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EUROPEAN MARITIME SAFETY AGENCY

USER-BENEFIT ANALYSIS OF RPAS OPERATIONS IN THE MARITIME DOMAIN

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EXECUTIVE SUMMARY

DISCLAIMER

This report presents the findings of the study on user-benefit analysis of RPAS operations in the maritime domain.

This document – besides providing an accurate compilation of the needs of end users as stated by the end users themselves – also provides statements and assessments drawn together by the contractor based on the information collected during the study. Such statements and assessments may be subject to uncertainties that are beyond the contractor's ability to control, such as additional information, data, needs and requirements of end users which did not provide inputs to the study.

This study does not necessarily state EMSA position and opinions but is a report provided to analyse the user benefits of RPAS operations in the maritime domain.

EXECUTIVE SUMMARY

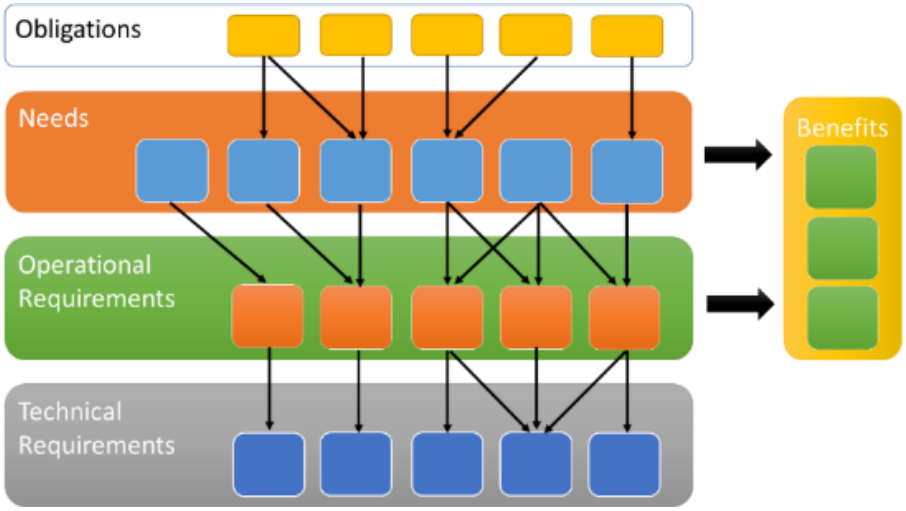
The field of maritime surveillance is of growing importance, due to a range of factors including safety of navigation, illegal, unreported and unregulated fishing, drug trafficking, and, particularly in recent years, the growth of irregular migration.

Historically, constructing the maritime picture has been reliant on utilising a number of technologies and platforms such as manned aircraft (helicopters/airplanes), earth observation/satellite systems, land-based infrastructure (AIS, VTS, etc.), LRIT[1] and patrol vessels. Contemporary technologies and systems, for example Remotely Piloted Aircraft Systems (RPAS), bring innovative and key capabilities which can potentially provide an additional source of data and operational capabilities that can bridge the gap between satellite derived information and local information acquired by on-scene assets.

The main objective of this study was to better understand user requirements for the use of RPAS in the maritime domain across a range of maritime tasks and activities - marine environment protection, maritime safety and security, fisheries control, border control, law enforcement and customs. The study focused on communities currently being supported by EMSA's operational tasks.

In order to prepare the study various structured steps were undertaken. Firstly, the relevant legal and technical documents were analysed. In parallel, maritime stakeholders (European and national maritime authorities, national competent authorities and other organisations of relevance) were identified and contacted regarding their needs and to explore the potential benefits that RPAS operations could bring to the users in the maritime domain. These stakeholders were contacted by email, telephone and – in some cases – through face to face meetings. This first phase step resulted in a catalogue of the legal obligations and needs of institutional and governmental users that are relevant to implementing operational RPAS services. From this information, the potential applications and their operational requirements were established and the technical requirements for RPAS and sensors were identified to be able to fulfil these operational requirements. In order to avoid repetition and identify common characteristics, the needs and benefits have been grouped and interlinked as depicted in the following diagram. Commonalities in the different levels allows for the identification of potential RPAS multipurpose operations and to the identification of synergies between the services.

[1] LRIT: Long Range Identification and Tracking



Finally the key success factors and problems related to the operational use of RPAS in the maritime domain were described and analysed.

Almost all of the surveyed organisations mentioned that they are able to fulfil their existing legal obligations with existing resources – hence they are able to fulfil their current operational needs. Importantly, they also highlighted that they view RPAS as a tool to complement existing resources and/or to replace them in a more cost-effective way.

Pollution Monitoring and Response organisations identified that RPAS can be used to fulfil a range of operational needs, i.e. pollution detection in particular of oil spills, assessment and confirmation, pollution sampling as well as supporting (oil spill) response operations. Specifically, RPAS equipped with appropriate sensors are able to detect pollution by ships at sea when undertaking targeted or regular maritime surveillance operations, confirm a pollution initially detected by another resource (for example satellites), as well as collecting water and pollution samples for analysis and prosecution in court of law and finally, RPAS can support pollution response operations both by providing "eye in the sky" capabilities and acting as a communications relay platform to coordinate the involved resources. These organisations stressed that the availability of RPAS would be of significant benefit as they would complement their existing tools and would make their activities more efficient.

Authorities in countries where Emission Control Areas (ECAs) apply currently lack – in most cases – the real time capability to check ***ship emissions.*** This most obvious way to do this would be by aircraft that fly in the emission plume of the ship of interest. Due to the fact that no humans are on-board, RPAS are the perfect resource to perform this type of mission and fulfil this operational need. The health hazard to pilots is avoided. For this maritime community, the use of RPAS would bring new capabilities – that does not exist today – to *enforce* ship emissions legislation and as such to fulfil their missions.

Search and Rescue organisations see RPAS as a tool to improve search capabilities over large SAR areas due to better endurance compared to manned aircraft and faster response times compared to using vessels. Being unmanned, RPAS can also better operate in harsher weather conditions than manned aircrafts and vessels and the associated risk to personnel on-board is reduced. As previously identified with regard to pollution response operations, SAR operations might be performed in places far from shore with reduced or no communication coverage. RPAS can be used as communication relay platforms

to support the coordination of resources involved in the search and rescue operations. The authorities in the search and rescue community are also interested in exploring the flexibility of RPAS for incorporating new technologies and sensors on-board, for instance – as one authority referred – *"to detect a person's head in the ocean"*.

The ***Fisheries Control*** authorities (both at national and European level) are keen to explore the capabilities of RPAS to monitor compliance with new regulations e.g. the *Landing Obligation*[2]. For instance, the flight endurance, range and covert capabilities of RPAS are very relevant as with respect to targeting and following fishing vessels that may be involved in illegal activities e.g. discharging fish at sea or undertaking fishing in restricted zones. For fisheries control authorities the main benefit of using RPAS would be the detection of illicit actions that today are very difficult to be done with existing means or in a cost-efficient way.

European institutions involved in ***Customs Control***, ***Border Control*** and ***Law Enforcement*** want to use RPAS for general maritime surveillance and reconnaissance, to monitor suspicious vessels, and to provide a communications relay and "eye in the sky" platform when performing operations at sea. For these user communities, the main benefit of RPAS over manned resources is longer endurance and range. Additionally, some of the authorities in these communities rely on other (national or international) authorities to obtain their maritime domain awareness information, and as such, having additional sources of information is always a relevant benefit.

Analysing the different answers by end users, the primary benefits of the use of RPAS can be summarized as:

- **Operational** - RPAS provide *increased operational flexibility* when compared to those resources being used today; and
- **Financial** - potential users expect that RPAS will bring material financial benefits across all life-cycle cost elements.

Consequently, improved operational performance combined with cost benefits is very attractive to potential users.

When compared to ships and manned aircraft and because they are able to patrol or survey large areas quickly, Long-Range and Long-Endurance RPAS can perform operations with higher effectiveness[3] than ships and, in some aspects – namely endurance – better than manned aircraft. RPAS have better endurance when compared to similar manned aircraft, as crew fatigue can be addressed on the ground, at the flight control centre, by having two or more crews controlling RPAS successively without any loss of performance for the RPAS. Endurance is only limited by aircraft mechanical limits e.g. fuel capacity and rate of consumption. Consequently, RPAS can stay on site for a longer time period when compared to similar manned aircraft. This feature was identified by contacted organisations as particularly

[2] Common Fisheries Policy (CFP), Regulation (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013.

[3] Whereas efficiency means "doing the thing right," effectiveness means "doing the right thing" without reference to the resources spent in achieving the desired goal.

beneficial for search and rescue scenarios, response operations and the monitoring of specific activities at sea.

Mini, Short-Range and Medium RPAS can perform operations at mid distances and coastal waters (less than 100 km) with higher effectiveness[4] than ships. Regarding deployment, RPAS flight readiness time is perceived by interviewed organisations, as no pilots are aboard, as similar as or better than that of manned aircraft. Some of the organisations also mentioned that, in comparison to manned helicopters, Vertical-Take-Off-and-Landing (VTOL) RPAS can fly (take-off and landing) from the decks of ships and can operate in worse conditions as no human is on-board.

When compared to satellites, RPAS offer the capability of:

- Being directed to a certain position and to stay on site for a continuous period, as opposed to the relative "snapshot" of a satellite sensor. Accordingly, RPAS are better at collecting information for a longer time period over a given target area.
- Can operate at all times, day and night. This enables RPAS to react promptly to events and emergencies. Satellites often have a lead time being in position over the area of interest due to the need to re-task the sensor and alignment with the next suitable orbit/overpass.
- Being able to fly close to the sea surface with dedicated sensors e.g. SOx sniffers. RPAS can carry sensors that are not available at the moment for satellites or vessels. These sensors collect additional relevant and spatially more detailed information than satellites.

More general benefits of using RPAS have also been identified, related to the fact that RPAS do not have humans on board. Consequently, human life is not at risk whatever the mission or environmental conditions. For the same reason, RPAS can be used for missions in more hazardous environments e.g. poor weather, releases of chemical/HNS clouds, radioactive leaks into the atmosphere, physical proximity to cliffs, etc. than manned resources.

The main barrier identified by end users for the deployment of RPAS in the maritime domain is the current lack of a robust pan-European legal framework with respect to the ***regulatory aspects to achieve flight approval (permit to fly) for RPAS***, ***operating RPAS in non-segregated airspace*** and the certification of RPAS airworthiness.

A number of sensitive issues identified by end users regarding the use of RPAS are in common with the use of manned aircrafts and vessels, namely the ***privacy*** of data collected (photos, video, …), and ***confidentiality*** e.g. the whereabouts of fishing vessels are subject to commercial confidentiality rules.

A concern expressed by end users is related to ***upholding the integrity of the "chain of evidence"*** without a legally mandated official on-board the aircraft. National and European legislation regimes do not expressly cover RPAS data elicitation and distribution conditions.

Users expressed the need that "**data collected by RPAS has to be channelled to the maritime surveillance systems of end users"**. They requested investigation of how that information can be

[4] Again, faster than ships.

combined with existing data. Finally and for certain types of operations – namely those targeting a ship to collect evidence of illegal activities or those requiring reaction from RPAS as the situation evolves at sea – users expect to be able to **"control in real-time"** the actions of the RPAS in cooperation with the pilot and sensor operator during the flight.

The **current economic situation** for some European organisations means that it is not feasible to make new investments or incur any additional costs for maritime domain systems e.g. funding of RPAS is not currently viable.

The overarching positive conclusions of this study on the use of RPAS as based on the expressed positions of European maritime organisations are that:

- There is a European need to enhance existing maritime domain capabilities.
- RPAS-based services have the potential to fulfil such a need, as they can be established and operational throughout Europe, trans-nationally.
- Multi-purpose RPAS missions would allow efficiency gains as the maritime information collected could be used in support of different activities/tasks/operations and users.

Finally, as the development of RPAS for use in the maritime domain is in its early stages, there is the opportunity to design RPAS services in such a way that they have the technical capability and the flexibility to evolve in accordance with the needs of the different maritime tasks and activities of the users.