Remotely Piloted Aircraft System (RPAS) based Services of the European Maritime Safety Agency

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Introduction

Maritime domain awareness is of growing importance, due to societal challenges such as marine pollution, the massive growth in irregular migration, illegal fishing, safety of navigation, and consequently the increasing interest by EU Member State authorities in having a complete maritime picture.

The European Maritime Safety Agency (EMSA) provides comprehensive maritime domain information to the European Union Member States and bodies (e.g. FRONTEX and EFCA). After building-up capacity within its mandate over a number of years, EMSA has become the major provider of reliable and efficient information services in the maritime domain. The EMSA Regulation tasks the Agency to support national authorities carrying out coastguard functions at a national and Union level, by providing surveillance and communication services based on state-of-the-art technology, including space-based, aerial, and ground infrastructures.

Marine pollution, in particular oil spills at sea, and the associated impact on the coastline can cause extensive socio-economic and environmental damage e.g. polluting tourist beaches and/or contaminating fishery facilities. The impact of such pollution can be reduced through prompt response actions by Member States and/or deterring their occurrence based on up-to-date maritime information. For pollution monitoring, maritime domain awareness implies particularly the capacity to cover large sea areas primarily to detect illicit oil spills, monitoring of vessel movements.

RPAS surveillance platforms

Since 2007, EMSA has provided satellite based services covering all European and adjacent waters using radar and optical imagery. However, continuous monitoring and additional detailed data analysis is necessary for effective maritime surveillance. From a technical perspective, this remains a challenge; e.g. the services based on satellite imagery do not have the capability to cover a certain area of interest at a certain moment of need.

Remotely Piloted Aircraft Systems (RPAS) have the potential to radically improve surveillance and detection capabilities such as:

- they can be directed to a specific location at-sea and stay on site for a continuous and extended period, as opposed to the relative “snapshot” of a satellite sensor.
- they can operate at all times, day and night. This enables RPAS to react promptly to events and emergencies. Satellites often have a lead time before being in position over the area of interest. This is due to the need to re-task the sensor and align with the next suitable orbit/overpass.
- they are able to fly close to the sea surface with dedicated sensors and these sensors are not currently technically available to satellites. These sensors can collect additional relevant and spatially more detailed information than satellites, e.g. SOx sniffers.

RPAS can be used to fulfil a range of operational needs, i.e. pollution detection of oil spills, assessment and confirmation of pollutions and supporting (oil spill) response operations, as well as finding and monitoring vessels and persons in distress, and finding certain risk activity patterns. This requires information with lower spatial resolution over a large area, as well as the detection, tracking, and identification of small boats which requires higher spatial resolution surveillance.

Compared with manned aircraft, RPAS have the advantage of not being “manned” i.e. there are no pilots and operators on board. Human life is not directly put at risk due to the nature of a particular mission or the associated environmental conditions. Consequently, RPAS can be used for missions in more hazardous environments e.g. in poor weather, releases of chemical/HNS clouds, radioactive

leaks into the atmosphere, physical proximity to cliffs, etc. Furthermore, unmanned aircraft are not limited to flying a limited number of hours with the need for a crew change as in manned aircraft, meaning they can have longer endurance for specific missions.

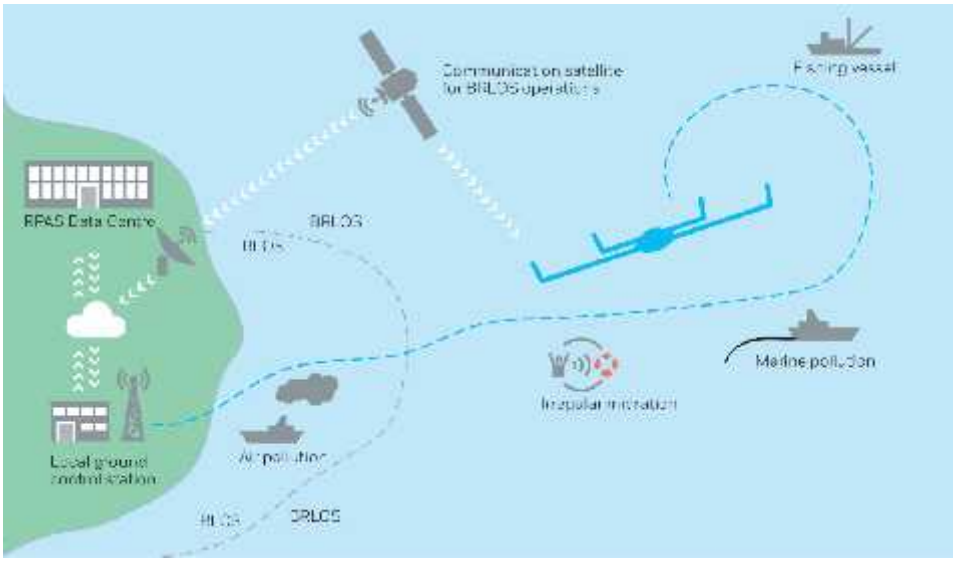

Figure 1: RPAS operation overview

Pollution Monitoring and Response using RPAS

RPAS equipped with appropriate sensors are able to detect pollution by ships at sea when undertaking targeted or regular maritime surveillance operations, making them able to confirm a pollution initially detected by another resource (for example satellites). In support of pollution response operations they can provide “eye in the sky” capabilities and act as a communication relay platform to facilitate the coordination of the various assets involved. Meaning they are able to see what areas of the spill may need more response vessels and equipment, the efficiency of the application of dispersants, or also can have a good overview of the area to see where the spill may have separated or be spreading to different areas.

The different maritime surveillance applications require similar capabilities from the RPAS and from the sensor equipment. The key capabilities are:

- Long range and long endurance e.g. applicable for regular monitoring of a maritime zone for an extended period or targeting a specific area. Beyond Radio Line Of Sight (BRLOS) operations require specialised equipment on board to communicate via satellite.
- Capabilities to stay on site (loiter over a specific sea area) for a certain time
- To operate in a broad range of conditions i.e. variable environmental temperature, high humidity, rain and over potentially dangerous environments
- Invisible to vessels (acoustically and visually) due to the technical performance of the on-board sensors.

The possible sensor payload includes:

- Maritime radar for initial long range detection of vessels and oil slicks
- Electro-optical cameras to record the maritime scene e.g. photographic evidence linking spill to vessel and/or general observing of vessel activities in high resolution
- Thermal infrared cameras for slick thickness detection, vessel identification, fire analysis, locating people in distress, general observation of vessel activities at night
- Distress signal transponder to determine the location of the person/object in distress
- AIS transponder to identify vessels and determine their position.
- shipborne emissions monitoring through special SOx sniffing devices

System description

Complementing the already available maritime data sets at the Agency, EMSA, as an institutional service provider, has contracted RPAS companies providing operational services for a total budget of 77 million Euros to be operated on all European waters and adjacent seas, based on request of national

users or of European Agencies. The aircrafts currently available have an endurance ranging from 6 to 12 hours, flying up to 140km/h and weigh from 25kg to 235kg. To address the different operational requirements, three types of RPAS are available:

- larger aircraft with “long endurance” and a more comprehensive set of sensors;
- medium size aircraft for specific purposes, e.g. ship emission monitoring;
- Vertical Take Off and Landing (VTOL) RPAS.

Figure 2: EMSA contracted RPAS for maritime surveillance

The sensor payload on board can reach up to 50kg and includes electro-optical (in the visible range) and thermal infrared cameras, maritime radar, AIS transponder, distress signal receivers and sniffers for ship emission measurements. In order to have the data in near-real time available to the user the payload data will be send via radio communication and for far range operations via satellite communication to ground. EMSA provides these RPAS services at no direct cost to the Member State authority concerned and bodies. The data is integrated via a dedicated RPAS data centre with the data already existing at the Agency, e.g. AIS, LRIT, satellite imagery, ship databases, in order to provide a complete maritime picture to the users.

Initial operations

On 6 December 2017, EMSA began the first RPAS based operations to assist the Portuguese authorities to undertake multipurpose maritime monitoring and surveillance operations e.g. to detect illegal activities and marine pollution, check fishery activities and monitor the separation of maritime traffic. The operations are led by the national coordination committee, which brings together several Portuguese Authorities and entities such as the Directorate for Natural Resources, Safety and Maritime Services, the National Maritime Authority, the National Republican Guard , the Judiciary Police, the Border Control Service, the Navy, the Portuguese Air Force. EMSA is making the RPAS services available over a three-month period. Depending on the mission, RPAS fly close to shore, i.e. within Radio Line of Sight or further offshore using satellite communication.

Conclusion

RPAS provide superior situational awareness while minimizing the danger to which humans are exposed. RPAS provide an efficient solution for European institutions and administrations working to enhance safety and security in the maritime domain. RPAS (platform and sensor payload) are multi-purpose in nature and can, in reality, be used for a range of multipurpose missions. These include the monitoring and detection of maritime pollution, vessels and people in distress, as well as the general identification and tracking of vessels and their activities.

The combination of Near-Real-Time delivery of satellite radar images to a Member State authority with the subsequent RPAS overflight can provide real time on site operational information i.e. confirmation of an oil spill and/ or identification of a potential polluter. This is helpful for marine pollution monitoring and to provide real time feedback on the efficiency of any clean-up activity. With the new RPAS services EMSA is complementing its maritime information services and is providing to the Member States an enhanced maritime picture for their operational needs.