supported Commander	Example Platform
CLASS I < 150 kg	MICRO <2 kg	Tactical Platoon, Section, Individual (single operator)	Up to 200 ft AGL	5 km (LOS)	Platoon, Section	Black Widow Mikado SpyArrow
	MINI 2-20 kg	Tactical Sub-unit (manual launch)	Up to 3K ft AGL	25 km (LOS)	Company, Squadron	Scan Eagle Skylark Raven
	SMALL >20 kg	Tactical Unit (employs launch system)	Up to 5K ft AGL	50 km (LOS)	Battalion, Regiment, Brigade	Luna Hermes 90 Skylark II
CLASS II 150 kg - 600 kg	TACTICAL	Tactical Formation	Up to 10,000 ft AGL	200 km (LOS)	Brigade	Hermes 450 Seeker 400 Shadow 600
CLASS III > 600 kg	Strike/ Combat	Strategic/National	Up to 65,000 ft MSL	Unlimited (BLOS)	Theatre COM	Predator B Predator C
	HALE	Strategic/National	Up to 65,000 ft MSL	Unlimited (BLOS)	Theatre COM	Global Hawk
	MALE	Operational/Theatre	Up to 45,000 ft MSL	Unlimited (BLOS)	JTF COM	Predator A Heron Hermes 900

Different typologies of users have access to RPAS, demonstrating the dual-use potentiality of these technologies as illustrated by Figure 5.

Figure 6. Possible employment of RPAS. Source: Authors.

Agriculture - pesticide application, monitoring of livestock and surveying of farmland

Journalism - coverage of news

Commerce - Assistance in delivering services, data collection, for-profit photography

Policing - monitoring crowds during riots or protest, first response. Protection of Critical Infrastructures

Emergency Services - transportation of medical equipments during emergency or in difficult areas

Environmental and wildlife conservation - anti-poaching welfare opeations, monitoring of protected areas

Military - situational awareness contribution through monitoring, surveillance and recoinnassance activities

Three main characteristics make the RPAS stand out for conflict prevention and peacebuilding missions: persistence, disposability and flexibility. Its persistence, compared to other devices which may have the same use (e.g. manned aircraft) is a crucial advantage for long-lasting surveillance missions. The fact of being unmanned allows RPAS to fly for longer periods than traditional aircraft since they do not need to change on-board personnel and pilots that are on the ground and can be easily and quickly substituted without interrupting the operation. The remote control also allows deployment in high-risk operations without putting the life of personnel at risk, by affording a high level of disposability. Finally, the vast range of RPAS on the market, from micro to MALE ones, with different characteristics, offers flexibility regarding possible applications, from support to police irruptions to wide area monitoring (Sartori et al., 2016).

The EU has been supporting the development of RPAS since the late 1990s adopting, *inter alia*, several documents described in section 2. In CSDP military operations RPAS are increasingly considered an essential element to be employed within the full range of EU-led CMO. RPAS have proved to be operationally efficient in the military domain, providing force protection and risk reduction for soldiers and influencing the course of CMO, maintaining a high level of persistency and effectiveness, along with a reduction in costs, logistics and footprint. In the past, EU forces already felt the need for airborne assets like RPAS as a force multiplier providing permanent and all-weather coverage with high quality sensors, such as in EUFOR Chad and Congo.

In the context of CSDP civilian missions, RPAS have never been used at the operational level. According to interviewees within EEAS, the only case in which the Civilian Planning and Conduct Capabilities (CPCC) considered deploying RPAS was in the planning of the European Union Monitoring Mission in Georgia (EUMM Georgia) in 2008. The mission started its monitoring activities on 1 October 2008, beginning with the oversight of the withdrawal of Russian armed forces from the areas adjacent to South Ossetia and Abkhazia (Interview). The mission's efforts have primarily been directed at observing the situation on the ground and at reporting on incidents. Generally speaking, through its presence in the relevant areas, it contributed to de-escalation and improved the security situation. Two main reasons stood against introducing RPAS in the Operation Plan (OPLAN), however. First, the sensitive political situation in which the mission was deployed might have been considered RPAS 'intrusive'. Second, the use of RPAS should have been included in the Memorandum of Understanding (MoU) agreed between the mission and the Georgian Ministry of Internal Affairs but this was not the case. The MoU, signed in October 2008, introduces a degree of transparency and imposes restrictions on the equipment used and the activities performed by the Georgian police forces in the adjacent areas (Interview).

Today, military RPAS mostly operate in an Area of Operations (AOO) outside of European air space. Nevertheless, they could be launched from a location outside the AOO and would have to use common airspace to reach it. They may also have to take off and land from or to EU airspace, and civilian regulations are not directly applicable to military RPAS since they are considered as state aircraft, being operated as Operational Air Traffic (OAT). However, when military RPAS need to operate in an integrated manner with General Air Traffic, either compliance with civil aviation regulations or an equivalent level of safety will have to be ensured.

At the European Council on Defence of 15 October 2013, the then High Representative/Vice-President (HR/VP) Catherine Ashton underlined that “RPAS are very likely to constitute a key capability for the future. They offer a broad spectrum of capabilities that can contribute to various aspects of EU-led military and civilian operations”, showing a clear intention to use RPAS also in civilian missions (European Council, 2017).

The European Union Military Committee (EUMC) supported and implemented the request from HR/VP Ashton in this field. Already in March 2013, the EUMC gave a task to the European Union Military Staff (EUMS) to draft an RPAS concept: an EEAS RPAS Task Force was then created in June 2013 to define the EU’s position on RPAS, to assess foreign policy implications and to focus on legal issues of their use. The concept was developed in a few months, with input of several MS, the EC, the EDA, EU SatCen and the NATO Joint Air Power Competence Centre.[5] On 28 March 2014, the EUMC circulated internally the “*Concept for the contribution of remotely piloted aircraft systems to EU-led military operations”*, a complete point of reference for the military staff involved in operations with a potential use of RPAS. Accordingly, the document provides a conceptual framework for the use of RPAS in EU-led military operations and missions with a focus on their contribution to both ISR activities and Target Acquisition (TA). The concept describes the features of RPAS covering operational environments and draws conclusions regarding interoperability, use of airspace, certification, training and education. A small section of the document also addresses the potential dual-use of RPAS, and actions which can be considered useful also in conflict prevention and peacebuilding civilian activities, such as search and rescue, cargo logistic replenishment, meteorology and navigation situational awareness are clustered among optional military tasks. The EUMS, on behalf of EEAS, has further operationalised the use of RPAS in CSDP with, at the moment, more than 4 years of experience since the first operation in Congo.

5.1 EU RPAS COOPERATION

As discussed in the previous section, the EU still lacks a proper RPAS capacity for CSDP missions. The capabilities of Member States are limited too, as was clear in the Mali and Libya operations, where Europeans had to rely on American RPAS (Davis et al., 2014). There are several ongoing European projects, most of them led by Europe’s top defence spenders,

[5] Austria, Belgium, Germany, Finland, France, Italy, Spain and Sweden contributed directly drafting through SNE at EUMS the document, while the other MS gave feedback on the document, according to those interviewed.

France and the UK. For instance, Dassault Aviation and British Aerospace Electronic Systems are working together on Telemos, a MALE RPAS. The Germans and the Spanish are developing Barracuda, and the French are leading a six-country endeavour (alongside Greece, Italy, Spain, Sweden, and Switzerland) to create the nEUROn, an experimental Unmanned Combat Air Vehicle that has already flown information with manned aircraft. The focus of this section will be on the capacity already used in conflict management and peacebuilding by the selected Member States.

5.1.1 France

In recent years, France has envisioned an increased role for RPAS in the armed forces as a crucial system in the acquisition of intelligence able to combine air, land and naval situation awareness, thus allowing the acquisition of real-time information. The 2013 Defence White Paper envisaged the acquisition of 30 tactical RPAS by 2025 and 12 theatre surveillance RPAS. This planning has been confirmed by the Law on Military Planning of 2014-19, which recognises that the RPAS *Harfang*, deployed since 2009 in Afghanistan, Libya and Mali needs to be replaced by "RPAS of superior performance" (Ministère de la Défense, 2017). On the basis of lessons learned from past operations, the Defence Ministry identified MALE RPAS as a key instrument for immediate deployment in conflict, including in conflict prevention or peacebuilding phases.

The French inventory of RPAS is the widest one in Europe. It owns 18 Tactical RPAS (Système de Drone Tactique Intérimaire – SDTI), 48 Recognition ones (Drone de Reconnaissance Au Contact – DRAC), 10 for the military engineering, and 10 MALE RPAS including 4 Harfang and 6 Reaper. While the first three kinds of RPAS are owned by the French Army, the MALE ones are employed by the French Air Force (FAF). The difference is mainly in terms of dimensions: the RPAS owned by the French Army are categorised as CLASS I and CLASS II of NATO taxonomy (see section 3.1 on classification), so small and medium capabilities, whereas the FAF devices belong to CLASS III (Ministère de la Défense, 2017).

The Harfangs are operating in military observation missions since 2009. They have autonomy of 24 hours, allowing them to perform long-lasting aerial intelligence, surveillance and reconnaissance missions, reaching an altitude of 8000 meters. The former include four modules: one for programming the mission, one to drive the device, one to collect real-time information on the mission, and a fourth component for the interpretation and diffusion of the information obtained by the RPAS itself (Jaouen, 2010).

One interesting feature of this kind of RPAS, in comparison with the smaller ones, is the possibility to operate as a liaison for sharing information with other assets (manned aircraft, ground posts, etc.) through the radio net of VHF/UHF. The three missions in which the Harfangs have been extensively used are: International Security Assistance Force in Afghanistan, for a period of 3 years and a total of more of 5,000 hours of data gathering; OUP in Libya for a total of 500 hours in 2 months; Operation Serval in Mali for more than 5,000 hours in 15 months (Interview).

The FAF used Harfang for three clusters of missions: operation planning, force protection and TA. The monitoring of checkpoints, villages, pattern of life and troops identification falls within the first category. This group of actions see the largest use of drones: around 55-65% of RPAS flying hours are devoted to such clusters. Force protection comes second, with an average of 25% of RPAS flying hours for this purpose, especially for supporting convoy escort, base protection and maritime operations. The third one occupies only around 10% of the total hours and is instrumental to further kinetic operations. This division of RPAS usage shows that even the military forces are using RPAS for non-kinetic purposes in 75%-85% of cases. Indeed, monitoring villages and checkpoints, as well as supporting convoy escorts, can be very useful and productive in peacebuilding missions where the protection of EU personnel is a crucial issue (Interview).

The replacement of Harfang RPAS envisaged by the French Defence White Paper is already ongoing with new orders of MQ9 - Reaper MALE RPAS. Its uses are very similar to the Harfang ones, and the new platform ensures higher autonomy and greater speed than the older one (Mercier, 2015).

In the lower category of RPAS II, the SDTI is capable of assuring the conduct of observation missions, the surveillance of wide areas and the monitoring of movements of suspected individuals or groups. Its use also depends on a land component set on vehicles, which allows the rapid deployment of the drone in different areas. The cameras, added-on, enable day/night monitoring. France owns 4 terrestrial stations, which serve for the deployment, the control and the diffusion of information and 2 launching, retrieving and reconditioning systems. The system also comprises one logistic training facility and a transportation asset. These RPAS can fly to a maximum altitude of 3500 meters with a range of 80 km from the launching point, and have a flying autonomy of 5 hours (Ministère de la Défense, 2017).

The maximum flying autonomy is a crucial feature of RPAS. The current threshold of 5 hours is a limit for such technology, which is why the French army is replacing the SDTI with a newer model, developed in cooperation with the British army. This cooperation is not expected to be undermined by Brexit, since it falls under the Lancaster House Treaty of 2010, deepening the cooperation between France and Great Britain (Briançon, 2017). The new system should be operational from 2020 onwards and will consist of 15 devices (Gallois, 2016).

Unlike the SDIT, the DRAC is a smaller device for a more tactical deployment, for reconnaissance missions of the observation of the closest areas. It provides real-time information by contributing to situational awareness at a tactical level. It comprises two aerial vectors, two terrestrial consoles and two cameras, one for daytime and one for night operations. The relatively easy deployment and the possibility to set mission cycles allow for a lasting and continuous overview of a determined area, which is useful when natural conditions preclude other assets. Its daily cameras can recognise a face within 700 meters and identify it within 400 meters, while the night sensors can detect a person within 400 meters and recognise that person within 200 meters (Louis, 2014).

Another interesting RPAS with a clear intrinsic dual-use capacity is the Dro-Gen. The French army owns more than 30 devices that were deployed mainly in Afghanistan to support troop movements. With a possibility to load it with 5 kilograms of thermal and 360° cameras, it is included within the Class I category as mini-RPAS. With autonomy of 120 minutes, it needs just 10 minutes of programming to set up a mission. Moreover, the Dro-Gen does not need any station to be launched (manual launch) and can fly up to 3,000 meters. This model has been useful in detecting Improvised Explosive (IED) in Afghanistan.

5.1.2 Italy

Italian Armed Forces are among the first to use RPAS in Europe. The air force has had an RPAS battalion using Predator A since 2002 and today has a fleet of 12 systems, including 6 RQ-1 Predators and 6 Reapers. The Italian Army has acquired two different RPAS, the Raven and the Bramor Strix C, and also operates the Strix C mini RPAS.

In the 2016 Ministry of Defence three-year defence planning document, RPAS are mentioned several times (Camera dei Deputati, 2016). RPAS are identified as a sector with rapid linear growth. The document envisages the renewal of the RPAS fleet, especially regarding the management systems and the sharing of information among different operating systems. The aim is to enhance capacities in the operational theatre, in particular regarding the protection of troops. The second main objective underlined by the document is the imminent development, within a European framework, of a new generation of dual-use RPAS. It is worth underlining the dual-use term inserted into the programmatic document as a key objective for the near future. In financial terms, a priority is the programme for the maintenance and upgrade of the Reaper fleet, as well as for strengthening the professional and technical know-how of operators. Within the reserve list of projects, there is the acquisition of mini and micro RPAS systems, which unfortunately does not present other detailed information (Ministero della Difesa, 2015).

Regarding RPAS used by Italian armed forces, the RQ-1 Predator was first deployed in the ISAF mission. Predator has flown more than 6,000 hours in Afghanistan, Iraq and Djibouti. In Iraq, within the Italfor-Antica Babilonia operation, Italian Predators were said to be involved in the data theft scandal operated by local insurgents, which will be analysed in the last section of this study (Arthur, 2009). In Djibouti, the RPAS supported the anti-piracy operation EUNAVFOR Atalanta by increasing situational awareness for a total of 5,000 hours' flight. This is the only example of RPAS used by Italy in an EU mission (Interview).

The Reaper has been deployed by Italy in Libya, Kosovo and Afghanistan. In Libya, it supported the OUP, working closely with its homologous French system. Details are not public, but according to the interviews the two armed forces shared surveillance and operational awareness missions, thanks to the compatibility of the two systems (Interview). The Reaper tasks were the usual ones: the surveillance of crucial parts of Libyan territory, and operational planning and contribution to situational awareness. Reaper has also been used in patrolling the Mediterranean Sea during 'Operazione Mare Nostrum', in detecting migrant smuggling vessels (Marrone et al., 2015). Another important task achieved by the Reaper was the escorting of the ships involved in the repatriation of Italian nationals from Libya. On 15th February 2015, during the evacuation of the Italian Embassy in Tripoli, a Reaper filmed and protected the members of the Embassy supporting the ISR, the IED monitoring and the convoy escort, until the ships that provided transportation to Italy could sail (Cenciotti, 2015).

A crucial role for force protection in Afghanistan has been played by the Strix-C mini RPAS, in use since 2013 for the surveillance of the perimeter of the Camp Arena Base in Herat (Scarato, 2013). Their features make use relatively easy by a team of only two individuals. It can be equipped with day and night cameras and has the capacity to complete an automatic mission, from take-off to landing. It is important to underline another Strix-C task: monitoring possible attempts to fire at military and civilian airplanes taking off from Herat airstrip (Analisi Difesa, 2013).

The Italian army also used a mini RPAS Raven on a daily basis in peacebuilding operations and missions. The Raven has been used in Afghanistan, Iraq and Kosovo missions. It can be easily deployed, launched by one man, and can assure an excellent coverage and contribute to the situational awareness of critical points and infrastructures. The system can be equipped with an optic and an infrared camera for day and night vision and broadcasts live video to the analysts and operators on the field (Interview). In particular, according to the interviewees, Raven has played a crucial role in the defence of the Deçani monastery in Kosovo, contributing to the arrest of 4 persons suspected of preparing a terrorist attack on the religious community (Interview).

The second mini RPAS widely used by the Italian Army is the Bramor. Bigger than Raven, it can be launched through a catapult system and has an incorporated parachute for landing operations. It is highly efficient in communication networks thanks to a built-in auto-tracker antenna, and to a special camera able to create a 360 degrees image and geometrically corrected images, which allows the operator to recreate a uniform scale. The images are then printable through 3D state of the art printers to recreate the exact topography, diminishing lens distortions and camera tilts. The Italian army used it mainly in Afghanistan for ISR operations and the acquisition of targets (Lopatin et al., 2015).

In addition to these capabilities, Italy's strengths in the RPAS domain include two centres of excellence. The Italian army's RPAS fleet is administrated by the Reconnaissance, Intelligence, Surveillance, Target Acquisition – Electronic Warfare, (Rista-Ew) centre. This centre of excellence, established in April 2005, is responsible for the training of analysts, the interoperability with NATO assets and intelligence gathering in operational theatre (Ministero della Difesa, 2017).

A dedicated RPAS training centre of excellence was established in 2006 in the Amendola's base by the Air Forces. Its annual training programme is not only for the Italian Air Force and Army, but adopts a broader, joint inter-agency cooperation, with participants coming from the Navy, the Carabinieri and fire brigades. This provides clear support for the dual-use of RPAS and their interoperability across various users: as of 2017, 350 individuals from the above-mentioned actors have been trained in the Amendola's centre (Ministero della Difesa, 2017).

The centre of excellence prepares five different members of the crew: the pilot, the sensor operator, the person responsible for mission monitoring, the data and images analyst and the avionics technician. Among the requirements, the pilot needs to have had a sufficient number of flying hours using the conventional jets and must have undergone previous trainings. According to interviews, this is considered necessary to be able to pilot MALE RPAS, but is not needed for micro or mini devices. The sensor operators are responsible for the functioning and the movements of cameras on board of the RPAS, while the mission monitors prepare and set the RPAS for the take-off and landing. The data and images analysts are intelligence experts, whose role is to match the data from the field with those already available, and to transform these data into usable knowledge and analysis.

The Italian army and air force operate frequently with personnel on the field in charge of following operations from the same area covered by RPAS - and not in the headquarters kilometres away from the theatre of operations. This is seen as a plus by those interviewed because it helps the exchange of information among the team and facilitates a quick change of mission objectives if needed (Interview). Finally, the avionics technicians are responsible for the electronic components of the RPAS.[6]

5.1.3 Germany

Within the selected sample, Germany has the third highest number of RPAS, after France and Italy. In the White Paper on defence adopted by the German government in June 2016, RPAS (as well as satellite communication) are mentioned as a priority in the framework of the European approach to common security threats and challenges. The document underlines the willingness of German government to *"act as both a framework nation and partner for*

[6] To complete the Italian case study, it is crucial to focus on the initiative of the Italian Red Cross, which in 2015 launched the RPAS programme and in 2016 established training schools for Red Cross pilots. Its RPAS fleet, headquartered in Bologna, specialises in various civilian operations: search and rescue, support for firefighting operations, and post-earthquake missions. The assets owned by the Italian Red Cross are numerous and of different classes, from mini to medium RPAS. The most interesting one is the SD-150 Hero UAV, a tactical class RPAS system which has a maximum speed of 185 kilometres per hour and can carry up 50 kilograms of medicines or cameras. Here there is also a significant dual-use potential.

multilateral projects" in the field of RPAS, also focusing on the need for civil-military cooperation. In order to achieve this degree of cooperation, Germany is willing to establish a permanent civilian-military operational headquarters for the planning and conduct of operations. At the European level, the document strongly emphasises the development and procurement programmes such as the EUROMALE.

Germany currently has five different kinds of RPAS in service, four owned by the German Army and one leased by the German Air Force. The latter has three Heron I MALE RPAS leased from the Israel Aerospace Industries. The leasing contract has been extended until February 2018. The systems should have been substituted by 5 Heron TP from the same contractor, until the EURODRONERPAS reached Full Operational Capability (Jennings, 2017). However, in June 2016, the German parliament did not approve the leasing contract, valued at around EUR 1.1 billion (Schulte, 2016). This development shows a significant politicisation of the procurement and subsequent use of RPAS in the German case, which will be taken into consideration by the policy proposals in the final part of this study.

The HERON I is a MALE RPAS used for strategic and tactical missions and can be equipped with 450 kilograms of payload, which can comprise patrolling radars, a combination of sensors and cameras and devices for satellite communication. This last feature makes the HERON I capable of functioning as a bridge for communications among actors on the field, satellites and headquarters (Israel Aerospace Industries, 2017).

The German air force has employed the HERON I for intelligence, surveillance and force protection missions since 2010 in the Afghan theatre, collecting more than 14,782 operating hours (Deutscher Bundestag, 2013). Since 2016, HERON I have flown from the German-Dutch base in Gao, Camp Castor, in support of the United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) peacekeeping mission in Mali, sadly famous for being one of the UN peacekeeping mission with the highest number of casualties. During her visit to Mali of December 2016, the German Minister of Defence, Ursula von der Leyen, underlined the support that RPAS give to the security of peacekeepers (Stern, 2017).

HERON I started its operations in Mali in November 2016 and achieved full operational capability in February 2017. It is interesting to underline that the HERON support team comprises a mix of civilian contractors and German military personnel who operate the system, showing that it possible to exploit civilian-military synergies (De Cherisey, 2017).

The German army owns four different RPAS. Beside the HERON I, the biggest and most frequently used one is the LUNA that is launched through a catapult and recovered autonomously by net or parachute. Two special features characterise the LUNA. Firstly, it is able to perform glides without engine power with no acoustic signature and to restart the engine at any time. Secondly, LUNA flight is permanently monitored by an autonomous terrain and by the obstacle collision avoidance system using 3D digital map data. The LUNA has been used by the German armed forces within KFOR since 2000 and by the troops in

Afghanistan in ISAF mission. This RPAS is part of the capabilities owned by the German troops in Gao, with a total of 80 devices (Hegmann, 2015). The LUNA is a product of the German company EMT Penzberg, specialised in RPAS manufacturing and support, supplying both civilian and military customers.

Another product employed by the German army is the ALADIN RPAS. The ALADIN is categorised as a mini RPAS, being part of the tactical sub-unit category. It is easy to operate, having a manual launch system and being piloted through a small system that fits in a computer bag. Accordingly, a team of two is sufficient to manage its operative phase. However, such a category of RPAS has very limited endurance (a maximum 60-minute mission); coupled with its relatively small range the ALADIN can only be used for very circumscribed operations (Bundeswehr, 2017). It has been used mainly in Afghanistan for reconnaissance missions and to support force protection. Since autumn 2016, it has also been deployed in the MINURSO mission in Mali. The third RPAS deployed by the German army is the KFO, a CLASS II device for tactical deployment.[7] The fourth kind of RPAS owned by the German army, Mikado, is deployable in a context of civilian conflict prevention and peacebuilding and is the lightest device used by the German army (Bundeswehr, 2017). The main feature of this mini RPAS is the vertical take-off and landing system, which allows for rapid deployment in narrow areas. The KFOR German troops have deployed Mikado RPAS in Kosovo since 2015 and in the ISAF mission (Defense Video Distribution System, 2015).

An interesting (publically available) fact about the German experience of RPAS is the high number of destroyed, crashed and lost devices; according to German army sources, there have been many crashes and losses of RPAS. The LUNA has the highest number of losses, 58 out of 84 devices acquired by the German army.[8] These statistics shed light on the vulnerability of such of devices, which are probably less expensive of bigger ones inexpensive, but may lack reliability in the long term (Bundeswehr, 2017).

5.1.4 Sweden

RPAS are not mentioned in the Swedish Ministry of Defence's latest White Paper (2016). Sweden has raised attention of RPAS experts due to a controversial regulation on them, which was voted last year. The Sweden's Supreme Administrative Court ruled that RPAS should be treated as surveillance cameras under the terms of the data protection regulation. Privacy underlines one of the considerations included in the final part of this study.

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[7]It is not relevant to this study because of its particular launching mode. The KFO, in fact, needs a special military ground vehicle to be deployed, which does not fit with the purposes of conflict prevention and peacebuilding goals of this research.

[8] The ALADIN definitely has better performance, with only 33 RPAS destroyed or lost out of 290 owned. Relatively low performance in terms of endurance is reported also by the KZO RPAS, which record, out of a total 43 devices, 18 lost or crashed. Finally, the Mikado is the most reliable RPAS, according to statistics: only 5 devices have been lost by the German army out of 163 owned.

The Swedish army owns three kinds of RPAS: the UAV 03 Eagle[9], the Raven and the Wasp III (Forsvarskmakten, 2017).

The Raven is one of the oldest small hand-launched RPAS, CLASS I, mostly used in operational theatres. It is owned by more than 20 states, and the Swedish army has deployed it since 2013 in Afghanistan to provide support to troops and force protection (Forsvarskmakten, 2017).

The Wasp III is a mini RPAS, CLASS I, in use in the Swedish Air Force, Army and Navy. Its small dimensions allow it to be easily deployed and recollected. It has a reduced range of just 5 kilometres and can fly to a maximum of 300 meters, with a cruise speed of 50 kilometre/hours and an endurance of 45 minutes (Forsvarskmakten, 2017).

Considering the size and limits of Swedish RPAS fleet, Swedish forces could provide support for conflict prevention and peacebuilding tasks, but with a less relevant RPAS role compared to the other three case studies.

6. THE POTENTIAL OF SATELLITES AND RPAS TO SUPPORT EU CONFLICT PREVENTION AND PEACEBUILDING

The research conducted on the four case studies reported commonalities, room for improvement and problematic areas in the possible exploitation of satellites and RPAS in conflict prevention and peacebuilding activities conducted by the EU.

Firstly, as shown by the case studies, military forces utilise satellites and RPAS mainly for ISR and situational awareness aims. This group of tasks in which the technologies are employed can also be directly transferred to the civilian domain, resulting in typical dual-use. The main tasks that the systems can perform in a civilian context can be summarised as follows. First: intelligence, meaning the gathering of information for situational awareness and a complete view on the territory in the direct interest of the civilian mission. RPAS and satellites can provide information on specific areas that may be difficult to access by the mission's personnel, thus enhancing information-sharing within the operation.

Directly linked to the first possible exploitation is surveillance, in this case the surveillance of groups that may hinder the mission and the security of mission staff and the population. Possible movements of assets in remote parts of the country can be supervised and controlled through the use of these technologies. This is particularly relevant for conflict prevention or peacebuilding missions deployed where a vast area of the region is not fully controlled by local governments (see, for instance, the Niger).

[9] Since the Eagle is a CLASS II tactical RPAS that needs a vehicle-mounted launcher to be deployed will not be analysed by this study.

Satellites and RPAS deployment can also be crucial in the monitoring of internally displaced persons, in the case of growing local tensions, allowing staff to gauge the possible escalation of a conflict. Scarcity of resources may trigger a population to leave some parts of the country. This migration of people, internally or towards neighbouring countries, can be detected by earth observation satellites and easily monitored over time, thanks to devices such as French Harfangs or Italian Reapers. Information about movements of people or dam water levels in remote areas of the country can be retrieved thanks to satellites, but also by RPAS, for instance, through the Bramor RPAS in use by the Italian Army, which can take photos and create 3D orographic maps of the area under investigation.

Another task which can easily be achieved through the use of RPAS and satellites is the definition and control of boundaries between disputing states. This task is at the core of the mandate of several missions, *inter alia* the EUMM in Georgia or the European Union Advisory Mission (EUAM) in Ukraine. EUMM Georgia is one of the EU missions and operations that are supported by the EU SatCen with IMINT / GEOINT products, and it is not by chance that the EU carefully considered the deployment of RPAS during the draft of the OPLAN for EUMM Georgia. The use of RPAS in a civilian mission can ensure a close and continuous control of potential troops along borders and facilitate the deployment of interposition forces (Interview).

Support to force protection is one of the main functions the RPAS perform for the military. There is a common understanding that EU civilian missions operate in safe and secure environments. This is unfortunately not always the case, as shown by several accidents that occurred in past missions. Focusing again on EULEX Kosovo, in September 2013 a Lithuanian EULEX border officer, Audrius Šenavičius, was killed during duty in the northern part of Kosovo by a gunman (never found) who shot him from a hill next to the road Šenavičius was driving along. The protective measures EULEX mission took from that day on significantly decreased the efficiency of the mission in the north of the country. Indeed, since this incident, EULEX staff are not allowed to cross the Ibar River towards northern Kosovo without a helmet and bullet-proof jacket, and no staff can enter that area without an official reason. This situation contributed to the pauperisation of the north of the country, which relied heavily on the presence of international stabilisation forces as a source of income in the post-war years, and surely did not help the peacebuilding operations. The support of RPAS MALE in this situation could facilitate the conduct of the civilian mission in the north, thanks to its contribution to force protection. In peacekeeping operations, the German army, as described, already uses the Luna to support force protection for its personnel deployed in the Sahel within the MINURSO mission. Force protection support is not just limited to the escort during peacetime but can also be used in RPAS deployment during an escalation of violence as an exfiltration tool for European and local populations from a dangerous area. This was the case during the repatriation of Italian embassy personnel from Tripoli during the 2015 uprising in Libya.

Police activities are a field in which RPAS still have to find their way. In this case, the focus shifts from MALE RPAS to mini and micro devices. This equipment is already in use by some national police forces (e.g. Italy) and can help EU conflict prevention and peacebuilding missions where training and support of the police sector is among the main tasks of the mandate (such as EUPOL COPPS in Palestine and EUCAP Sahel). The EULEX mission is a perfect example of where micro and mini RPAS could have been used for police purposes. Among the executive task of the European EULEX police was the capturing of suspected war criminals and this involved search operations in a difficult context, due to the orography of the territory or the complicity of the local population that helped the suspected person to escape. The use of SDTI French RPAS or manually launched RPAS as the Italian Strix-C could have a positive impact on this type of operations in the future.

Additionally, RPAS have the potential to help conflict prevention and peacebuilding operations through subsidiary tasks, such as the protection of critical infrastructure, the prevention of illegal traffic of human beings, firearms, drugs, etc. The monitoring of the surrounding areas of critical infrastructures or headquarters of a mission can facilitate the prevention of terrorist attacks. Deployment of RPAS in the nearby key checkpoints could help border control staff to identify a car or a truck smuggling goods. Persistent monitoring of borders could help to identify new paths used for human trafficking. As already seen in this study, satellites have supported the EEAS and EU MS through the 1864 IMINT/GEOINT products delivered by EU SatCen in 2016.

Despite the positive application described above, a series of risks and negative considerations related to the use of RPAS and satellites have to be taken in account to reach a comprehensive view of the possible exploitation of these devices.

The first relates to the security of information flows and to the chances of hijacking. Being composed by electronic parts communicating via a series of different interfaces, RPAS are definitively a target for possible cyberattacks. There are no notices about past hijackings of European RPAS, which are well protected since manufacturing, but a strong cyber defence scheme has to be borne in mind when acquiring and deploying such devices. Moreover, there have been reported cases of information leaks by US RPAS during operations in Iraq. Live video feed of Predators were reported to have been leaked and posted online by Iraqi citizens using software that can be downloaded online (*The Guardian*, 2009).

The issue of data protection is also relevant in this case. The privacy of the local population in areas where RPAS activities are conducted is highly impacted by the work of these devices. As long as the military is running the operations, the problem of privacy is trumped by the security aim and related protocols to handle data, but when these devices are deployed in a civilian framework this problem might still surface. A clear data protection regulation has to be agreed upon between the conflict prevention and/or peacebuilding missions and the counterpart in the field. For instance, the OPLAN section dealing with RPAS should have a chapter detailing data protection arrangements. Regarding satellites, protecting citizens' privacy with the actual resolution capacity is not an issue.

Moreover, clear engagement rules for the staff operating RPAS have to be designed. In the military, there are different roles in place and while a pilot is a certified former aviation pilot, an operator is charged with other tasks and cannot fly the RPAS. In the civilian RPAS world other regulations and vocabulary apply: the pilot and the operator are the same person and the certification depends on the weight of the RPAS, leaving a more flexible framework for the users. Qualified and trained personnel is needed to avoid incidents that may hamper the outcome of a mission and its reputation.

Returning to operational issues, the question of the segregation of airspaces has to be taken into account. For the moment RPAS can, in fact, fly only in segregated airspaces, to avoid clashes with other civilian and military airplanes. Therefore, the separation of these corridors is crucial for the authorisation to fly needed by RPAS. Italian military forces have developed 'smart segregation' procedures that considerably reduce collision risks, but no more information on this issue has been made available by the officials interviewed.

Finally, certain political consideration needs to be taken into account. The majority of RPAS models are produced by US-based companies, and in most cases authorisation by the American Congress is needed by these firms to sell certain models (mainly but not only the Predator) to European buyers. The heavy dependency of the US and Israel on these devices may influence the availability of devices or spare parts when needed, leading to a sub-optimal use of these systems.

CONCLUSIONS

While dual-use technologies have become ever more present in our lives and while increasing levels of attention have been given to the former in both policy and academic domains, there has still been a void in the body of related research, which has lacked assessment of how they might contribute to civilian EU conflict prevention and peacebuilding. This report seeks to fill this gap by providing an exploratory analysis of the possible exploitation of dual-use technologies in EU conflict prevention and peacebuilding. From the strategic documents analysed in this study, it becomes clear that the EU is pushing the development of such technologies. Among the variety of dual-use technologies that could have been analysed, the study focused on satellites and RPAS for three main reasons: firstly, the frequency of references in EU documents and their presence in planned EDAP projects; secondly, their clear dual-use implications and the possibility that they could be employed in conflict prevention and peacebuilding; and finally, the ownership of them, and their past use, by the selected MS.

The first part of the study revealed that the EU, through those European Commission DGs with an economic portfolio and the EDA, recognised the positive implications (in terms of security and economic benefits) to be realised through the development of dual-use capabilities. The discussion illustrated a path towards a sort of hybridised European research, featuring an increased connection between the civilian and military sectors. However, the implications and possible exploitations of dual-use technologies in conflict prevention and peacebuilding still lack sufficient attention on the part of EU institutions and stakeholders. Given the different initiatives in place, there is also a risk of fragmentation and duplication of efforts by different EU institutions in the research into, and application of, dual-use technologies.

The second part of the report presented four case studies (France, Germany, Italy and Sweden) through which it assessed the current operational usage of dual-use technologies at MS level and their potential application at EU level. Through a deep and comparative analysis, the second part of the report demonstrated how the selected dual-use technologies, satellites and RPAS can contribute to conflict prevention and peacebuilding activities, performing various tasks such as intelligence; surveillance; definition of borders; force protection; and support to police and law enforcement agencies. All these activities are included within the mandates of several ongoing civilian CSDP missions and can be supported using RPAS and satellites.

The report highlighted some positive developments and best practices that should be further encouraged or institutionalised at the EU level. Concerning satellite exploitation for conflict prevention and peacebuilding, the report underlined the role of EU SatCen in bridging MS policies, as well as between existing and future military-civilian earth observation systems. Amendola's excellence centre for RPAS was also identified as a leading example of cooperation between military and civilian forces. Given the importance of properly training personnel when it comes to dual-use technologies, this case could also be used as a model to develop specific training programmes on civilian-military cooperation in dual-use technologies. The potential and actual implications of the EDF in terms of dual-use technologies was also highlighted by the report. The EDF aims to provide a strong economic growth impulse, but its implications for the conflict prevention and peacebuilding sector are also evident. The EDF is expected to finance projects on defence research, which could include dual-use technologies, given the strong potential for the interoperability of military systems with those of the police, the wider security forces, and other law enforcement and border control agencies.

The potential opportunities offered by the EDF should be harnessed to enhance the exploitation of dual-use technologies in EU conflict prevention and peacebuilding. The report identified some specific challenges that need to be addressed in this area. For instance, concerning data policies, the report highlighted the lack of a precise and adequate data policy in civilian conflict prevention and peacebuilding at the EU and MS level. The German and

Swedish cases also show that public opinion has influenced decisions on RPAS acquisition and their use. Hence, the final decision to use this kind of device may become a political matter. For this reason, the EU and its Member States will have to address the public's reservations about the privacy and data protection implications of the instrumentalisation of dual-use technologies in conflict prevention and peacebuilding, both within EU MS and the beneficiary state(s). Drawing on this analysis, the report proposes seven policy recommendations and considerations.

<u>**Policy recommendations and considerations**</u>

1. **The EU should continue to promote inter-institutional funding opportunities to avoid a duplication of effort and spending.** Particularly, future projects awarded under the EDA defence research framework should follow the dual-use approach.
2. **A clear EU policy on how to use dual-use technologies in conflict prevention and peacebuilding activities is urgently required.** Such a vision is necessary to avoid politicising the matter and to ensure proper coordination among the EDA, Horizon 2020 programmes, and other upcoming EC initiatives such as the European Defence Industrial Development Programme.
3. **The EU should coordinate programmes launched through the European Defence Fund (EDF) funding stream with the strategic planning of the European External Action Service (EEAS).** The EEAS should couple and complement the efforts of EDF through the funding of related training activities for police and other law enforcement agencies, to ensure that security actors exploit the interoperability of dual-use systems.
4. **The EU should take advantage of the potentiality of satellites and RPAS in conflict prevention and peacebuilding by supporting the pooling and sharing of activities (both among MS and within CSDP missions), and by standardising procedures.** Particularly, synergies and exchanges of capabilities between military and civilian missions should begin in situations where military and civilian staff already work side by side, for example in the Sahel region. Moreover, the pooling and sharing of RPAS devices in civilian conflict prevention and peacebuilding could start with older models that are still operating (Harfang and RQ1, for instance), but are about to be replaced by newer models in the military sphere.
5. **Based on Amendola's base model, the EU should develop specific training models on military-civilian cooperation in the field of dual-use technologies.** This model should also be integrated into a revised EU training policy.

6. **The capabilities of EU SatCen, which bridges functions between EU institutions and MS and between existing and future military-civilian earth observation systems, should be further explored and enhanced** to facilitate access to earth observation data to address needs related to security and defence in the EU.
7. **In relation to the development of the Copernicus programme, there is a need to establish adequate data dissemination policies** that fulfil the needs of the EU's security and defence community.

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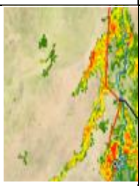
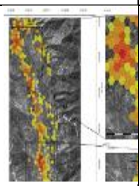
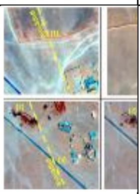
ANNEXES - SATELLITE IMAGERY USAGE MATRIX AND RPAS CSDP MISSIONS MATRIX

Figure 1 Satellite Imagery Usage Matrix. Source :Courtesy of EU SatCen

Product Examples	Name	Description	Peace Keeping/Peace Building	Monitoring	Border Assistance	Training	Police/Rule of Law	Decision Making
	Reference Map	Reference Maps are high quality cartographic products including a wide range of observable features	⚠	⚠	⚠	⚠	⚠	✓
	Road Network Status Assessment	Road Network Status Assessment provides users with up-to-date information of the status of the road network. This information is designed to support the planning of logistic operations in the field	⚠	⚠	✓			
	Conflict Damage Assessment	Conflict Damage Assessment product uses change detection in order to provide visual interpretation containing information on distribution of damage in a crisis area	⚠	⚠				⚠
	Critical Infrastructure Analysis	Critical Infrastructure Analysis identifies the relevant components of an infrastructure (e.g. power plants, industrial sites, transportation facilities) considered to be critical and assess their operational status	⚠	⚠	✓			✓

	Support to Evacuation Plan	Support to Evacuation Plan provides geospatial information to support the evacuation of EU citizens from crisis areas	✓	⚠	✓	⚠	⚠	
	Non-EU Border Map	Non-EU Border Map provides users with the possibility of acquiring information specific to support decisions about non-EU border issues	✓	⚠	⚠	✓	⚠	⚠
	Camp Analysis	Camp Analysis is a product oriented to support decision making regarding displaced population (either internally displaced or refugees)	⚠	⚠	✓			⚠
	Crisis Situation Picture	Crisis Situation Picture is a product designed for the overall assessment of the severity of a conflict/crisis and its consequences	⚠	⚠				⚠
	Activity Report	Activity Report is a product focused in providing the user with an analysis of a given human activity. By its nature, this product is very flexible and can be applied to a variety of situations	⚠	⚠	⚠		⚠	⚠

Very Useful	⚠
Useful	✓
Complementary or Not Applicable	

Figure 2 RPAS CSDP Mission Matrix. Source: Authors.

CSDP MISSIONS	Intelligence	Surveillance	Border Assistance	Force Protection	Police/Rule of Law
EUAM UKRAINE	⚠	✓	⚠	⚠	
EUBAM LIBYA	⚠	⚠		⚠	
EUBAM RAFAH	⚠	⚠	✓	⚠	
EUCAP SAHEL	⚠	⚠		⚠	
EUCAP SOMALIA	⚠	✓	✓	⚠	
EULEX KOSOVO	⚠	⚠	✓	⚠	⚠
EUMM GEORGIA	⚠	⚠	⚠	⚠	

Very Useful	⚠
Useful	✓
Complementary or not Applicable	

LIST OF INTERVIEWS

#	Affiliation	Type of organisation	Date	Place
1	European Union	Institutional	12/06/2017	Brussels, Belgium
2	European Union	Institutional	12/06/2017	Brussels, Belgium
3	Italian Ministry of Foreign Affairs	Institutional	15/06/2017	Rome, Italy
4	Italian Army	Institutional	22/06/2017	Rome, Italy
5	French Army	Institutional / Military	19/07/2017	Brussels, Belgium
6	European Union	Institutional	19/07/2017	Brussels, Belgium
7	German Army	Institutional / Military	18/09/2017	Rome, Italy
8	RPAS Professor	Academia	26/06/2017	Rome, Italy

All interviews took place on the basis of informed consent and anonymity in person and by phone. The "European Union" includes the EEAS, Commission and Parliament.