European Maritime Safety Agency

Appendix 1 to the tender specifications

SERVICE AND TECHNICAL REQUIREMENTS

Invitation to tender no. EMSA/OP/10/2018

Contracts for Remotely Piloted Aircraft System (RPAS) services

for Emissions Monitoring and Maritime Surveillance

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1 Introduction and Objective of service

1.1.1.1 This call for tender is to contract European Remotely Piloted Aircraft System (RPAS) services in the civil maritime domain for Emissions Monitoring and Maritime Surveillance.

1.1.1.2 The contracted RPAS services should have a high level of deployability and availability, which should lead to an increase of the operational capability for Emissions Monitoring and Maritime Surveillance and provide free of charge additional data streams to users from European Union (EU) Member States, Iceland, Norway, to the European Commission and to EU Agencies. Throughout this document the terms "user" and "Member States (MS)" refer to this given list of users.

1.1.1.3 A scalable service in terms of number of deployments is foreseen with a possibility to have a number of simultaneous RPAS deployments. The deployment should be based on mobile units (Local Ground Control Station - LGCS), which can be relocated as new requests may come over time. The RPAS services should be used as a complementary tool in the overall service chain, including satellite imagery, vessel positioning information and surveillance by manned maritime patrol aircraft and vessels.

1.1.1.4 By establishing framework contracts (FWC) to acquire RPAS services, the contracting authority seeks cooperation with Contractors covering one or both lots of the tender. The provision of cost-efficient RPAS services in the maritime domain should include assets and relevant expert staff to pilot the RPA, capture and disseminate the data.

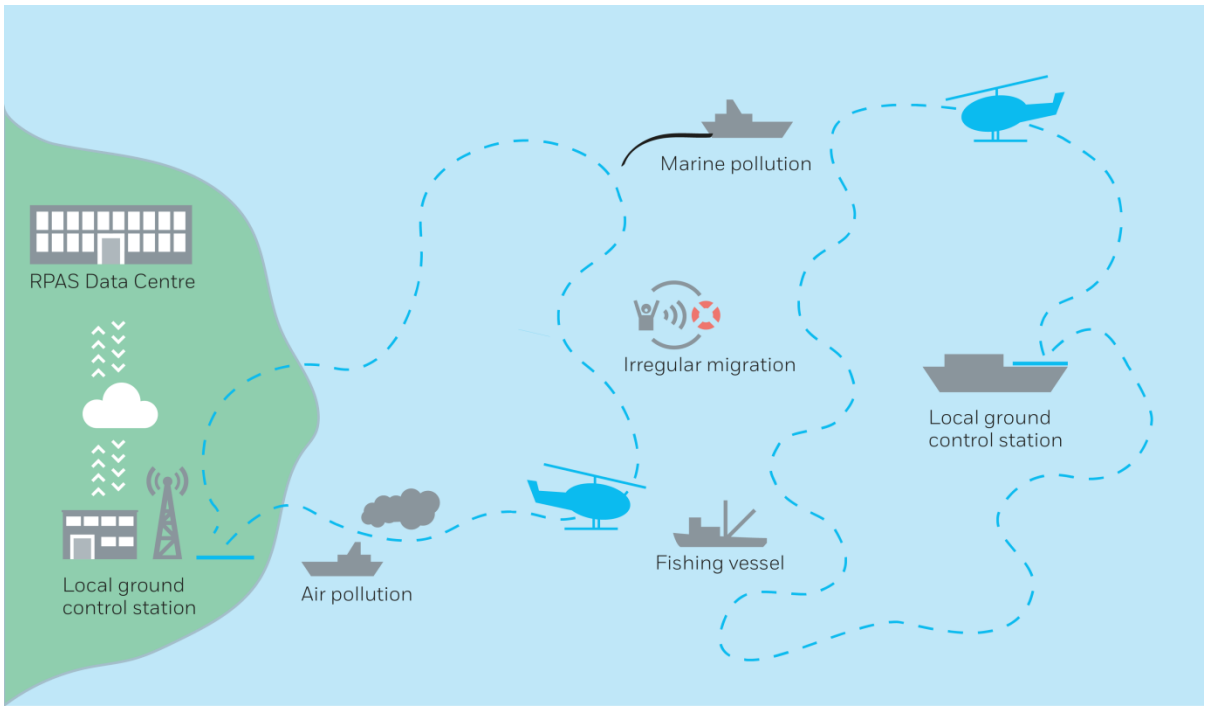

Figure 1: Typical RPAS operation in the maritime domain

1.1.1.5 The scenario depicted in Figure 1 illustrates some examples of the emissions monitoring and maritime surveillance services the contracting authority may request. The figure reflects the foreseen deployment where the RPAS performs emissions measurements or surveys an Area of Interest (AoI). This deployment includes the taxi flight from base (land or vessel) to the AoI, the specific activity for the service requested and finally passing all mission information and payload data to the users. For this transfer, the RPAS is expected to use a direct link when flying within Radio Line of Sight (RLOS) however other technologies may be used to extend the range. The communication link with the Local Ground Control Station (LGCS) will be part of the contracted operations.

1.1.1.6 Two classes of RPAS are foreseen to address the different operational domains in two lots: Vertical Take Off and Landing (VTOL) RPAS for Emissions Monitoring (Lot 1) and VTOL RPAS for Maritime Surveillance (Lot 2). Whereas the RPAS for Lot 1 will operate from shore with a limited set of sensors focusing on gas measurements, the RPAS for Lot 2 will operate from shore or from vessels operated by the users and will have a comprehensive set of sensor capabilities (refer to section 4) suitable for maritime surveillance.

1.1.1.7 The aircrafts and the sensors of the two lots shall be designed to respond to the user requirements of Member States and those of the three European Agencies covering their requirements in the maritime domain activities.

1.1.1.8 A maximum of two framework contracts will be signed (one per lot). Each framework contract shall foresee the capability to deliver two deployments in parallel (e.g. two platforms, ground control systems, teams etc.). The lots and their implementation are further described in the tender specifications.

1.1.1.9 In the case of Lot 2, the RPAS operations should address multiple purposes and cover different maritime surveillance needs, including fisheries, illegal immigration, anti-drug trafficking, etc., but could also be used for other public purposes on an emergency basis. Similarly for Lot 1, although the RPAS operations will focus on emissions monitoring it may also be used for other purposes on an emergency basis according to the capabilities of the RPA and according to EMSA's core tasks and Member State needs.

1.1.1.10 The RPAS services will only be initiated following specific requests from these users and the consent of the country(s) where the RPAS will be operating.

1.1.1.11 The RPAS shall be available on a scheduled basis, but shall also allow (in the case of Maritime Surveillance - Lot 2) unscheduled requests, see section 3.5.

2 Requested Services

2.1 General Considerations

2.1.1.1 The contract seeks to acquire RPAS based emissions monitoring and maritime surveillance services, including set-up, operations, piloting, maintenance, and data dissemination as defined in the specific contracts and based on user needs.

2.1.1.2 Any services requested should be performed by the Contractor in line with the operations defined in the Specific Contracts based on user needs.

2.1.1.3 Areas of operation can be all sea areas surrounding the European Union with an EU or EFTA country as a starting point of the service and if requested by governmental users, the service could be extended outside EU adjacent seas upon common agreement.

2.1.1.4 The following are expected as part of the service provided by the Contractor:

- RPAS fitted with (ad-hoc) payload, communications and deployment support;
- Being available on-site for deployments;
- Flight hours following the tasking requested by a user for a specific deployment and flight missions;
- Data sent, in the agreed format and from the following:
  - Payload data (images, videos, emissions measurements etc.);
  - RPAS housekeeping data (aircraft system information such as heading, position, system status, etc.).

  The data should be made available in the shortest possible time from when the data is acquired by the sensor on the RPAS to it being available to the EMSA applications for the user.

  The collected data will be streamed into the systems run by EMSA (EMSA RPAS Data Centre via a common data interface as provided in Enclosure 3 to these technical specifications[1]) and further distributed to the final users of the services (National authorities, other agencies e.g. FRONTEX and EFCA).

[1] Tender Specifications Appendix 1 Technical Specifications Enclosure 3 RPAS-DC ICD.

2.2 Emissions Monitoring (Lot 1)

2.2.1.1 New limits for sulphur content of marine fuels have entered into force since 1 January 2015[2] therefore SOx emissions from ships need to be monitored. The enforcement by Member States under Directive (EU) 2016/802 requires monitoring of the sulphur content of fuels used on board and information exchange between the responsible administrations.

2.2.1.2 RPAS have an increased capability to measure ship pollutant air emissions. The risk-based target mechanism developed in the EU's information system for recording and sharing the findings of enforcement actions to verify compliance with Directive (EU) 2016/802 includes specific alerts from remote sensing allowing Member States using this operational resource to significantly improve their capability to monitor compliance. Shipowners can also welcome such a service as an additional significant tool to ensure a level playing field in the implementation of sulphur limit regulations. EMSA is therefore interested in contracting RPAS capability for measuring SOx emissions[3] for individual vessels to be provided to Member States upon their request. In particular, lot 1 of this procurement will focus specifically on emissions monitoring.

2.2.1.3 This RPAS service will primarily be aimed at measuring the SO2/CO2 emission ratio that is emitted by individual vessels (see footnote below on sulphur content) travelling into or in the European Emission Control Areas (ECAs) located in the EU however the service could also be offered to any MS who could use them in other areas. Ships sailing in this area, irrespective of their flag (EU and non-EU flagged ships), have to comply with a maximum of 0.1% sulphur content per unit mass of fuel. This objective can be met by either using compliant fuels or any approved emission abatement method, in line with the

[2] Directive (EU) 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels.

[3] In practice the objective is the calculated determination of the sulphur content in the fuel used (% m/m) at the moment of measurement. For this to be achieved the practice is to measure the SO2 (ppm) /CO2 (% v/v) ratio at a convenient position in the emission plume.

relevant provisions of the Directive[4]. These areas are termed SECAs (Sulphur Emission Control Area).

2.2.1.4 In addition to ECAs, the Directive includes sulphur limitations for other areas, which are also found to be relevant within the context of these Framework contracts which will be concluded meaning that the RPAS services could also be used in other areas where the MS may have an interest. The following limits can also be applied according to the provisions of the Directive:

- Passenger Ships operating on regular service: limitation of 1.5% sulphur content in mass, valid for territorial seas, exclusive economic zones and pollution control zones falling outside SECAs (until 1 January 2020). When they are in port or in SECAs this would be limited to 0.1%.
- All Ships: 0.5% sulphur content in mass, valid for territorial seas, exclusive economic zones and pollution control zones falling outside SECAs (from 1 January 2020 onwards). Until 2020, the value is 3,5% except for passenger ships (see above).

2.2.1.5 Furthermore, EU Member States, as part of the Directive's implementation and enforcement, have their inspection obligations established in the Commission Implementing Decision (EU) 2015/253[5]. The frequency of fuel sampling and analysis is quantified in Article 3 as a percentage of the individual ships to be inspected, depending on the relative geographical location of EU Member States in relation to SECAs. The same Article states however that this frequency can be adjusted down but not reduced by more than 50 % "… *subtracting the number of individual ships for which possible non-compliance is verified using remote sensing technologies…*" The use of RPAS for SOx monitoring, as is considered for these tender specifications, is in line with this legal provision, in support of EU Member States obligations in the implementation and enforcement of Directive (EU) 2016/802.

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4 Directive (EU) 2016/802 includes, in its Article 8(1), the possibility for ships to use oil fuels that would otherwise be non-compliant, provided that the objective to "continuously achieve reductions of sulphur dioxide emissions that are at least equivalent to the reductions that would be achieved by using marine fuels that meet the requirements of Articles 6 and 7" is met.

5 Commission Implementing Decision (EU) 2015/253 of 16 February 2015 laying down the rules concerning the sampling and reporting under Council Directive 1999/32/EC as regards the sulphur content of marine fuels.

2.2.1.6 Briefly, a generic description of the operational concept for RPAS SOx "sniffing", in support of sulphur inspection programmes by EU Member States, shall encompass:

- Preparing the flight plan, permit to fly, communications, geo-location checks and verification, definition of the operational area and possible contingency plans;
- Identifying and characterizing individual ship's emission plumes, safely flying into it, within or crossing it as many times as technically required for representative sampling/measurements to be taken.;
- Integration and data transfer from the RPAS to EMSA's sulphur inspection data sharing platform (THETIS-S) either through direct data transfer from the CGCS or through the EMSA RPAS Data Centre

2.2.1.7 This would be followed by alerts to Member States generated automatically or done by email where there may be possible non-compliance cases, assisting national administrations in their decision-making process and allowing to possibly selecting ships for future inspection at a next port of call. These inspections and follow-up are not part of this contract.

2.2.1.8 EMSA provides services to all EU Member States and EFTA countries. Although emissions monitoring activities are expected to be in specified SECAs and approaches to the major European ports, the RPAS service for emissions monitoring can be used all over European territorial seas, exclusive economic zones and pollution control zones of Member States. The main objective of the RPAS service is to assist Member States not only complying with inspection obligations but, more importantly, identifying potential breaches with the use of fuel with sulphur content per mass of fuel above the limit value for the concerned areas. EU and non-EU flagged vessels that may be in transit in EU waters, visiting or not EU ports, will have in this way an element directly supporting an expected increasingly tendency for compliance with the requirements of the Sulphur Directive.

2.3 Maritime surveillance (Lot 2)

2.3.1 Multi-purpose activities

2.3.1.1 The maritime surveillance in the framework of this procurement is addressing any of the Coast Guard Functions.

2.3.1.2 Presently used satellite information provides an important source of information but in general is only available at certain times according to the satellite orbits. Additional services based on Remotely Piloted Aircraft Systems, can overcome these limitations.

2.3.1.3 The surveillance operation for maritime safety (2.3.2), border control (2.3.3) and fishery control (2.3.4) as described below could be provided by similar

RPAS configurations. It is therefore the aim of the Agencies to operate the RPAS in a multi-purpose mode, meaning that several of the described activities are facilitated concurrently in a single deployment.

2.3.1.4 All of the before mentioned operations are relying on vessel detection (2.3.5.1), vessel identification and behaviour monitoring (2.3.5.5) as detailed further down in this chapter.

2.3.2 Maritime safety

2.3.2.1 The International Convention on Maritime Search and Rescue (1979), commonly referred to as "the Search and Rescue Convention" (S&R; this is not the common abbreviation, but used throughout this document to avoid confusion with "Synthetic Aperture Radar"), was the first convention to establish an internationally recognised system covering search and rescue operations. The "North Atlantic Coast Guard forum" recently reiterated the importance of search and rescue activities, and is requesting further improvement of response operations. S&R is particularly challenging in remote areas and during bad weather conditions. Difficult sea conditions in general mean that the capacity to respond is diminished.

2.3.2.2 The Global Maritime Distress and Safety System (GMDSS) is a global network of emergency communications for ships comprising various different communication networks using both satellite and terrestrial radio services. The GMDSS system makes use of shipboard search and rescue devices, one of which is the AIS Search and Rescue Transmitter (AIS-SART), which, since 1 January 2010, can be used in lieu of a radar Search and Rescue Transponder (X-Band SART) on SOLAS ships.

2.3.2.3 <u>Detection of survival crafts and humans at sea</u>

2.3.2.4 S&R operations are often undertaken in conditions which are less than ideal. RPAs could support coastguards by making operations safer and by making certain operations possible which might not be otherwise.

2.3.2.5 (Satellite) AIS messages from ships which are distant from shore can be used for locating distressed vessels or survival craft. The same applies to RPAS equipped with an AIS sensor, with the added advantage that RPAS could stay in the area of the vessel in distress. The same applies for the reception of signals from Emergency Position-Indicating Radio Beacons (EPIRB) or also mobile detection signals which could help to direct the RPAS to the area where Search and Rescue is needed.

2.3.2.6 Finally, radar and thermal mapping of large areas and/or from great distances allows targets to be found more effectively. Search-and-rescue teams already use radar and infrared imagers to find and rescue humans lost at sea, in particular at night.

2.3.2.7 Safety of the environment against marine pollution

2.3.2.8 The European Union has adopted multiple directives, e.g. to address the "The International Convention for the Prevention of Pollution from Ships (MARPOL)"[6], in order to protect the environment from threats by shipping. RPAS could provide monitoring services to strengthen the enforcement of directives and identify MARPOL violations.

2.3.2.9 In this regard, RPAS equipped with Synthetic Aperture Radars along with EO and IR cameras have proved to be a reliable asset to detect oil spills and other pollution at sea.

2.3.2.10 Once an oil spill or other pollution has been detected, further investigation with regard to its size, location, and possible spread or movement might be relevant for a decision on response activities and for guiding the response assets or dispersant aircrafts to the most relevant locations. This requires surveillance and monitoring systems which can be directed to the location at all time.

2.3.2.11 In addition, RPAS EO and IR cameras can sweep the area of interest in order to detect and identify the potential polluter while collecting evidence supporting future prosecution.

2.3.2.12 Furthermore in support to marine pollution clean-up operations, e.g. oil spills or marine litter, RPAS could be useful to stay on site and to monitor where large areas of pollution or waste may be located to then guide the relevant assets during the clean-up operations.

2.3.2.13 Providing in-situ support

2.3.2.14 Both, support to search and rescue and to analyse marine pollution, might require the dropping of objects at sea. This could be life-saving equipment, beacons to ensure the recovery of persons and/or ships, but also devices to collect pollution samples or automatic analysers of the pollution. It would be an advantage if the RPAS contracted would allow carrying objects and dropping as required.

2.3.3 Border Control

2.3.3.1 The EMSA regulation as of 2016 gives the contracting authority the role to organise and provide, as an institutional service provider, RPAS services in

[6] The MARPOL Convention was adopted on 2 November 1973 at IMO, amended in 1978 and entered into force on 2 October 1983.

support of Member State border control authorities and Frontex in order to reinforce the protection of EU's external borders.

2.3.3.2 Currently EMSA provides services to Frontex supporting Frontex activities, including the European Border Surveillance System (EUROSUR). An intersystem service application has been set-up between EMSA and Frontex, allowing EMSA service layers to be visualised in the restricted Frontex (EUROSUR) Fusion Services web-interface.

2.3.3.3 Frontex and national border control authorities will substantially benefit from services collecting, processing, fusing and correlating data of human activity at sea. RPAS derived information would be handled as an additional data source.

2.3.3.4 In this regard, RPAS can scan wide areas and pursue suspicious behaviour at sea. The fusion of the data collected by their different sensors can facilitate the automatic detection of potential suspicious objects, for instance vessels detected by radar which are not broadcasting AIS information.

2.3.3.5 Once an object is detected and classified as suspicious, the RPAS can be commanded to engage in order to collect further details of the object of interest. The performance of the on-board sensors should allow the identification of the object of interest from a distance where the RPAS remains undetected.

2.3.3.6 In addition, Frontex and national border control authorities use complementary information sources. This information can be used to direct RPAS to specific targets of interest (i.e. vessels under investigation) and to track and monitor their behaviour without being detected.

2.3.4 Fishery Control

2.3.4.1 In support of the MS fishery inspection activities, EFCA is seeking to have access to the most complete maritime awareness picture available in view of fisheries Monitoring, Control and Surveillance (MCS).

2.3.4.2 RPAS may be primarily used to monitor compliance with spatial and temporal measures, such as closed areas, closed seasons and Real Time Closures (RTC's). Furthermore RPAS deployment will help to detect and identify vessels that are not emitting cooperative position data or that are suspected of not complying with fisheries regulations. Specific attention will be given to sensor capacities allowing to detect and to identify any discard of fish overboard.

2.3.4.3 EMSA provides EFCA with the EFCA Integrated Maritime Service (IMS) service. This is a layered operational ship tracking service to support fisheries control campaigns, which can be used for behaviour analysis, risk assessment and classification of possible non-compliance. The service has been operational since 2013. It combines various sources of vessel position data: T-AIS, SAT-AIS, and VMS (Vessel Monitoring System).

2.3.4.4 The EFCA IMS service is used by EFCA and MS authorities for the coordination of inspection activities and for monitoring fishing activity, as part of a dedicated risk management strategy. In addition, the service is used to gather information on possible IUU (Illegal, Unreported and Unregulated) fishing.

2.3.5 Maritime vessel monitoring and general surveillance

2.3.5.1 Vessel Surveillance: Detection, Recognition, Identification and Tracking

2.3.5.2 RPAS users are already provided by EMSA with a permanent feed of correlated terrestrial and satellite AIS combined with LRIT and VMS data combined with EMSA Central Ship Database information. The service provides integrated vessel track data for individual vessels and the information layers contain the last known vessel positions as well as other ship particulars.

2.3.5.3 RPAS sensor data shall complement the already available cooperative vessel position data sets. It will be used to cross-check vessel position and activity with the information available through available cooperative information sources in order to detect possible non-compliance to ship reporting and/or non-cooperative vessels (vessels not sending position information). The sensors carried by the RPAS will be able to allow detection, identification and categorising of vessels of interest (and any associated vessel or target) as well as being used for behaviour monitoring.

2.3.5.4 In case of particular interest RPAS shall be able to engage and provide information to identify the vessel:

- Vessel type, activity, behaviour, length, beam, estimated speed & course occupants, associated gear, attendant vessels etc.
- ID where possible (name, IMO number, call sign, external registration, MMSI, flag, home port etc.).

2.3.5.5 Behaviour Monitoring

2.3.5.6 Users shall be provided with alert notifications in real-time on specific vessel patterns which are derived from specific behaviour monitoring algorithms and or from the observation by the payload operators.

2.3.5.7 Parameters to be collected by the RPAS for behaviour monitoring include inter alia:

- vessel position, vessel course and speed, distance to shoreline, anchorage time pattern, range between vessels, (in a traffic lane - ship domain), vessel constrained by her draft, manoeuvring patterns, very low velocity tracks (under 1.5 knot), determination of possible landing point or port though the vector/course of the vessel
- Sudden changes of course and unusual vessel tracks, changes in the Estimated Time of Arrival, Destination

- detected activities on-board or around a vessel of interest (e.g. rendezvous at sea, transhipment, towage or any fishing or ancillary gear which might be used, etc.), including low radar cross section floating device adrift or undertow (Bluefin tuna cage(s))
- vessels entering or leaving particular areas (e.g. EEZ, area closed to fishing, restricted area, marine protected area)
- Identification of blacklisted vessels (e.g. IUU blacklist).
- Identification of a polluting vessel (e.g. oil, chemicals, litter, illegal discards and discharges, etc.)

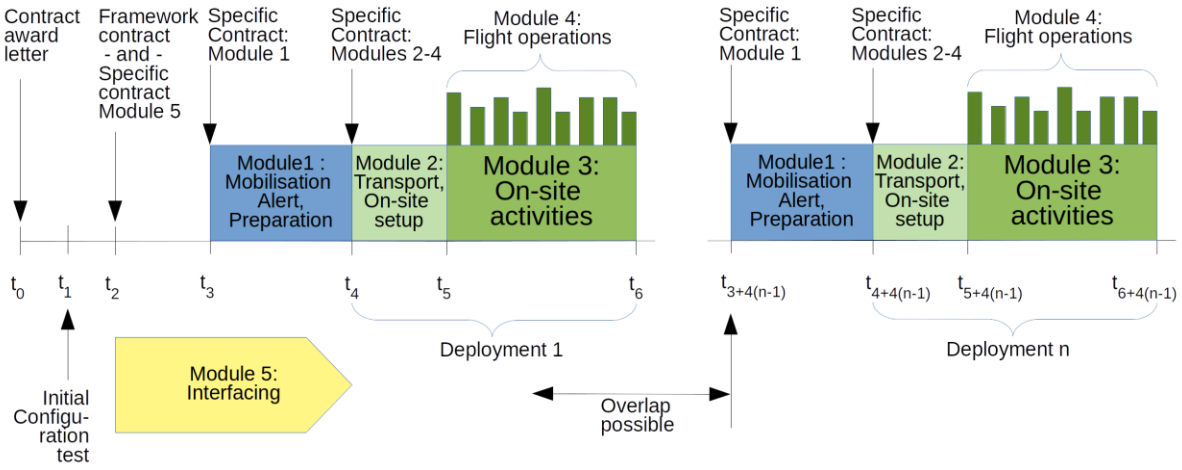
2.3.5.8 RPAS shall be able to provide the parameters that services will use as input into their behaviour monitoring algorithms.

3 Contract modules, timings and associated cost elements

3.1 General Considerations

3.1.1.1 Please note that the term "deployment" will be used in this document and means a specific "service" or "operation" which is requested by a user for a specific area for a determined period of time.

3.1.1.2 The following modules and associated cost elements over time will apply. Please be aware that multiple deployments could run in parallel:



Legend (details see text below):

- Configuration test: To enter into the operational phase and for the signature of the Framework contract, an initial configuration test will need to be successfully performed by the successful tenderer.
- Module 1: Mobilisation Alert and Preparation: means all costs associated to the preparations of a deployment, incl. site visits, documentation, getting the permit to fly, and adjustments needed to be ready for a future deployment and operation
- Module 2: Transport and on-site setup: means all costs associated with moving the RPAS vehicle, local ground control segment (LGCS), the staff, etc. to be on-site where the deployment base will be.
- Module 3: On-Site activities: means all costs associated to working staff, etc. associated with the deployment.
- Module 4: Missions/Flight Operations: includes all costs for the flight hours.
- Module 5: Interfacing: the development for interfacing between LGCS and the RPAS-DC will be contracted at the time of signing the framework contract.
- Capability tests: At the beginning of each deployment, a capability test will be performed in order to document if the capabilities offered are available for the deployment. Additional capability tests may be performed as necessary.

With:

- t0: Contract Award letter is sent to the successful tenderer
- t1: Test of the RPAS configuration offered by the successful tenderer (after 45 days of sending the Contract Award letter)
- t2: Signature of the framework contract and the specific contract for Module 5 after successful test of the offered configuration
- t3: Mobilisation alert and signature of the specific contract for Module 1. The mobilisation alert and signature of specific contract can already happen during a previous deployment. It is the intention to sign the first specific contract immediately after t2.
- T4: Signature of the specific contract for Module 2-4. The permit to fly must be available before the specific contract is signed.
- T5: and start of on-site activities and missions
- T6: end of deployment
- n: the number of the deployment

Note: the mobilisation of the second and following deployments might be requested already during the operation of the previous deployment.

3.2 Module 1: Mobilisation Alert and Preparation

3.2.1.1 The specific contract for Module 1 will be signed, when an end user has formally expressed their request for service that corresponds to the framework contract service requirements, followed by a mobilisation alert from EMSA to the contractor. This should be the time when the contractor will tune the RPAS service to meet the requirements of the user and for the requested operation.

3.2.1.2 At the beginning of each Module 1 the contractor has to deliver the (updated) documentation describing the system in detail and supporting the process in getting the permit to fly for that particular operation as further detailed in section 5.

3.2.1.3 This preparation phase will last at least 30 days, but cannot be concluded before the Permit-to-Fly (PtF) is obtained from the requesting State (see 4.1.5.1). The process to obtain the PtF might already have been started earlier.

3.2.1.4 The successful mobilisation alert and preparation including the availability of the PtF is a pre-requisite for Module 2. It will then enable the contracting authority to issue the specific contract for the transport, on-site activities and missions (Modules 2 to 4).

3.2.1.5 The tasks under this module shall include:

- Undertaking of site survey(s) as necessary incl. EMI testing and assessment for safety and health of operation
- assisting activities to achieve the permits to fly including updating the necessary documentation for this purpose
- adaptation of relevant documentation as required by the user and as needed for the operation (refer to section 5)
- preparations for a deployment

3.2.1.6 At the end of the module the data provision shall enable the MS users and those from the Agencies to have access to real time data/video streams

- via the EMSA RPAS Data Centre, or if the interfacing has not yet been completed,
- via a stand-alone mobile unit for flight monitoring and data visualisation which could be transferred to the requesting user, if necessary according to section 4.1.7.11.

3.2.1.7 In case a subcontractor will be operating the RPA, this subcontractor has to approve or to be co-author of the flight documentation used for requesting the permit to fly (refer to section 5).

3.2.1.8 A new mobilisation alert might be requested in parallel, so that two deployments can immediately follow each other, or that operations can be performed in parallel.

3.2.1.9 If the Contractor fails to mobilise as requested and according to the specifications, the contracting authority may terminate the contract in accordance with Article I.11 and II.18 of the framework contract.

3.3 Module 2: Transport and on-site set-up

3.3.1.1 This phase includes transport of the RPAS, the ground station, and the staff to the relevant location. The home base of the RPAs and equipment should be within the EU to facilitate its transport in case of mobilisation.

3.3.1.2 The contractor will be responsible to ensure that any equipment required for the operation (including the RPAs) is at any time accompanied by the necessary documentation to facilitate its transportation to any place in an EU or EFTA country. It is the contractor's responsibility to ensure that the transport through customs is done without delay and to ensure all efforts are made to ensure the RPAS arrives quickly to the operational location.

3.3.1.3 During one deployment the operation could be moved to another location if necessary for the operation. In this case an additional mobilisation alert and preparation fee will be paid.

3.4 Module 3: On-site activities

3.4.1 On-site Activities for Lot 2

3.4.1.1 Each on-site activity will have a minimum duration of 2 months with the possibility of extension if requested by the user.

3.4.1.2 The Contractor must be able to provide services during the day or at night. Below are two operational modes that could be requested for each operation (and would apply to the full duration of the operation, unless otherwise agreed and modified in writing):

Operational modes	Consecutive Flight hours (per sliding 24hour window) the contractor should be available upon user request.	Consecutive days per week the contractor should be available to fly upon user request.	**Estimated[7]** average Flight hours per week of operation (see 3.5.1.4)
5/7	6 hours (re-fuelling allowed)	5 (may include weekends)	30
7/7	8 hours (re-fuelling allowed)	7	56

3.4.1.3 The above availability target should accommodate for unscheduled tasking (refer to 3.5.1.10).

3.4.1.4 Additional flight hours might be agreed between the user and the contractor.

3.4.1.5 The operations might be interrupted by scheduled maintenance. This shall not exceed more than 4 days per month.

3.4.1.6 It is an advantage if the contractor has more than one RPA and team available and spare parts for each operation. It is up to the Bidder to define the appropriate fleet and teams needed to fulfil the availability requirements in the table above.

3.4.1.7 The on-site operational costs will be paid on a quarterly basis.

3.4.1.8 The actual on-site operational costs will be calculated per calendar day.

3.4.2 On-site Activities for Lot 1

3.4.2.1 Same as for Lot 2 with the following exceptions:

- Operations will in principle take place only during the day (i.e. it is very difficult to do emissions monitoring at night);
- Only the 5/7 operational mode is requested;
- No unscheduled tasking is requested.

[7] These are just an estimate of the number of hours but are not a commitment on the part of the Agency and hours could be more or less than the above.

3.5 Module 4: Flight operations/missions

3.5.1.1 At least one operational briefing on the CONOPS and objectives will be held per deployment on- site. The Mission Commander[8] who is the responsible person from the contractor for the deployment and the EMSA Service Manager will be present at this briefing.

3.5.1.2 Flight hours are calculated from take-off until landing of the RPA considering an airport provided by the requesting user.

3.5.1.3 Only the flight hours flown will be paid by the contracting authority.

3.5.1.4 Different operational scenarios in terms of the average number of flight hours could be foreseen, depending on user requests. The number of hours may vary throughout the month which means flights do not necessarily need to take place every day of the week. All pilot duty regulations should be followed when an estimate of the teams which will be deployed on site are given. However as indicated, it will be the customer or requesting user from the Member State that will decide how many flight hours are needed per day. The contractor shall make the staff available to cover the weekly schedule defined by the user in accordance with the operational modes as per 3.4.1.2.

3.5.1.5 Tasking time

3.5.1.6 The flights will be tasked based on a weekly schedule. Only in exceptional cases an unscheduled mission (only for Lot 2) might be requested, which the Contractor has to provide as soon as possible as indicated in section 4.

3.5.1.7 Operational Readiness for Scheduled tasking:

3.5.1.8 The flight operations can be detailed up to 1 hour before the start of flights.

3.5.1.9 A requesting procedure for Scheduled tasking will be discussed and provided by EMSA during the kick-off meeting.

3.5.1.10 Operational readiness for Unscheduled tasking (only for Lot 2):

3.5.1.11 In exceptional or emergency situations, the contracting authority may want to request flights on short notice. The goal is to get any mission started (air vehicle airborne) in less than 4 hours from the receipt of the tasking.

[8] This role could have a different name depending on the contractor.

3.5.1.12 For these situations, the provider may be requested to go beyond the availability requirements defined in 3.4.1.2 to provide 24/7 operations. This shall not exceed more than 4 days per month.

3.5.2 Unavailability of service during deployments

3.5.2.1 In case of extreme weather conditions exceeding the declared operational performance and limitations (See 4.1.1.3) of the RPAS or in case of force majeure (not including unscheduled maintenance), the Contractor is entitled to receive the on-site costs, but no compensation will be paid for scheduled, but not performed flight hours. The non-performed flight hours may be rescheduled and included in the next weekly flight plan, if possible.

3.5.2.2 Reductions of the on-site costs may apply as per article III.4.1 of specific contract.

3.6 Module 5: Interfacing

3.6.1.1 At the signature of the framework contract, the contracting authority will request by submitting the specific contract for this module, to integrate the RPAS data streams in the maritime surveillance applications of EMSA and in particular into the RPAS Data Centre (RPAS-DC).

3.6.1.2 The data formats and transport mechanisms shall follow the standards described in the Interface Control Document (ICD) [9] (refer to Enclosure 3 attached to these technical specifications[10]).

[9] When defining the ICD the following criteria were applied:

- All service video streams and image data shall be made available as georeferenced data to be further processed and visualised.
- All service feature data shall be made available as georeferenced data to be fed into geospatial web services (e.g. OGC WFS-T).
- The Contractor shall implement a solution for the inventory of the metadata within the context of the services.
- For communication purposes between contracting authority, the requesting national users (or European Agency or the European Commission) and the Contractor operational team, a chat interaction shall be established based on JABBER/XMPP.
- The transfer mechanisms shall be based on HTTP(S), FTP, REST.
- The web services will be based on OGC standards.

3.6.1.3 The contracting authority expects to have the implementation of module 5 done within 4 months. Any delay beyond 6 months from the signature of the specific contract will have a negative impact on the capability evaluation as per section 6.2.

3.6.1.4 After module 5 has been completed, the Contractor is then obliged at the request of EMSA to provide the data as defined in the ICD.

4 Service requirements

4.1 General Considerations

4.1.1 Requirements for the two Lots

4.1.1.1 The contracting authority wants to build on RPAS solutions that are already flying the required sensors and therefore ready to provide the service immediately. Exception is made for the integration of the emissions monitoring sensor in Lot 1 where more time is given although liquidated damages apply for delays beyond 3 months following the signature of the FWC as explained in section 7 of the tender specifications. In this regard, the bidder shall clearly specify in the bid the configuration which is already in place.

4.1.1.2 The Remotely Piloted Aircraft System (RPAS) should already include relevant aircraft (RPA), ground control system, launch and recovery equipment (if needed) and communication systems and any other relevant parts required to provide the services.

4.1.1.3 The Bidder shall provide information on general performance and operational conditions of the proposed RPAS. Details provided in *Tender Specifications Appendix 4 Technical tender template*.

4.1.1.4 The service should be based on a mobile unit (s) (LGCS), which can be relocated as needed.

4.1.1.5 The Bidder has to describe in detail the technical capabilities of the RPAS and sensors, and to which degree the requirements in this document are met.

4.1.1.6 Additional equipment/sensors or capabilities that are not available at the moment of the bid could be indicated for future implementation.

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[10] *Tender Specifications Appendix 1 Technical Specifications Enclosure 3 RPAS-DC ICD*

4.1.2 RPAS platform and sensors

4.1.2.1 The RPA shall be fully remotely piloted. However the bidder is free to also offer optionally piloted aircraft systems under the condition that the RPA could be flown without the pilot if needed.

4.1.2.2 For the services the contractor must have appropriate insurances in place for third party liability, for his staff and for his equipment.

4.1.2.3 With regards to the liability for any loss or damage caused by the Contractor during or as a consequence of the implementation of the FWC, Article II.6 of the FWC applies. This liability insurance shall be part of the documentation for every deployment/operation delivered prior to obtaining a permit to fly.

4.1.3 RPAS communication infrastructure

4.1.3.1 The Contractor should include a clear description in his proposal on the communication channels capable of transmitting the payload data. This should include communication from the RPA to the ground segment and from there to the users and the three Agencies (the communication between the aircraft and the ground segment is detailed in section 4.1.3).

4.1.3.2 The contracting authority will request the user/ the hosting entity of the operations to provide an internet connection at the Local Ground Control Station (LGCS) as depicted in Figure 1 (i.e. for distributing the payload data).

4.1.3.3 The radio communication from the RPAS to the ground segment shall be ensured by the Contractor based on the operational needs defined by the user. This shall be assessed under the activities of module 1 (refer to 3.2).

4.1.3.4 An ATC communication link with the Air Traffic Controller in charge of the sector the RPAS is operated in must be provided. This link must be proven to meet the relevant ATC communication standards.

4.1.3.5 If the frequency bands are not in the aeronautical band and/or the equipment do not have an aviation certification, there will be a need to obtain an approval to emit in the specific frequency band before being allowed to fly.

4.1.3.6 <u>Communication (command and control) between the RPA and the ground segment</u>

4.1.3.7 The RPA and the ground segment should be both able to transmit and receive command and control data under RLOS. A back up Command and Control Link is mandatory, preferably using another set of frequencies than the primary datalink.

4.1.3.8 All communications systems shall provide a bandwidth allowing to transmit all command and control and flight data from the RPA to the ground segment.

4.1.3.9 Communication (payload link) between the RPA and the ground segment

4.1.3.10 The RPA and the ground segment should be both able to transmit and receive payload data under RLOS conditions.

4.1.3.11 The RLOS communications shall provide a bandwidth allowing for the transmission of all payload and relevant flight data from the RPA to the ground segment.

4.1.3.12 The communication bandwidth for the payload data shall be enough to be capable of transmitting in parallel the following information:

- Data from the image giving sensors (EO, IR, Radar, still camera) which allows the operation to achieve the target DRI (Detection, Reconnaissance and Identification);
- Emissions measurement data (specific to Lot 1)
- AIS and distress information
- all flight, housekeeping and metadata needed to fully characterise the data received (e.g. georeferenciation).
- EMSA assumes that a bandwidth of at least 4 Mbps is necessary.

4.1.3.13 Communication between the Ground segment and the RPAS-DC or the users

4.1.3.14 The Contractor should provide the payload and relevant flight data from the ground segment via internet communication to

- The EMSA operated RPAS-DC (if module 5 is implemented), and / or
- To the users in the host country or to European Agencies.

4.1.3.15 The requesting user shall provide the primary internet connection (as stated in paragraph 4.1.11.5), which can be used by the contractor.

4.1.3.16 For any vessel based operations the Contractor shall ensure that the RPAS service can be delivered locally in coordination with the staff on the vessel without the need to stream the payload data via internet. In addition, the data shall be streamed to land, if an internet link is provided by the user/hosting entity on the vessel. If no internet access is provided on board of the vessel, then the contractor shall upload the data when they are next on land.

4.1.3.17 Backup-internet connection (only for shore based operations)

4.1.3.18 The contractor shall provide a secondary (back-up) internet connection, in case of technical failure in the primary internet connection. The bandwidth should be suitable to transfer all data without any latency delay due to the contractor internet connection.

4.1.3.19 Whether the internet communication is managed by the Contractor or sub-contracted to a telecommunications service provider, it should be a fully managed service including all necessary circuit, hardware and software rental and maintenance for the duration of the contract.

4.1.3.20 The Contractor shall bear all costs (set-up, maintenance, operation and the fee's to the communication service providers) for data transfer to the end point.

4.1.3.21 Use of GEANT (only for shore based operations)

4.1.3.22 EMSA has a connection to the European R&E[11] network GEANT (http://www.geant.net/) via the "National Research and Education Networks" (NREN) which provides a shared bandwidth transfer of up to 1 GBit/s and a guaranteed bandwidth of 250 Mbit/s.

4.1.3.23 With the availability of the guaranteed, high bandwidth and cost effective GEANT solution, the data transmission time contributes only marginally to the overall delivery time.

4.1.3.24 The Contractor may, through the local NREN, connect to the R&E network.

4.1.3.25 The cost of the data transmission over the GEANT network and the transmission from the Portuguese NREN to EMSA will be covered by EMSA.

4.1.3.26 If the Contractor decides to use the R&E network, the Contractor will only need to bear the costs to the next NREN node (set-up, maintenance, operation and communication cost to the next NREN) and potential fees of the local NREN.

4.1.4 RPA approval

4.1.4.1 The RPAS must as much as possible use systems/sensors and/or communication devices that have been approved as part of an RPA which was granted a previous permit to fly. Alternatively, compliance to recognised industry standards shall be demonstrated. The level of compliance to environmental

[11] Research and Education

standards should be compatible with the envisaged maritime operations (e.g. salt, humidity, temperature range, high intensity radiated fields, etc.). For example, Eurocae ED14/RTCA DO160 defines environmental qualification tests for equipment used in manned aviation. Equivalent military standards such as for example STANAG 4370 (AECTP 230) or MIL-STD-810-G could also be used.

4.1.4.2 Safe operations shall be ensured by having qualified personnel and risk mitigation measures. This shall encompass all the elements of the operations from the deployment preparation, the design safety features to the qualification of the RPA pilots and the efficiency of the emergency procedures. Some references are provided in section 4.1.4.3 in order to clarify the expectations.

4.1.4.3 Contractors shall support the European Union in its activities to draw European standards on RPAS authorisation and operation. To this extent the Contractor is requested to provide data related to the successful deployments and to voluntarily report incidents. These voluntary reports shall be submitted to the European Aviation Safety Agency[12]. These events will be recorded in the European Central Repository and analysed as part of the Annual Safety Review[13]. The Contractor is asked to make these data available also for the development of a standardised operational environment and risk assessment of RPAS for the "Specific operation" category[14] for maritime surveillance. The extraction and analysis of the data will be performed by the European Aviation Safety Agency.[15]

[12] http://www.easa.europa.eu/

[13] See for example, http://easa.europa.eu/system/files/dfu/203807_EASA_SAFETY_REVIEW_2014.pdf

[14] See EASA: https://easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2015-10

[15] References:

- Safety Assessment & Certification for UAS, Andrew R Evans & Dr Mark Nicholson, JRA Aerospace Ltd / The University of York: http://www-users.cs.york.ac.uk/~mark/papers/BristolUAV07.pdf
- Safety Assessment & Certification for UAS, Andrew R Evans & Dr Mark Nicholson, JRA Aerospace Ltd / The University of York: http://www-users.cs.york.ac.uk/~mark/papers/BristolUAV07.pdf

4.1.5 Air traffic management

4.1.5.1 The contracting authority is aware of the difficulties to operate RPAS in non-segregated air space and getting the permits-to-fly. The users request the services and as such provide an official need for a permit-to-fly. As the requesting users in general have institutional contacts with the civil aviation agency responsible for the national Air Traffic Management (ATM), it will also be the responsibility of the users in cooperation with the contracting authority to facilitate the process to obtain the permits-to fly.

4.1.5.2 Cross border operations shall be possible. Therefore paragraph 4.1.5.1 will be applicable for all the concerned Member States.

4.1.5.3 The Contractor is obliged to provide all documentation necessary in a timely manner and to support the process of receiving flight approval. Even though the company is formally responsible to submit the request for the permit to fly, the requesting user will be required to support the process and to ensure that the permit-to-fly will be issued by the national authorities.

4.1.5.4 It will be the decision of the national ATM authority to approve or suggest acceptable solutions related to the flight modalities, e.g. flying within the non-segregated or segregated airspace, the flight levels, the restrictions and/or if the segregated airspace is dynamically allocated for the aircraft operations.

4.1.5.5 In order to achieve flight approval, it is an advantage, if the Contractor can:

a) provide previous authorisations for the aircraft and sensors operated
b) have ”detect and avoid”[16] technologies, even if international standards are not yet available. This will also enable to gather in-service experience to mature the technologies.
c) document the flight hours carried out so far with this RPA. Since the flight operations will be approved by different Member States, evidence of similar operations with incident rates and consequences is expected to simplify the approval process.

[16] In this document, ‘detect and avoid’, ‘sense and avoid’ or ‘collision avoidance’ system are used loosely; the intent of such a system is to detect aircraft and/or obstacles within the vicinity of the RPA, and support the RPA pilot or automatically execute manoeuvres to restore a safe situation if needed.

4.1.6 Data analysis

4.1.6.1 The Contractor shall analyse the video streams based on user requests which are defined within the weekly flight plan, but can be updated during the flight. This analysis is mandatory for lot 2. For lot 1 the focus is on emissions monitoring, however the user might also optionally request this analysis during a specific lot 1 operation. This includes the immediate informing of users. The analysis could include for example and not limited to the following:

- Vessel identification
- any activity which may be taking place (i.e. fishing, towing, transfer, etc.)
- scanning/sweeping of certain areas for specific targets
- tracking of objects in support of search and rescue operations
- oil spill detection and response and
- all the relevant parameters as indicated for behaviour monitoring in section 2.3.5 "Maritime vessel monitoring and general surveillance"

4.1.6.2 The data to be analysed will be specified further in the deployment or mission briefing by the users requesting the service or by EMSA.

4.1.6.3 The contractor could also be required to prepare case files of a specific mission event (incl. analysis, video footage, images and other) upon request by the user or EMSA. This work is expected to be performed post mission. The contractor will have 1 day to prepare and deliver the case file.

4.1.6.4 Any further data product provided by the Bidder shall be listed in the proposal and will be evaluated as an advantage.

4.1.7 Data provision

4.1.7.1 The data should be presented in the shortest possible time from when the data is acquired by the sensor on the RPAS to it being available to the EMSA applications for the user to access via an RPAS viewing system and enabling him to react immediately. There should be no additional delay other than the data transfer between data capture and availability at any of the Agency applications. In case the data products have to be processed and/or are derived from multiple measurements (e.g. an averaged figure) then the data should be made available immediately after the processing has been finalised with no additional delay.

4.1.7.2 Therefore the video data for example should be live streaming so that the user can see in almost real time what the RPAS is seeing or where it is flying or following a specific object at sea. The tenderer is requested to state the latency time of the different data products.

4.1.7.3 <u>Data distribution</u>

4.1.7.4 EMSA is providing an RPAS Data Centre (web-based) which will be the main interface seen by the users of this RPAS service. This interface combines RPAS mission data with data available to EMSA therefore completing the maritime picture available to users.

4.1.7.5 The RPAS service data shall be sent via system to system to the EMSA's RPAS-DC in accordance with the Interface Control Document (Enclosure 3 to this document[17]). This data dissemination mode is implemented by module 5. For radar products EMSA intends to make use of the relevant STANAG standards which currently are not included in the ICD. This will be further clarified at the kick-off meeting.

4.1.7.6 Additionally as a back-up solution and as long as module 5 is not fully implemented, the data shall be provided by a visualisation system provided by the contractor. EMSA expects that the proposed solution is already available and that no developments/customizations are needed.

4.1.7.7 The service provider shall be able in real time/in the shortest possible time to present via a geospatial information system and video viewer (video/GIS) data captured by all the sensors in the aircraft payload. This video/GIS system shall be made available to the users and to the contracting authority.

4.1.7.8 For Lot 1: at least the following data shall be made available to the user:

a) Live Streaming Video (and recorded video access) of the image sensors on the RPA

b) Ship emission related data

- Aircraft position
- Flight Plan
- Executed flight path
- Deployment Map
- Image sensor frame centre projected on the map
- SOx, NOx, CO2 concentrations and corresponding ship emissions report including the accuracies of the data (relative error margin or a measurement of the quality of the measurement which may be based on time in the plume, wind conditions, relative humidity, CO2 levels, etc.)
- AIS information and track (position, MMSI, …) of the vessels

[17] *Tender Specifications Appendix 1 Technical Specifications Enclosure 3 RPAS-DC ICD*

4.1.7.9 For Lot 2: at least the following data shall be made available to the user in real time/in the shortest possible time (with no more than 5 seconds delay):

a) Live Streaming Video (and recorded video access) of the image sensors on the RPA

b) Compiled Maritime Picture should include at least the following:

- Aircraft position
- Flight Plan
- Executed flight path
- Deployment Map
- Image sensor footprint and slant range
- EO, IR high resolution still images, if available
- Radar images (if available)
- Identified objects in the radar signal, electro-optical and IR images
- AIS information and track (position, MMSI, …) of the vessels
- Georeferenced objects and incidents of interest in any of the sensor data

4.1.7.10 It is an advantage if this video/GIS is a web based video/GIS application and can be visualised with standard web browsers without requiring special plugins. The following web browsers should be supported (for the specific version of the browsers, please consult the EC "Browser support" web page: http://ec.europa.eu/ipg/standards/browsers/index_en.htm.):

- Microsoft Internet Explorer or EDGE
- Firefox
- Chrome
- Safari

4.1.7.11 In case the Contractor cannot provide a web based video/GIS application as described above and proprietary technology for data dissemination is being used then mobile units (e.g. laptops with the relevant software installed) should be provided for stand-alone data monitoring by users. Enough mobile units should be provided as needed by the users in different locations to monitor the operations (at least 5 laptops to be provided).

4.1.7.12 These mobile units must allow data export. The data should be made available in agreed formats and exchange protocols to users and the applications of the Agencies.

4.1.7.13 All data shall be at least accessible from the contractor from his servers for a period of 3 months after the data have been obtained.

4.1.8 Data privacy and ownership

4.1.8.1 EMSA shall have full ownership and access to the data collected during operations in the framework of the contract; see Article I.10 of the draft

framework contract. As EMSA is providing the services to national authorities and EU bodies, the contracting Agency might decide to forward the ownership to the requesting user.

4.1.8.2 EMSA and the requesting user are entitled to receive all data obtained. If these data are not completely submitted to the RPAS-DC, then EMSA and the requesting user can request to obtain the data in a readable format (standard formats) on an electronic medium. This might also include the data stored on the RPA itself.

4.1.8.3 The service provider is not entitled to use the data for his own purposes beyond what is defined in the framework contract.

4.1.8.4 EMSA or the requesting user can ask all data obtained and generated to be destroyed/deleted and have this documented by a certified institution. This request for deletion will be communicated by EMSA to the service provider.

4.1.8.5 The requesting user (at a national level) shall have the possibility to limit/stop the payload data feed to other users.

4.1.9 Data security and Storage

4.1.9.1 The Contractor shall perform standard virus checking, anti-hacking and network security procedures on all messages to prevent malicious attacks.

4.1.9.2 For data security reasons the Contractor shall at minimum use firewalls in conjunction with the encryption of data for data security.

4.1.9.3 The contractor shall provide mechanisms, procedures and systems to ensure resilient against cyber-attacks against the RPAS operation.

4.1.9.4 Data shall be stored and managed under European law in order to ensure data privacy as required in the European Union. Therefore either:

a) all the data derived from the RPAS are processed and stored in the premise of the contractor, which shall be located in the EU under a legal regime of an EU Member State.

b) Or if the contractor processes and/or stores any data in the cloud, the cloud has to be physically hosted within the European Union and the cloud provider has to operate under a legal regime of an EU Member State (it is not sufficient that the cloud is hosted in Europe and the hosting company is under the legal regime of a non EU country).

4.1.10 Experts and operational personnel

4.1.10.1 The agencies and/or Member State requesting the service would like the possibility to have operational control of the missions. This means that the

requesting user is able to communicate with the RPAS provider team to tell them where to fly, where and what to zoom into, and what to analyse.

4.1.10.2 The Contractor shall provide:

4.1.10.3 - Mission Commander

a) will be the responsible person on-site;
b) will be interfacing with the requesting user and the EMSA service manager;
c) Shall have the relevant experience to manage RPAS operations on-site;
d) shall demonstrate a good command of English;.

4.1.10.4 - Remote pilot(s):

a) shall be authorised to deliver the missions during day/night;
b) shall be trained to relevant standards and should be authorised to pilot the RPAS vehicles/platforms;
c) should at least be previously qualified on another aircraft or should hold a qualification of knowledge of the rules of the air;
d) all RPA pilots shall demonstrate that they underwent a full RPA training program;

4.1.10.5- Sensor/payload operators:

a) Shall have a proven record on sensor operation and data analysis;
b) must have the knowledge and experience to operate the payload, to analyse the data and to report to the users;
c) shall demonstrate a good command of English to be able to communicate with the requesting user.

4.1.10.6- Ground crew:

Experienced staff to ensure the availability, operation and reliability of the service (technician(s) - for maintenance, payload management, communications, etc.).

4.1.10.7 Any security clearance of staff shall be mentioned in the bid and will be evaluated as an advantage.

4.1.10.8 In case an expert will be replaced during the lifetime of the contract, a person with at least similar qualifications shall take over the duties. The contracting authority has to approve the changes and a new CV has to be provided.

4.1.11 Logistics

4.1.11.1 The user requests the services and as such provides an official need for operations. It will also be the responsibility of the users or hosting entity to provide the following:

- the base airport or vessel facilities, taking into account the operational suitability, working hours and the existence of adequate logistical services.
- a storage location for the RPAS. However the hosting entity or EMSA cannot take responsibility for the security of the storage location.

4.1.11.2 The contractor shall provide an external power supply (generator) to be used if necessary and in case of power failures. For vessel based operations the power supply must be suitable to be installed on board a vessel.

4.1.11.3 This facility will normally be located in the near vicinity of the airport or on a vessel. The requesting Member State will provide the infrastructure like power, cable, phone lines, internet, water and sanitation and will cover the associated costs.

4.1.11.4 In case the requesting Member State cannot provide some of the above mentioned items, it will be up to the contractor to either bear the costs or to reject the specific mobilisation for RPAS services.

4.1.11.5 The hosting entity will aim to provide an internet connection capacity necessary to upload all the data to the RPAS-DC.

4.1.11.6 Only for shore based operations: in case the Member State cannot make available an internet connection on site, the contractor is obliged to use its backup internet connection during operations to connect the LGCS to the CGCS, respectively to the users and the RPAS-Data Centre. This backup solution shall have the bandwidth to the RPAS-DC without degradation

4.1.11.7 For vessel based operations the contractor is not required to have a backup-internet connection (as per 4.1.3.17) while on the vessel, however he shall be able to upload to the RPAS-DC the data obtained during the missions after returning to land.

4.1.11.8 The Contractor shall manage logistical issues including:

- Ground support for the RPAS including the mobile unit (LGCS) at the location of operation;
- Deployment support to staff (transport, accommodation, etc.);
- Set up the link to the ATC authorities;
- Set up the local communication links to operate the RPA as needed and described above;
- Diplomatic clearance (when required).

4.1.11.9 It is an advantage during evaluation, if the RPAS system offered is free from International Traffic on Arms Regulation – ITAR restrictions.

4.1.11.10 There shall be no restrictions to

- operate the RPAS offered in any of the sea areas surrounding the European Union Member States, or the EFTA countries
- provide the RPAS documentation (refer to section 5) to EMSA, other European and the national aviation authorities.

4.1.11.11 The service could be extended outside EU adjacent seas upon common agreement. The Contractor must support the preparation of these operations, and ensure that restrictions or constraints

- from customs in the countries in which they are operating or transporting their RPAS through
- due to export licenses and also
- imposed in terms of the ITAR

do not hinder them.

4.1.12 Quality control

4.1.12.1 A quality management plan or system for the services provided should be shown or alternatively an ISO certification or an aviation organisation approval for the services provided.

4.1.12.2 The Contracting Authority can request calibration certificates of the sensors and the on-board housekeeping equipment

4.1.13 Other considerations

4.1.13.1 For immediate services after signature of the framework contract, the *mandatory* configuration (as used in the tables in sections 4.2 and 4.3) shall be already available and provided by the Contractor as a minimum.

4.1.13.2 RPAS characteristics which are marked as "advantageous" will be evaluated as part of the entire airframe resp. payload set. The entire system is linked to award criteria in section 15 of the tender specifications. Consequently, the more advantages a company can offer and the earlier these advantages can be provided, the better the scoring will be for the particular award criteria.

4.1.13.3 If the performance of the individual devices is going beyond the minimum requirements, that will be evaluated as an advantage.

4.1.13.4 Aircraft which are optionally piloted could be an asset in the process of getting the permit to fly. Therefore bids offering optionally piloted RPAS will be admitted for evaluation. However these optionally piloted RPAS must have the mode to fly fully remotely controlled without a pilot on board.

4.1.13.5 The Bidder is required to state the flight hours the RPAS has already undertaken in this *mandatory* configuration (as used in the tables in sections 4.2 and 4.3). It

will be an advantage if the Bidder can prove that this configuration was already in operational use beyond the requested flight hours.

4.2 Lot 1: VTOL RPAS services for Emissions Monitoring

4.2.1.1 This lot includes the provision of 2 VTOL aircraft focussing on Emissions Monitoring covering the services indicated in section 2.2. Within this lot the RPAS platforms must be able to take-off and land from shore. The RPAS platform will focus on short range operations and will be equipped with the necessary sensors needed for emissions monitoring.

4.2.2 Aircraft and operational requirements

4.2.2.1 Emissions monitoring does not require the coverage of large areas but smaller areas on a more frequent basis.

4.2.2.2 The best practices adopted by the Compliance monitoring pilot for MARPOL Annex VI (COMPMON)[18] should be taken into account when developing the operational procedures for the RPAS to take the plume measurements. These are widely accepted by many Member States following previous experience and therefore have useful information on limits on how close to fly to a ship, what items to take into consideration when approaching the plume, etc.

4.2.2.3 For taking samples of the plume the aircraft shall fly at low altitude, meaning that the RLOS link could be compromised in case the ground antennas are not installed high enough.

4.2.2.4 In order to ensure the RLOS link when flying at low altitude (and therefore guaranteeing a RLOS range as long as possible), it would be an advantage if the ground antennas could be placed in a separated higher spot from the local ground control station. A typical scenario could require the installation of the LGCS on shore and the ground antennas on a hill nearby.

4.2.2.5 The main requirements on the aircraft and the operational flight performance are listed below:

Area (see also 4.1.5.1 and 4.1.5.2)	The flights may mainly take place in areas in the vicinity of ships and their exhaust plume. Areas of operation can be all sea areas	Mandatory

[18] Best Practices Airborne MARPOL Annex VI Monitoring, Ward Van Roy, MUMM, 16 December 2016.

	surrounding the European Union an EU or EFTA country. Cross border operations can be included. Starting point can be any EU/EFTA country.	
	If requested by governmental users, the service could be extended outside EU adjacent sea basins.	Advantage
Range	Up to 50 km (RLOS operation)	Mandatory
	More than 50 km	Advantage
	RLOS ground antennas and the local ground control station are placed in separated spots	Advantage
Endurance	4 hours with the full payload configuration at cruise speed (time between take-off and landing)	Mandatory
	A longer endurance above 4 hours is a key advantage of the system	Advantage
Maximum flight speed	True airspeed (TAS - the relative velocity between the aircraft and the surrounding air mass) of 50kts / 90km/h	Mandatory
	A higher TAS is a key advantage of the system	Advantage
Operational Readiness	Scheduled tasking (see 3.5.1.7).	Mandatory
Fleet	Two RPA systems available for two separate mobilizations in parallel	Mandatory
	If more than the two mandatory RPA systems can be made available for operations	Advantage
Daytime	Day operation capability	Mandatory
Environmental conditions /	Aircraft must be safe to fly in turbulent exhaust plumes in the immediate vicinity	Mandatory

Flight stability	of the ships.	
	Operation with wind up to 25kts @ 660ft	Mandatory
	Take-off and landing maximum wind: up to 21kts @ SL	Mandatory
	Operation in light rain conditions (up to 2.5mm/h)	Mandatory
	Operation in icy conditions (e.g. de-icing capabilities)	Advantage (please detail the capabilities in the bid)
Ship based operations	Capability to vertically take-off and land on vessels at sea	Advantage
Modes	Vertical take-off and landing	Mandatory
	Approaching vessels to measure the gas concentrations in the plume (SOx, NOx, CO2) (refer to 4.2.2.2)	Mandatory
	Hovering	Mandatory
	Fly to coordinates	Mandatory
	Hold altitude and hold speed	Mandatory
Area for take-off and landing	Operation from a landing area smaller than 5m x 5m	Advantage
Flight altitude	The RPAS should be capable to fly at least at flight levels between 50 and 200m (approx. 150-660 feet)	Mandatory
Low altitude	RPAS capable to fly at least at 33m/100ft	Advantage
Communication RLOS for command-and-control and payload data	All data generated by the payload must be downloaded in real time at least following the quality in 4.1.3.12.	Mandatory
Autopilot, automatic take-off and landing	The RPAs shall allow automatic flight operations and fully automatic take-off and landing.	Advantage

Payload carriage capabilities	The RPAS should be capable to carry all offered payload at the same time for a flight duration equal to the declared endurance.	Mandatory
	Additionally 1kg spare carriage capability shall be available for future sensors.	Advantage
Detect and avoid systems	Even, if no international standards are yet available, detect and avoid systems on the RPA would support the safety of operations	Advantage
Safety issues / authorisations/ safeguards-pilot licenses	Operational risk management file and mitigation means for the flight authorisation (see 4.1.4.2); Reporting of incidents (see 4.1.4.3).	Mandatory
	Transponder (mode S preferred)	Advantage
Pilots, payload operator issues	See 4.1.10.5.	Mandatory
Ground station /segment issues	Operational risk management file and mitigation means for the flight authorisation (see 4.1.4.2); Reporting of incidents related to ground station (see 4.1.4.3).	Mandatory
	Hand-over procedure for RPA pilots as applicable (see 4.1.4.2);	Advantage

Table 1 *Operational requirements Lot 1*

4.2.2.6 In order to extend the range and endurance in a single operation/deployment, the bidder may also propose a multi-RPAS/multi-ground station setup. In both cases it is up to the tenderer to define the most appropriate fleet of RPASs which could be of the same kind or a combination of different RPAS. In any case they must meet all the minimum requirements indicated in Sections 3 and 4. However this system will be evaluated as one Remotely Piloted Aircraft System to be used in a single operation/deployment.

4.2.3 Minimum Payload Requirements

4.2.3.1 The requested information can be retrieved from a set of sensors which include electro optical (EO), SOx and CO_2 sniffers which shall allow a user to determine

the sulphur content of the fuel used on board, and an AIS transponder. Furthermore, these sensors shall for the the RPAS to approach the plume and to identify the vessel. The sensor technology used should be state-of-the-art.

4.2.3.2 The main objective is SOx measurements however the CO2 measurements are essential to be able to make the relevant calculations to determine the sulphur content of the fuel used. The SO2 emitted can be measured but cannot be related to the sulphur content in the fuel unless the ratio of SO2/CO2 is known (will assist calculation from ppm to % S in fuel). The specific algorithms and methodology to calculate the Sulphur content in the fuel of the inspected vessel should therefore be explained in the proposal. Possible procedures are available in the literature (e.g. Alfody et al., 2011[19] and MARPOL Annex VI (COMPMON)[20]).

4.2.3.3 The RPAS should have the capability to take simultaneous measurements of SOx and carbon dioxide (CO2) in the exhaust plume of a ship. The RPAS will need to fly inside the ships' exhaust in order to take the measurements which will mean:

- a procedure to identify the plumes;
- a need to be able to fly in more turbulent wind conditions as well as being adaptable to differing speeds of ships and flying at very low altitudes and heights above the ship (i.e. 50-100 m from the ship).

4.2.3.4 The installation of thermal infrared cameras on an RPA would strengthen the capabilities to identify the plumes of the vessels and to visualise the vessel details.

4.2.3.5 Although the initial priority is to measure sulphur oxides which is mandatory for the contract, it would be an advantage if nitrogen oxides (NOx) could also be measured.

4.2.3.6 The following minimum capabilities shall be achieved by the system's payload sensors offered. Capacities exceeding the minimum requirements listed below will be considered as an advantage.

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19 Alfoldy, B., J. Balzani and F. Lagler (European Community, 21.06.2011, http://ec.europa.eu/environment/air/transport/pdf/ships/Final-report.pdf)

[20] Best Practices Airborne MARPOL Annex VI Monitoring, Ward Van Roy, MUMM, 16 December 2016.

4.2.3.7 There are no preferred advantage payloads and there are no fixed weightings for different 'advantage' payloads. Advantage payloads will be evaluated as part of the entire payload set. Consequently, the more advantages a company can offer, the better scoring it will receive for the particular award criteria.

4.2.3.8 The bidder shall provide a comprehensive description of the capacities of the payload sensors fitted on the RPA, and their ISTAR capabilities in terms of detection, recognition and, when applicable, identification (DRI) of the imaging sensor.

4.2.3.9 The three DRI levels can be summarised:

- Detection: ability to distinguish an object from the background
- Recognition: ability to classify the object class (type of vessel and object in the sea …)
- Identification: ability to describe the object in details (the ship name, number of persons on a vessel, distinction of human arm/head, …)

4.2.3.10 The minimum of the DRI requirements for the combination of optical and infrared devices are:

DRI (during daylight operations)	Range (Km)		
	Detection	Recognition	Identification
Small Boat	5	3	1 by reading a ship name of 30cm letter sizes
Human	2	1	0.3 - by counting the number of people on board from a distance - Distinction of arm/head, etc. of a human being

DRI (during night operations) - <u>if offered</u>	Range (Km)		
	Detection	Recognition	Identification
Small Boat	2	0.9	0.25
Human	1	0.3	0.15

4.2.3.11 The DRI requirements given before are minimum requirements. Better DRI (longer ranger, smaller objects) are an advantage and will be evaluated better

4.2.4 Payload configuration

4.2.4.1 The targeted configuration of the payload sensors is provided in the table below. The bidder is requested to provide a System with such configuration and characteristics or better. The bidder may propose alternative solutions or different sensors' characteristics as long as the minimum requirements listed in this chapter are fully met for this Lot. In this case, the bidder has to:

a) explicitly describe the rational;

b) indicate which payload devices are altered by the configuration offered by the bidder;

c) provide the specification of the proposed payload devices;

d) how the proposed changes will impact the conduction of the requested operations (see 2.2).

4.2.4.2 The targeted configuration of the payload sensors is provided in the table below:

All sensors	Specification of the environmental conditions for operations and for storage (e.g. humidity, stable wind and gusts, salt concentrations, etc.) shall not limit the RPAS as specified in 4.2.2.	Mandatory
Gimble, including the following devices: - EO sensor - thermal IR (if available	Forward looking and steerable in all directions (fully stabilised)	Mandatory
Electro optical (EO) sensor (visible range)	Field of view > 30 degrees Optical zoom more than 3 At least 800 pixels in one dimension	Mandatory
IR	Infrared channels support the detection of the plume (IR also at night). This could be done by additional cameras or with appropriate filters in front of the wide range electro-optical camera. At least 600 pixels in one dimension	Advantage

AIS	AIS receiver with capabilities to relay the data Range: 30 km in 360 degrees	Mandatory within 3 months
SOx and CO_2 sniffer	Capability to have simultaneous concentration measurements of Sulphur Oxide (SOx) and carbon dioxide (CO2), and NOx indicators to target the plume. Calculating the sulphur content of the fuel burnt by the vessel	Mandatory
Additional emission measurements	Capability to have concentration measurements of NOx in the exhaust plume of a ship.	Advantage
Data quality	Calculating of the sulphur content of the fuel burnt by the vessel with at least 30% accuracy.	Mandatory within 3 months
	The sulphur concentration measurement uncertainty should be calculated and expressed as RSD (relative standard derivation) in percentage	Mandatory within 3 months
	Quality of the measurement: a score should be provided expressing the level of confidence of the measurement in terms of concentration levels and sensor exposure time	Mandatory within 3 months
	The data provided shall be geo-referenced with an accuracy of better than 50m within a range of 5 km.	Mandatory within 3 months
Reporting time	The emission results of noncompliant vessels should be reported in near real time to the end user (Maximum <30 minutes after taking the samples)	Mandatory

Table 2 *Sensor requirements Lot 1*

4.2.5 Data Collection

4.2.5.1 The data collected by the System shall comply with the requirement described in the table below:

Aircraft housekeeping data	The System shall provide aircraft housekeeping data as defined in the ICD (Module 5, Enclosure 3 to this document[21]), e.g. position, altitude, aircraft principal axes, viewing geometry of the sensors, health of the system and sensors, bandwidth of communication links	Mandatory
Geolocation	The data provided shall all be geo-referenced with an accuracy of better 25 m within a range of 5 km.	Mandatory
Data quality	The sensors shall be calibrated. See section 4.1.12.	Mandatory
Data latency	The time between the observation and the time it reaches the RPAS-DC for further visualisation shall not exceed 5 seconds. This also applies to the RPAS providers own solution as per 4.1.7.6.	Mandatory
Data delivery and formats	See section 4.1.7.	Mandatory
	See section 3.6 (Module 5: Interfacing) and ICD (Enclosure 3 to this document[22])	Mandatory
Data exploitation in the LGCS	All data collected by the on-board sensors will be delivered and accessible for data exploitation	Mandatory

[21] *Tender Specifications Appendix 1 Technical Specifications Enclosure 3 RPAS-DC ICD*

[22] *Tender Specifications Appendix 1 Technical Specifications Enclosure 3 RPAS-DC ICD*

	Image enhancing capabilities should be available in the LGCS in order to be able to apply the corrective measures/filters to the images collected	Advantage
	The Payload operator should be able to extract dimensions of objects of interest from images	Advantage

Table 3 *Data collection requirements for Lot 1*

4.2.5.2 The bidder is requested to provide all the evidence that supports and confirms compliance with the requirements indicated in these technical specifications.

4.2.5.3 In this regard, "evidence" should be understood as any ground and/or flight test (logfiles, videos, images etc.) conducted by the bidder that validates a specific performance or capability of the RPAS in real operational conditions.

4.2.5.4 Any evidence provided going beyond the minimum requirements will be considered as an advantage in the evaluation of the bid.

4.3 Lot 2: VTOL RPAS for Maritime Surveillance

4.3.1.1 This lot includes the provision of 2 VTOL aircraft focussing on maritime surveillance operations covering the services indicated in section 2.3. Within this lot the RPAS platforms must be able to take-off and land vertically from shore or from vessels operated by users. The RPAS platform will focus on short range operations and will be equipped with the necessary sensors needed for maritime surveillance.

4.3.2 Aircraft and operational requirements

4.3.2.1 The main requirements on the aircraft and the operational flight performance are listed below:

Area (see 4.1.5.1 and 4.1.5.2)	Areas of operation can be all sea areas surrounding the European Union with an EU or EFTA country. Cross border operations can be included. Starting point can be any EU/EFTA country.	Mandatory
	If requested by governmental users, the service could be extended outside EU adjacent sea basins.	Advantage

Range	Up to 50 km in RLOS operation	Mandatory
	> 50 km	Advantage
Endurance	4 hours with the full payload configuration at cruise speed (time between take-off and landing)	Mandatory
	A longer endurance above 4 hours is a key advantage of the system	Advantage
Maximum flight speed	True airspeed (TAS - the relative velocity between the aircraft and the surrounding air mass) of 60kts / 110km/h	Mandatory
	A higher TAS is a key advantage of the system	Advantage
Operational Readiness	Scheduled tasking (see 3.5.1.7).	Mandatory
	Unscheduled tasking (see 3.5.1.10).	Advantage
Fleet	Two RPA systems available for two separate mobilizations in parallel	Mandatory
	If more than the two mandatory RPA systems can be made available for operations	Advantage
Daytime/Nighttime	Day and night operation capability	Mandatory
Environmental conditions / Flight stability	Operation in strong and turbulent weather conditions incl. crosswind: up to 27 knots)	Mandatory
	Take-off and landing maximum wind: up to 21kts	Mandatory
	Operational Temperature limits of -10ºC to +40ºC	Advantage (please detail the capabilities in the bid)
	Operation in heavy precipitation situations and reduced visibility	Advantage (please detail the capabilities in the bid)

	Operation in icy conditions	Advantage (please detail the capabilities in the bid)
Ship based operations	Capability to vertically take-off and land on vessels at sea	Mandatory (please detail the undertaken flight hours from vessels in the bid)
RPAS Fuel	Consumption of heavy fuel by the RPAS.	Advantage
Modes	Vertical take-off and landing	Mandatory
	Monitoring mode: Flying in order to detect vessels, pollution, humans in distress, and other human activity at sea	
	Loitering/hovering: Supporting actions (e.g. pollution response, search and rescue, rendez vous at sea) at different flight levels	
	Adaptation of the flight track and sensor operation according to last user request upfront and during the flight operation	
Area for take-off and landing	Operation from a landing area smaller than 5m x 5m	Advantage
Flight altitude	Up to 1500ft	Mandatory
Communication RLOS and BRLOS (if offered) for command-and-control and payload data	All data generated by the payload must be downloaded in real time at least following the quality in 4.1.3.12.	Mandatory
Autopilot, automatic take-off and landing	The RPAs shall allow automatic flight operations and fully automatic take-off and landing. This includes the availability of fully redundant inertial navigation systems.	Advantage

Payload carriage capabilities	The RPAS should be capable to carry all offered payload at the same time for a flight duration equal to the declared endurance.	Mandatory
	Additionally 5kg spare carriage capability shall be available for future sensors or for carrying objects to be dropped at sea (e.g lifesaving devices/services, packages, refer to 2.3.2.14).	Advantage
Detect and avoid systems	Even, if no international standards are yet available, detect and avoid systems on the RPA would support the safety of operations	Advantage
Safety issues / authorisations/ safeguards-pilot licenses	Operational risk management file and mitigation means for the flight authorisation (see 4.1.4.2); Reporting of incidents (see 4.1.4.3). Transponder (mode S preferred)	Mandatory
Pilots, payload operator issues	See 4.1.10.5.	Mandatory
Ground station /segment issues	Operational risk management file and mitigation means for the flight authorisation (see 4.1.4.2); Hand-over procedure for RPA pilots as applicable (see 4.1.4.2); Reporting of incidents related to ground station (see 4.1.4.3).	Mandatory

Table 4 *Operational requirements Lot 2*

4.3.2.2 The characteristics that make the RPAS detectable by the potential targets is a key operational parameter. EMSA understands that the proper assessment of this is always conditioned by multiple parameters (atmospheric/visibility conditions, background noise etc.) however EMSA requests the bidder to provide:

a) The acoustic signature of the RPA. Tables or diagrams for different engine regimes and different aircraft orientations showing the acoustic dBs versus distance could be used.

b) The visual signature of the RPA. Distance from where the RPAS can be visually detected by an observer.

4.3.2.3 In order to extend the range and endurance in a single operation/deployment, the bidder may also propose a multi-RPAS/multi-ground station setup. In both cases it is up to the tenderer to define the most appropriate fleet of RPASs which could be of the same kind or a combination of different RPAS. In any case they must meet all the minimum requirements indicated in Sections 3 and 4. However this system will be evaluated as one Remotely Piloted Aircraft System to be used in a single operation/deployment.

4.3.3 Minimum Payload requirements

4.3.3.1 The following minimum capabilities shall be achieved by the system's payload sensors offered. Capacities exceeding the minimum requirements listed below will be considered as an advantage.

4.3.3.2 There are no preferred advantage payloads and there are no fixed weightings for different 'advantage' payloads. Advantage payloads will be evaluated as part of the entire payload set. Consequently, the more advantages a company can offer, the better scoring it will receive for the particular award criteria.

4.3.3.3 The bidder shall provide a comprehensive description of the capacities of the payload sensors fitted into the RPAs, such as EO and IR camera and Radar (if offered), and their ISTAR capabilities in terms of detection, recognition and, when applicable, identification (DRI).

4.3.3.4 The three DRI levels can be summarised:

- Detection: ability to distinguish an object from the background
- Recognition: ability to classify the object class (type of vessel and object in the sea …)
- Identification: ability to describe the object in details (the ship name, number of persons on a vessel, distinction of human arm/head, …)

4.3.3.5 The minimum of the DRI requirements for radar (if offered) device are:

Long range target detection (day and night)	**Range (Km)**
Large vessel (metallic, bigger 100m)	60
Small boat (metallic, 10m to 30m)	20
Non-metallic small craft (e.g. rubber boat)	10

4.3.3.6 The minimum of the DRI requirements for the combination of optical and infrared devices are:

DRI (during daylight operations)	Range (Km)		
	Detection	Recognition	Identification
Small Boat	10	7	4 by reading a ship name of 30cm letter sizes
Human	4	2	0.6 - by counting the number of people on board from a distance - Distinction of arm/head, etc. of a human being

DRI (during night operations)	Range (Km)		
	Detection	Recognition	Identification
Small Boat	8	5	2.5
Human	3	1.5	0.5

4.3.3.7 The DRI requirements given before are minimum requirements. Better DRI (longer ranger, smaller objects) are an advantage and will be evaluated better

4.3.3.8 In addition to the above-mentioned minimum capacities, the system shall be able to:

a) track the position of collaborative vessels within 30 km range or more in 360 degrees;

b) detect and provide images of oil spills during night and day with a maximum resolution of 1 m and range (in one direction) of 20 km;

c) receive multi-standard distress signals such as Emergency Position-Indicating Radio Beacons (EPIRB).

4.3.3.9 Capacity for the system to detect mobile signals, which could help to direct the RPAS to the area where Search and Rescue is needed, are considered as advantage.

4.3.4 Payload configuration

4.3.4.1 The targeted configuration of the payload sensors is provided in the table below. The bidder is requested to provide a system with this configuration and characteristics or better. The bidder may propose alternative solutions or different sensor characteristics, as long as the minimum requirements listed above are fully met. In this case, the bidder has to:

a) explicitly describe the rational;

b) indicate which payload devices are altered by the configuration offered by the bidder;

c) provide the specification of the proposed payload devices;

d) how the proposed changes will impact performing the requested maritime surveillance activities (see 2.3).

4.3.4.2 The targeted configuration of the payload sensors is provided in the table below:

All sensors	Specification of the environmental conditions for operations and for storage (e.g. humidity, stable wind and gusts, salt concentrations, etc.) shall not limit the RPA as specified in 4.3.2.	Mandatory
Gimble, including the following devices: - EO sensor - thermal IR sensor - laser illuminator	Forward looking and steerable in all directions and fully stabilized (2D)	Mandatory
	Optical axes of all sensors aligned	Mandatory
	Forward looking and steerable in all directions (fully stabilized) and horizon stabilisation (3D)	Advantage
Electro optical (EO) sensor (visible range)	Max. field of view > 40 degrees Optical zoom more than 10 At least HD resolution (1920 x 1025 pixel)	Mandatory
	Low light capability	Advantage
Still camera	Optical zoom more than 5 At least 16 Megapixel resolution Low light capability	Advantage

IR, **applicable to either MWIR or LWIR**	Noise equivalent temperature resolution better 0.1K At least 600 pixels in one dimension		Mandatory
	Temperature calibration (Temperature range 0 to 2000 ºC)		Advantage
	MWIR (4 μm band)	**LWIR** (10 μm band)	Only one IR sensor necessary
	Max. field of view > 30 degrees Optical zoom more than 10	Max. field of view > 30 degrees If no optical zoom available, a two camera approach has to be chosen with a narrow field of view < 5 degrees	Mandatory
		Optical zoom more than 5	Advantage
Laser illuminator in the NIR (1 μm band)	Allows illumination at a distance of 2 km and to be able to read a ship name which has 30 cm letters during the day and at night. Forward looking and steerable in synchronisation and in a spectral range covered by the EO (the visible range has to be attenuated) and/or IR		Advantage
Maritime radar	360º coverage with multimode capabilities: Maritime modes: • Detection and tracking of vessels according to the long range detection capabilities given above • Detection and position of aircraft • Detection and location of rainy areas/fronts • Interrogation/Detection of		Key Advantage

	Search and Rescue beacons	
Radar in Synthetic aperture radar (SAR) mode (could be a combined device with the maritime radar)	X or C band Preferably 360 degree sweeps or otherwise each side of the aircraft With detection and recognition capability of oil on water, wakes and vessels Available modes: - ScanSAR - SpotSAR	Advantage
	With a max. resolution of 1 m	Mandatory if SAR offered
	With a max. resolution of < 50 cm	Advantage
	Range (one direction) of 15 km	Mandatory if SAR offered
	A range (one direction) of more than 30km is a key advantage.	Advantage
AIS	AIS receiver with capabilities to relay the data Range: 30 km in 360 degrees	Mandatory within 3 months
Distress sensors (The RPAS shall be equipped with at least one sensor allowing homing based on EPIRB signals.)	EPIRB: EPIRB with 406 and 121.5 Mhz signals allowing for homing being a significant aid to search and rescue activities.	406 Mhz: mandatory 121.5 Mhz: advantage
	RARAR-Search and rescue transponder (SART): X-band radar signals allow homing to itself. It is expected that the RPAS maritime radar already can detect and interpret these radar pulses	Advantage
	EPIRB-AIS, AIS Man Overboard (MOB), AIS-SART: An AIS device is a mobile equipment mounted on an EPIRB, MOB or SART, to assist homing to itself (i.e. life boats, life raft) by transmitting a text broadcast. The reception and interpretation of the AIS	Advantage

	messages should be supported by the RPAS by using and interpreting the messages received from the AIS receiver	
Telephone mobile unit detections	Terrestrial mobile frequencies	Advantage
	Satellite mobile frequencies	Advantage

Table 5 *Sensor requirements*

4.3.5 Data Collection

4.3.5.1 Same as for Lot 1 defined in section 4.2.5.

5 Documentation

5.1.1.1 The contractor has to provide the documentation necessary to achieve the Permit-to-fly from the national aviation authorities and/or from EASA during module 1 activities. This includes the documentation for air worthiness and air traffic management. When applicable the roles of the various subcontractors and partners should be clearly defined in the documentation for the aviation authorities to be made aware of these roles. For example from which company are the pilots, who is training them, who is running the operation, and who owns the aircraft.

5.1.1.2 In order to facilitate, standardise and speed-up the process of achieving the permit to fly, a detailed table of contents of the documentation to be delivered is given in Enclosure 4 to this document[23], called "RPAS passport". The contractor can either structure the documentation according to this table of contents or the bidder is requested to provide a mapping table identifying in detail (document, chapter, page), where this information can be found in the company documentation provided.

5.1.1.3 For the planning of each deployment/operation the following documentation will need to be provided by the contractor:

- An RPAS portfolio document (summary document on the RPAS characteristics and on-site requirements) which would be sent to requesting users
- On-site Operational Procedures

[23] *Tender Specifications Appendix 1 Technical Specifications Enclosure 4 Template - RPAS Passport*

5.1.1.4 The technical tender template[24] identifies what needs to be provided already for the preparation of the bid.

6 Testing of services

6.1 Initial Configuration test

6.1.1.1 Before signature of the Framework contract, an initial configuration test will be required for the first of the two RPAS being offered per contract (as explained in section 2 of the tender specifications). This shall ensure that only mature systems already equipped with standard minimum payload will be selected for the framework contract.

6.1.1.2 The initial configuration test is also used to assess any delays in the delivery of the second RPAS and the timely integration of the emissions sensors as explained in section 7 of the tender specifications.

6.1.1.3 This configuration test can take place at a location chosen by the contractor.

6.1.1.4 The initial configuration test is defined in Appendices 2 and 3 Initial Configuration evaluation. The four main objectives of the test are to check that the following elements of the proposal are met:

- The RPAS Configuration;
- The ability to fly with the minimum endurance;
- That the payload is operated as expected and the data is exploited in the LGCS;
- That the crew are available and already trained to operate the system.

6.2 Capability tests (in situ for each deployment)

6.2.1.1 At the beginning of each deployment, before the start of operations (module 3) ground and flight tests shall take place at the deployment site. Both EMSA and the user will be present in order to assess and document if the capabilities offered and requested for the specific operation are available for the deployment.

6.2.1.2 Before the initial capability test, the following documents have to be provided by the contractor:

[24] *Tender Specifications Appendix 4 Technical tender template*

- Capability Test plan including the description of the test cases in-line with the test guidelines provided by EMSA in enclosure 1 and 2 to this document[25].
- Test Readiness Review for the Capability Test, which shows that the pre-tests performed by the contractor have been successful

6.2.1.3 The first capability test will be concluded with an evaluation of the operational service capabilities (see enclosure 1 and 2 to this document[26]). Additional capability tests in case of change of configuration may be performed as necessary. Article I.15.2 of the framework contract[27] applies in case the contractor does not fully provide the requested and offered operational capabilities.

7 Service Reports and Invoicing

7.1 Mobilisation alert and preparation Reports

7.1.1.1 For each module 1, the Contractor has to produce a mobilisation alert and preparation report including activities performed according to Section 3.2.

7.2 Service Reports

7.2.1.1 For each deployment (modules 3 and 4), the Contractor has to produce a weekly service report indicating what happened during the operations. A template will be provided at the Kick-Off meeting which includes relevant information for invoicing purposes and flight observations.

7.2.1.2 In case the Contractor was not able to perform the service, a non-flight report shall be issued per deployment, indicating

- User who requested the deployment
- Reference made to the weekly flight schedule
- Description of the planned missions

[25] *Tender Specifications Appendix 1 Technical Specifications Enclosure 1 and 2 Template - Capability evaluation*

[26] *Tender Specifications Appendix 1 Technical Specifications Enclosure 1 and 2 Template - Capability evaluation*

[27] Annex 2 to the invitation to tender: *Framework Service Contract*

- Reason for cancelling the flight or for reduced flight hours compared to the agreed weekly flight schedule and specific flight plan

7.2.1.3 Templates may be provided during the lifetime of the contract depending on the requesting user.

7.3 Interfacing Report

7.3.1.1 A report indicating what has been undertaken during the development of the system interfaces (module 5) including acceptance of the interfacing based on relevant testing must be produced by the Contractor.

7.4 Invoicing

7.4.1.1 The Contractor shall request the payment of the services delivered and agreed by the parties on a periodic basis as defined in the framework contract and/or specific contracts. The above mentioned reports in chapters 7.1 to 7.3 will be used as supporting evidence for the invoices.

8 Contact point

8.1.1.1 The Contractor shall provide a contact person for the contracting authority to be able to address any enquiry. Enquiries shall be resolved in a timely manner.

8.1.1.2 A contact person for planning of deployment shall also be provided by the Contractor. This will be the focal point for any planning issue with regards to the missions.

9 Project management, operational, emergency, and quality plans

9.1 General

9.1.1.1 All documentation and communications during project implementation shall be in the English language.

9.1.1.2 The Contractor shall be available for a monthly tele-conference.

9.2 Project Management Plan

9.2.1.1 The project will require the highest standards of project and operational management.

9.2.1.2 The Project Management Plan for the implementation of the whole contract shall be provided for the bid and updated by the contractor as needed and shall contain the following elements:

- Work breakdown structure;
- Proposed team composition and organisation: including the involvement and interaction of each team member within the different modules of the FWC including within a deployment. The proposed staff training plan shall also be described including pilots, operators and other experts;
- Risk Assessment: identification of risks including their severity and likelihood;

9.2.1.3 For the preparation phase the Project Management Plan the contractor shall also include:

- Work Packages identifying inputs, outputs, list of tasks and staff involved;
- Gantt chart defining the project timeline including milestones, meetings and deliverables;

9.2.1.4 For project management the EMSA web based tool TEAMFORGE will be used by both parties for the duration of the contract.

9.3 Operational Plan

9.3.1.1 The Operational plan is related to Module 3 and 4 and must clearly indicate how to comply with the proposed frequency of flights in terms of number of aerial vehicles available in the field, spare parts, crews, working shift hours, etc.

9.3.1.2 This document should also cover how the RPA system is operated during deployments, including command and control procedures and communication with pilots, ATM authorities, etc.

9.4 Emergency /Contingency Plan

9.4.1.1 A plan should be provided which includes any emergency and contingency plans should an operation not go according to planned. This should be provided to the contracting authority during the mobilisation alert and preparation phase (module 1).

9.5 Quality Management Plan

9.5.1.1 The contractor shall apply a stringent quality management which includes specific quality related measures to be followed during the lifetime of the contract (i.e. ISO certification, etc.).

10 Working procedures

10.1.1.1 If operations are performed by subcontractors or partner companies, EMSA requires an excerpt of the subcontracting contract showing the clear roles and responsibilities of the subcontractor. This document has to be duly signed by both parties.

11 Abbreviations

11.1.1.1 The terms in the table below, appearing either in a complete or in an abbreviated form, when used in this document and its enclosures, relating to the Technical Proposal, Financial Proposal and Draft Contract shall have the following meaning:

Term	Abbreviation	Meaning
Area of Interest	AoI	The geographical area where information that will satisfy an information requirement can be collected. Areas of Interest are inside the Service Deployment Area.
Base Airport		Is the airport, provided by the Host country of the operation, where the deployment will be done.
Beyond Line of Communication	BLOC	Equivalent to BRLOS, please see there.
Beyond Line of Sight	BLOS	A related term used to describe that the object is too distant or obscured by terrain to be visually detectable.
Beyond Radio Line of Sight	BRLOS	A related term used to describe radio communications capabilities that link personnel or systems to objects, which are too distant or fully obscured by terrain for Line of Sight communication (LOC or RLOS).
Broadband Link		A high-capacity transmission technique using a wide range of frequencies, which enables a large number of messages to be communicated simultaneously using a single telecommunication link.
Central Ground Control Station	CGCS	A fixed station, served by the service provider to operate the RPA, to monitor the payload, to process the data and to disseminate the information to the users and the Agencies.
Data Link		A telecommunication link over which data is transmitted.
Deployment		A deployment is composed of the transport, the on-site activities and a number of flights called missions, each of these missions is carried out in a specific Areas of Interest, defined within the Service Deployment Area.
Emission Control Area	ECA	Sea areas in which stricter controls are established to reduce or minimise emissions from ships.
EU, EEA and EFTA		European Union, European Economic Area and European Free Trade Association.
Ground Segment		The segment which receives the payload data from the RPAS via satellite communication or via the Local Ground Control Station (LGCS), processes the payload data and make them available to the users and the Agencies. Could be the LGCS itself or dislocated at the Contractor premises (CGCS).
High Intensity Radiated Fields	HIRF	Standard test specified in Eurocae ED14/RTCA DO160 section 20 or equivalent standard test
Hazardous and Noxious Substances	HNS	

Term	Abbreviation	Meaning
Host Country	HC	The country of the requesting user, where the Coordination Centre and the base airport are situated.
Infrared wavelength	IR	
Line of Communication	LOC	Equivalent to RLOS, please see there.
Line of Sight	LOS	A related term used to describe that the object is visually detectable without any sort of obstacle between the observer and the object.
Local Ground Control Station	LGCS	A deployed station, served by the service provider crew, capable operate the RPA including take-off and landing. Can also act as CGCS, depending on the set-up of the RPAS.
Long Wavelength Infrared	LWIR	8 - 15 micron spectral band
Mean Take Off Mass	MTOM	
Mid Wavelength Infrared	MWIR	3 - 5(8) micron spectral band
Deployment		An assignment, within by a specific contract, for a certain number of weeks in which RPAS operations will take place.
Near Infrared	NIR	0.75–1.4 micron spectral band
Operation		The operation of the RPAS during a mission
Payload		The load carried by the asset, consisting of sensors, necessary to the purpose of the flight: i.e. Electro-Optical, Infrared, Radar, GPS and AIS receiver with capabilities to relay the data.
Radio Line of Sight	RLOS	Type of communication that can transmit and receive data only when transmit and receive stations are in view of each other without any sort of obstacle between them.
Satellite Communications	SATCOM	When a signal is transferred between the sender and receiver with the help of satellite. In this process, the signal which is basically a beam of modulated microwaves is sent towards the satellite. Then the satellite amplifies the signal and sent it back to the receiver's antenna present on the earth's surface.
Search and Rescue	S&R	
Sulphur Emission Control Area	SECA	Sea areas in which stricter controls are established to reduce or minimise SOx emissions from ships.
Service		It is the subject of a specific contract.
Sulphur oxides	SOx	
Synthetic Aperture Radar	SAR	
Short Wavelength Infrared	SWIR	1.4 - 3 micron spectral band
Thermal Infrared	TIR	Covering the range of MWIR and LWIR, please see there.
Vertical-Take-Off-and-Landing	VTOL	