European Maritime Safety Agency

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Copernicus Maritime Surveillance Service

First User Group Report

V1.0

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European Commission

Copernicus Europe's eyes on Earth

EMSA

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1 Introduction

Copernicus is a European Union (EU) Programme aimed at developing European information services based on satellite Earth Observation (EO) and in-situ (non-space) data.[1] The European Maritime Safety Agency (EMSA) is the Entrusted Entity responsible for implementing the Copernicus Maritime Surveillance (CMS) service under a Delegation Agreement signed with the European Commission (EC) for the period 2015-2020.

The CMS service supports monitoring of human activity at sea for a range of functions, including amongst others, maritime safety and security, fisheries control, marine pollution monitoring, and law enforcement.[2] The CMS service can be accessed by national administrations with responsibilities at sea, as well as relevant EU bodies and institutions. It provides additional EO information through existing EMSA applications, and also establishes new opportunities to use remote sensing data in contexts in which it may not have been used in the past. Copernicus products can extend the geographical scope and enhance the types of maritime information available, thereby contributing to an overall improvement of maritime domain awareness.

In order to continue the dialogue with users, and with the purpose of eliciting needs, generating new ideas, assess feedback on the use of the service and gathering operational requirements, a User Group Workshop was hosted at EMSA's premises in Lisbon, on 9 October 2018.

The workshop was aimed at both policy-makers and operational staff of administrations with responsibilities at sea, including those who are already users of EMSA services, as well as potential new users. In total, the workshop was attended by 72 participants. Representatives of 17 EU Member State administrations were present: Belgium, Bulgaria, Croatia, Denmark, Finland, France, Germany, Italy, Latvia, Poland, Portugal, Romania, Slovenia, Spain, Sweden, The Netherlands, and the United Kingdom. One European Free Trade Association (EFTA) Member State, Iceland, also participated. The EC was represented by the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW). In addition, participants from the following bodies also attended the workshop: European Commission Joint Research Centre (JRC), European Border Agency (FRONTEX), European Fisheries Control Agency (EFCA), European Union Satellite Centre (EU SatCen), the Maritime Analysis and Operations Centre – Narcotics (MAOC (N)) and the United Nations Office on Drugs and Crime (UNODC).

[1] For more information on the programme in general, please see www.copernicus.eu.
[2] The Copernicus Maritime Surveillance Service does not support border surveillance, for which a separate Copernicus service has been set up.

2 Welcome and opening

Leendert Bal, Head of Operations, EMSA, opened the workshop by welcoming participants. Mr Bal then briefly described the agenda of the User Group, introducing the speakers who would be making the presentations.

Image 1: Workshop participants

3 Copernicus Maritime Surveillance Service

3.1 Overview of Copernicus Programme (DG-GROW)

Rui Meneses, of the European Commission's Directorate General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) delivered a presentation providing an overview of the Copernicus Programme

Copernicus, formerly known as the Global Monitoring for Environment and Security (GMES), is an EU-led initiative for an autonomous and operational European earth monitoring capacities. It has been developed by the EC in partnership with the European Space Agency, with an envelope of €4.3 billion for the period 2014-2020.

The provision of Copernicus services is based on the processing of data collected from EO satellites and *in situ* sensors. The EO satellites which provide the data exploited by the Copernicus services are split into two groups of missions: 1) the Sentinels, which are currently being developed for the specific needs of the Copernicus programme; 2) the Contributing Missions, which are operated by national, European or international organisations.

In addition to a space segment, the Programme aims to provide users with reliable and up-to-date information through a set of services. The services address six thematic areas: land, marine, atmosphere, climate change, emergency management and security. It was emphasized that although the general principle of the Copernicus Programme is that users are provided with free and open access to data and products, for the Security Service products are fully customised to user needs and have limited distribution.

It was recalled that Copernicus is the largest EO programme in the world, and attracts interest globally. The Programme encourages use of EO data internationally, and pursues cooperation with interested parties in the US, Asia and Africa. With regard to maritime surveillance particularly, recent communications with the US State Department demonstrate interest in developing collaboration and an exchange of best practice in use of space for maritime applications.

The proposed budget for the overall Copernicus Programme in the next financial period (2020-2027), currently under discussion in the European Council and Parliament is €5.8 billion. It is important therefore that future user needs are carefully analysed, and that the Copernicus services have an ever greater impact in achieving the policy goals of users. Research and development (R&D) is important for service evolution. User requirements in the areas of new technologies and data processing should be collected and transmitted by the Entrusted Entities, so that it will be covered in the new calls for R&D, for example under Horizon 2020 and Horizon Europe.

It was noted that events such as the CMS User Group are particularly important in this context, as only through dialogue with users is it possible to create a user driven service. The CMS service will continue to evolve in line with user expectations.

Please contact the Commission at ec.copernicus.mss@ec.europa.eu, or Rui Meneses directly at rui.meneses@ec.europa.eu at any time with questions, comments, suggestions, or additional requirements.

3.2 Overview of the Copernicus Maritime Surveillance Service (EMSA)

Pedro Lourenço, Head of sector for Earth Observation Services, EMSA, delivered a presentation on the Copernicus Maritime Surveillance Service, the activities to date, and plans for the future.

The Copernicus Maritime Surveillance Service is one of the Copernicus Security Services. It is a service tailored to specific users and is delivered according to restricted access rights. The CMS service offers image products, value added products, and fusion products including other data sources (e.g. vessel position data), based on two types of EO data: synthetic aperture radar (SAR) and optical data.

EMSA recognises that for the purposes of maritime surveillance, speed is of the essence. Big efforts have been made to reduce delivery time. The delivery time of radar and optical images from acquisition by the satellite to the users is reducing steadily with pressure on contractors to improve performance. In the near future (based on new contracts recently awarded), service delivery will be under 20 minutes for SAR and under 30 minutes for optical. The speed with which satellites can be tasked is also a key factor, and this will be discussed further during the User Group.

An overview was given of the six function areas covered by the CMS.

I. Fisheries Control

The main user of CMS for fisheries control is EFCA, which coordinates Joint Deployment Plan (JDP) operations for monitoring fisheries activities in selected areas of interest and federates Copernicus maritime surveillance fisheries control related requirements on behalf of Member States. EMSA provides EFCA with a real time maritime awareness operational picture, fusing and correlating different sources of vessel data with specific information from EFCA operations, and with Copernicus EO data. The service provided through EFCA is delivered to more than 500 users across the EU Member States.

EO capabilities support a range of operational fisheries control activities, including monitoring of:

- Fishing grounds, in order to:
  - provide a situational awareness picture,
  - monitor fishing effort,
  - monitor discard bans,
  - cross-check monitored fishing activity with recording obligations,
  - check vessel behaviour in restricted areas.
- Fish cages and fish farms, in order to:
  - monitor operations and vessels close to fish farms,
  - reveal unreported fish farming,
  - detect tug vessels towing cages.
- Fishing ports, in order to:
  - monitor recording and reporting requirements of the EU fleet,
  - monitor ports,
  - detect non-reporting vessels (when combined with intelligence information).

II. Maritime Safety and Security

Maritime safety and security operations include prevention of accidents and collisions, search and rescue (SAR), vessel traffic routing, and port security. The CMS service supports authorities in their efforts to ensure the safe transit of vessels, people and goods in European waters, and European flagged vessels worldwide, and to provide assistance in the most timely and effective way possible when accidents or incidents occur.

Some examples of applications provided under the CMS service for maritime safety and security operations are listed below:

- Support to vessel traffic monitoring
- Support to SAR operations and identification of ships in distress
- Rapid surveillance following loss of contact with vessel or platform
- Support to ice and iceberg monitoring
- Detection of floating containers and missing aircrafts at sea
- Monitoring of ship-to-ship transfers (e.g. at-sea refuelling).

III. Law Enforcement

Integrated maritime services (IMS) provided by EMSA can be used for a range of law enforcement purposes. Vessel information originates from both terrestrial and satellite-based telecommunication systems as well as other available positioning data, is correlated against vessel detections extracted from EO data (SAR and optical images).

The CMS service provides support to:

- Monitoring of identified ports and shores for departure of specific ships
- Detection of abnormal behaviour (e.g. Transhipment of drugs from larger vessels to small boats)
- Searching for non-cooperative targets.

Law enforcement users often request the service for short-term acquisitions, tasking very high resolution optical images just a few days in advance of operations.

IV. Customs

Customs authorities aim to ensure that legitimate trade can flow freely, whilst preventing trafficking and smuggling, and import of illegal or dangerous goods. Authorities are interested in monitoring key links in the goods supply chain, such as the transport and entry of such goods into the EU.

Satellite image and related value-added products reinforce custom authorities' capacity to maintain oversight of goods transported at sea, and particularly to detect and intervene when criminal activity is suspected. The CMS service supports Customs through:

- Detection of potentially suspicious vessels involved in trafficking or smuggling of goods
- Monitoring of ship-to-ship transfers
- Early warning and identification of criminal trafficking and smuggling.

V. Marine Environment (Pollution Monitoring)

Rapid detection and early warning of marine oil spills allow national and regional coast guard authorities to catch polluters in the act of illegal discharges, and to respond quickly to emergencies in the case of large accidental spills. CleanSeaNet, the European oil spill monitoring and vessel detection service operated by EMSA since 2007, combines SAR and optical data with other kinds of information (e.g. ship tracking data) to identify the potential polluters, and provides relevant authorities with valuable information to take further action. Through Copernicus, this service is extended to new geographic areas of European interest, for example overseas territories of EU states.

The CMS service supports pollution monitoring in areas of European interest through:

- Detection and tracking of illegal ship-source pollution
- Identification of possible polluters by combining information on oil spill detections with information on vessel positions and routes
- Monitoring the extent and spread of oil over time following a large-scale accident.

VI. Support to International Organisations

International cooperation enables actors to share costs, resources and expertise as well as to address common problems in a collaborative and focused way. In the area of maritime surveillance, bi-lateral or multi-lateral approaches can bring significant benefits. This kind of cooperation is often coordinated through specific organisations or programmes established for the purpose of discharging

specialised tasks. On request, CMS provides support to such relevant international organisations in consultation with and based on the approval of DG-GROW and the European External Action Service (EEAS).

The CMS service supports international organisations through:

- Wide area surveillance with vessel detection and correlation of reporting and non-reporting vessels
- High resolution imagery to provide detailed information on specific vessels and activities for intelligence-led operations
- Monitoring of shoreline activities.

Some trends over the period since operations began in late 2016 were presented. Law Enforcement and Fisheries are the function areas which make most requests for CMS services. The forecast for the end of 2018 is that there will be a 57% increase in services delivered in comparison with 2017. There was also an increase of 107% in terms of the number of organisations served between 2017 and 2018, from 13 to 27.

Finally, the importance of feedback from users was emphasized. This occurs on a regular basis following the conclusion of each operation, but the importance of face-to-face meetings through dialogue at User Groups and Workshops was emphasized.

4 Integrated Maritime Services (EMSA)

Lukasz Bibik, Senior Project Officer, Integrated Maritime Services, EMSA, gave an overview of the key features of EMSA's Integrated Maritime Services (IMS). He explained that EMSA has developed a platform to guarantee the performance, availability and reliability of all the maritime information systems it hosts. This platform integrates and correlates different types of data, including data provided by the end-users, to produce customised services tailored to specific requirements. These services are called IMS and are used by Member State authorities and EU bodies to obtain the most complete maritime situational awareness, building a common picture across EU maritime interests.

Examples were given of how Copernicus Maritime Surveillance satellite images can be displayed and combined with other data sources on the web interface, including the use of optical images and the detection of correlated and non-correlated vessels. A live demonstration was given of different forms in which the service can be delivered through the web interface on a desktop computer or the mobile application, using the recent collision between two vessels in the Mediterranean, and the ensuing oil spill, as an example. It was noted that services can also be offered through system-to-system interfaces to Member State authorities.

An overview was given of Automated Behaviour Monitoring (ABM), which is a computer, rule-based system that analyses ship positions for the automatic detection of abnormal and/or specific vessel behaviour. The purpose of ABM is to support EMSA's Integrated Maritime Service users in their maritime surveillance functions, by providing an enhanced situational picture in near real time (NRT).

IMS are managed at national level by the IMS Point of Contact (PoC), i.e. the body appointed by the Member State, which is a single point of contact for the IMS related matters and assumes, at national level, responsibility for: coordination of data users and, if applicable, data providers; the designation of the national IMS administrator; the access rights coordination with the competent authorities, and user requirements coordination.

5 Copernicus Maritime Surveillance Operational Use (Presentations from Users)

Seven users of the CMS service, EFCA, the Icelandic Coast Guard, the Portuguese Navy, MAOC (N), the Spanish Customs Authority, the Danish Defence Command – Joint Arctic Command (JACO), and the UNODC, delivered presentations on their experiences of using CMS and providing case studies to illustrate the use of CMS for the different maritime function areas under their responsibility.

For more details on the use cases presented, please see the relevant presentations in annex.

5.1 European Fisheries Control Agency (EFCA)

Sven Tahon, Senior Officer Control Technologies

The presentation from EFCA began by providing key figures on EFCA activities. EFCA coordinates the requests for fisheries control from EU Member States and third countries. It has used the CMS service both for EU and for non-EU waters (e.g. NAFO and NEAFC areas), and in 2018 ordered over 300 images, mainly SAR. However, it is expected more optical images will be ordered in future, some of which will be shared in the context of joint operations with other Agencies.

The experience of using CMS in the context of operations was shared, from sitting with Members States during JDP meetings to define areas of interest, to the level of detail needed to make the requests, to the selection of images to acquire from amongst the footprints available. EFCA stated that the client-focused approach of EMSA was appreciated. As EFCA gains more experience, use of the service is becoming more proactive, for example aligning the patrol pattern of vessels with the expected acquisitions.

Some examples of fisheries control operations were given, including the PESCAO operation in West African Waters for which EFCA provided capacity building, and the CMS service contributed with optical and SAR services. Many vessels in the area are not correlated, so there is a difficulty in deciding which vessels to target given the scarcity of means in the area. It was noted that due to network constraints, EFCA was taking screenshots to PDF and send to on-scene assets.

Some examples of use in the Mediterranean were also shown, including SAR images in which fixed fishing gear could be observed, and vessels towing fish cages. In the Black Sea, in addition to vessel detection, other features could be identified in the images, such as a shipwreck.

To conclude, for EFCA, CMS services are in high demand. They are incorporated in the operational framework and offer additional value from enhanced analysis. However, the quality of the automated processes needs to be monitored and feedback provided. There needs to be a more careful planning and selection of Area of Interest (AOI), as well as more dedicated human resources to use the data. It was noted that use of images acquired further from the coast, in less dense traffic areas, required high quality but were not as time critical; whereas closer to the coast, the reverse was the case – speedy delivery is more necessary to ensure the vessels have not moved too far from the detected location.

5.2 Icelandic Coast Guard (Landhelgisgæsla Íslands)

CDR Snorre Greil, Project Manager, Operations Department

The CMS service supports the Icelandic Coast Guard in various function areas, including Maritime Safety and Security, thus aiding the Icelandic authority with its legal duties. The Icelandic Coast Guard has been requesting the service since 2017, and currently, Iceland requests 40 to 60 (mainly SAR) satellite images and related products per month.

Iceland has a vast geographic responsibility; satellites allow the Icelandic Coast Guard to focus manned surveillance in Icelandic waters, thereby concentrating efforts on specific areas where it is more necessary. Iceland uses satellite monitoring to detect vessels which do not comply with reporting requirements and which are not transmitting their positions, thereby allowing the Icelandic Coast Guard to redirect limited means to investigate the unidentified vessels. There have been a number of cases of hard drugs discovered on board yachts, and icebergs are also an issue of concern.

The benefits of satellite images depend on the capability to take advantage of them; ordering of images needs to be done with care, and data from the images, such as uncorrelated vessel detections, need to be inspected on the spot. A chain of detection and follow up is only as strong as the weakest link. From the perspective of the Icelandic Coast Guard, satellite monitoring is cost effective; it is consistent, capturing both large and small areas and objects, as well as remote places. Satellites can provide valuable information, expand the capacity to act and widen the area coverage and time period for observation of targets.

Examples were provided of follow-up to detections of uncorrelated vessels, including one occasion when a dead whale was detected, and another when a non-reporting vessel was found to be in violation of reporting requirements and was requested to turn on its reporting system. In another case, five icebergs were detected, which posed a danger to navigation.

A number of examples were also given of investigation of non-transmitting vessels detected by other means (other than the CMS service), but which illustrate the importance of detecting and investigating non-transmitting vessels. These included a passenger vessel in violation of a number of regulations, a research vessel prospecting for minerals in a sunken wreck operating without a permit, and a Russian research vessel.

An account was given of a recent exercise, when an optical image was cancelled due to cloud cover, and one occasion when a false negative was detected. These show some of the limitations of the service. The Icelandic Coast Guard is still experimenting with how different products may useful in different contexts, including use of optical images, and assessing how small the detected vessels can be on images with different resolutions.

5.3 Portuguese Navy (Marinha Portuguesa)

CFR Luís Miguel Bessa Pacheco, PO Navy, Naval Command, CADOP

The Portuguese Navy has been using the CMS service for a year and a half. Portugal has a very large maritime area, giving the Navy a great responsibility, yet its resources are very limited in comparison. The CMS service is used mainly for Maritime Safety and Security. Two different types of use were described.

Firstly, CMS provides satellite services for a first glance of the AOI, to ascertain whether there needs to be an intervention. It can monitor:

- ships in maritime traffic corridors, making sure vessels transit in the designated lanes;
- unidentified vessels, i.e. those without the Automatic Identification System (AIS) turned on, which will then be targeted for follow up;
- fishing vessels, particularly foreign vessels, and the fishing grounds they use, as well as research vessels present in the Portuguese Exclusive Economic Zone (EEZ).

Secondly, CMS is combined with Remotely Piloted Aircraft Systems (RPAS) operations. A satellite image of an AOI is acquired, then an RPAS flight is scheduled based on that image to follow up on any interesting detections for more information, with a patrol boat in the area to undertake on board investigation if necessary.

Despite the benefits of the CMS service, there are still challenges to be addressed, for example the reported size of vessels in acquisitions, the timeliness of product delivery, and areas or times of day where satellite coverage is limited.

In conclusion, the CMS service was recognised as a useful tool, in combination with others, for the Portuguese Navy to intervene at sea. Satellite images support decision-making, whilst RPAS adds value to the system, maximising the efficiency of naval asset interventions at sea.

5.4 Maritime Analysis and Operations Centre – Narcotics (MAOC (N))

Paulo Gomes da Silva, MAOC (N) Intelligence Analyst

MAOC (N) is a regional initiative of seven EU Member States: France, Ireland, Italy, Spain, the Netherlands, Portugal and the United Kingdom (within the framework of the EU), set up in 2007 in response to the notable increase in maritime and air transport of cocaine across the Atlantic Ocean from South America to Europe and the West African coast.

MAOC (N) uses the following products of the CMS service: satellite imaging (SAR and optical), vessel detection, and vessel correlation. The CMS service is used by MAOC (N) to search areas with non-transmitting vessels, support operational activity, and support deployed assets.

A number of examples were given to illustrate how MAOC (N) uses EO products based on SAR and optical images in its operations. These included: detection of vessels in an AOI, vessel identification based on the estimated length and heading, and evaluation of whether images could detect objects on deck.

5.5 Spanish Customs Authority (Departamento de Aduanas e II.EE.)

Carlos López Carrera, Subdirección General de Operaciones, Dirección Adjunta de Vigilancia Aduanera

The main objectives of Spanish Customs' surveillance were described as follows:

- fight against drug trafficking,
- fight against cigarette smuggling,
- fight against money laundering,
- fight against customs fraud,
- security and protection.

Spanish Customs has close to 2 000 officers and with resources such as patrol boats, special operations vessels, helicopters and airplanes. The organisation also has operative bases in all 25 of Spain's maritime regions (11 Atlantic and 14 Mediterranean).

Satellite imagery provides more capabilities to control merchant activity at sea and therefore to act when criminal activity is suspected. The Spanish Customs makes routine requests for monitoring purposes, and short-notice requests based on intelligence information. Spanish Customs uses predominantly SAR products because criminal activity, such as drug trafficking, is almost always conducted at night. Less frequently, optical images of remote ports are requested to find specific targets. Short notice requests are often intended to support interception of targets, and as a result, more urgency is needed. Spanish Customs stressed that the CMS service should be a permanent (24/7) service.

Examples of routine and short-notice requests were presented. This included an encounter between a merchant vessel and a 15 metre length vessel; only the former had the AIS switched on, indicating a possible transhipment. In a number of operations, SAR products reduced the search area for the target either by capturing the vessel in the image, or to the contrary by revealing the vessel was not in

the anticipated AOI and must already have transited through; either way, this assists the speedier identification and apprehension of suspected vessels.

The Spanish Customs then provided some feedback on limitations experienced, including occasional false targets or mistakes to the calculations of lengths of vessels, particularly in poor weather conditions.

5.6 Danish Defence Command (Værnsfælles Forsvarskommando)

Rasmus Burin Høgh Kimer, Captain, Chief of Joint Operations Center, Joint Arctic Command

The Danish Defence Command has maritime responsibilities over a very large area, including Greenland waters. The CMS service covers the eastern and western coast of Greenland. The relative responsibilities and competencies of the Greenlandic government and the Danish State were outlined. With limited naval capacity, satellite images are essential. It was noted that when detections on CMS services warrant further investigation, sometimes civilian ships in the vicinity are requested to make confirmations as the closest governmental asset could be up to nine hours away.

For Greenland, one of the biggest problems in the maritime domain is ice and icebergs. Uncorrelated targets are sometimes confirmed as ice, which can be a danger to safety of navigation. Many detections of uncorrelated vessels are in fact icebergs. There are rarely vessels transiting to the north of Greenland, so vessels transiting from Denmark or Iceland to Greenland are of most interest. Marine pollution can also be problematic. Research camps on non-permanent ice leave behind debris, which drifts towards Greenland when the ice starts to melt in the spring and sinks in the summer, polluting the water with oil and machinery.

DG GROW questioned whether the Copernicus Marine Environment Monitoring Service (CMEMS) ice monitoring service could be useful for this last example. The Danish Defence Command responded that the research station debris drafting on ice can move quickly; within 48 hours they can drift a hundred miles. The NRT element is therefore important to monitor such situations.

5.7 United Nations Office on Drugs and Crime (UNODC)

Shanaka Jayasekara (Mr.), Programme Coordinator (Indian Ocean Region), Global Maritime Crime Programme (GMCP)

The UNODC manages a Global Maritime Crime Programme (GMCP) with activities in the areas of counter-piracy, maritime capacity building, and combating maritime crime including the trafficking of illicit substances by sea.

Cooperation between the UNODC and EMSA began in September 2016. Requests from UNODC are channelled through the EEAS and approved by DG GROW, with the involvement of the respective EU delegation in the country or countries concerned.

The UNODC provided an overview of UNODC exercises and operations in which the CMS service had been used, including: Sao Tome and Principe (September 2016); Senegal, Guinea-Bissau and Gambia (June 2017); Togo with the French Navy (November 2017); Liberia (December 2017); Senegal, Cabo Verde, Guinea Bissau, Sierra Leone with the French Navy (May 2018); Cape Verde (August 2018); and Sri Lanka (June 2017). Outcomes were evident in capacity building, and a number of inspections and boardings were made based on CMS data, including one arrest.

It was noted that, outside Europe, vessel position information such as fishing vessel monitoring system (VMS) data may only be available to the host state. In Sri Lanka, for example, there was a need to manually correlate the Vessel Detection System (VDS) from the CMS service with the VMS positions provided by the Sri Lankan authorities.

UNODC is undergoing a learning process with regard to the CMS service. Initially more optical images were ordered but it is becoming apparent that SAR can bring greater benefits on many occasions – it has a higher dependability in cloudy conditions, and can cover much greater areas. More strategic requests for services are now being made in West Africa, in order to time deliveries with the presence of French Navy vessels in the area, providing additional on-scene support.

A number of challenges were identified, including in the preparedness locally for receiving such data, such as poor internet connection and inadequate coordination among local law enforcement agencies and between the CMS service and the different authorities.

UNODC concluded by expressing enthusiasm about working more closely with EMSA in 2019, adopting a more structured approach. This will include taking a proactive approach to requesting images at different time periods during the year when activities such as drug smuggling or illegal fishing are known to be more prevalent. However, although a calendar of dates can be used to time acquisitions with seasonal dynamins, there will always be a need for short-notice requests based on intelligence information. Given this, the need for a speedy approval process for non-EU users was emphasized.

5.8 Questions

Elisaveta Peneva, Sofia University St. Kliment Ohridskif, Bulgaria, thanked EMSA for the organisation and the presenters for their interventions, then presented a number of questions, detailed below along with the answers.

- How reliable are the satellites used in coastal areas?

Reliability of imagery in coastal areas depends on several variables: type of target to be detected, weather conditions, distance to shore, relief of coastal area being monitored, etc. Although maritime surveillance in coastal areas is indeed challenging, technology is continually improving, and EMSA is collaborating to try and provide the best service possible within current limitations as well as provide feedback for future improvements.

- Where does the vessel reporting information come from?

Depending on type and size, vessels are legally required to fulfil certain reporting requirements, and transmit identity details, latest positions and other status information in near-real-time for around 17,000 vessels operating in and around EU waters. EMSA manages vessel traffic monitoring and information systems which act as a platform for maritime data exchange for the waters in and around Europe, as well as tracking vessels globally. EFCA also provides reporting data from fishing vessels, which have additional reporting requirements.

- Are there plans to include other types of pollutants, such as sewage, in the function area Marine Environment (Pollution Monitoring)?

With regard to sewage from land, this is currently not covered by the CMS service. The possibility of this kind of service would have to be discussed with the Commission, as it is not clear that it would necessarily fall under the scope of the CMS service.

6 Break-out sessions

Breakout sessions during the afternoon provided an opportunity for attendees to participate more actively and share ideas on topics of particular interest and relevance to their tasks. There Some administrations with several participants were able to be present in all the break-out sessions. Others chose according to interest. The size of the break-out session groups varied from less than 20 to almost 40 participants; however, each of the sessions was conducive to more in-depth discussion than was possible during the presentations.

6.1 Break-out session: Improving the CMS

Helena Ramon Jarraud, Head of Maritime Surveillance Unit, EMSA, asked the users to provide their feedback on which aspects of the service are most important for their activities.

I. Presentation and feedback by the German Waterways Police

Hartmut Neumann, Head of the German Waterways Police Reporting and Coordination Centre (GWP), delivered a presentation on a recent operation in the context of the G20 Summit in Hamburg for which the Copernicus Maritime Surveillance service was requested. Due to threats of terrorism and in anticipation of considerable presence of protesters, monitoring nearby waters, including the port of Hamburg, was part of the operation.

The GWP provided an overview of lessons learned from the experiences, including the opportunities and limitations provided by CMS images. It was concluded that CMS services are useful in planning risk prevention and disaster response, including for maritime threats and law enforcement operations.

With regard to classified information, DG GROW noted that products are only classified after being analysed, therefore the fact that data are visible to other authorities within the closed community sharing the web interface should not be considered a limitation.

II. Feedback from SASEMAR

SASEMAR stated that in emergency situations there should be 24/7 availability and an immediate response, to provide CMS products without delay. Currently CMS does not have this capacity. SASEMAR further suggested that in the case of an emergency there should be a simpler request form to make it easier to fill and send, as such, the request form should be simplified. In addition, in emergency situations SASEMAR would like to be notified when the product is delivered, and would like to receive an alert report similar to that of CleanSeaNet.

In response to a question on how frequently SASEMAR requests CMS services, SASEMAR responded that routine requests are made for the Alboran Sea, since there are emergency operations regarding search and rescue on almost a daily basis, and the emergency request does not cover SASEMAR needs for search and rescue operations.

EMSA pointed out that it had already been suggested to the Spanish Navy and Spanish Customs that they align their requests for the Alboran Sea, since there are many similar requests for that area. It was recommended that national authorities should coordinate their requests.

III. Ice monitoring

Participants asked about ice monitoring under the CMS service.

DG GROW replied that ice monitoring falls either under the scope of the Marine Environment Service (CMEMS) or Maritime Surveillance service (CMS), depending on the context. In general, CMEMS provides services which are open and available online to the general public, based on satellite, in-situ or model data, with a spatial resolution of kilometres and a range of temporal resolutions (from average daily sea ice thickness to weekly). CMS provides services to authorised users on a restricted interface based on satellite image, value added and fusion products, with spatial resolution of 1 to 100 m, in NRT (from 30 min after satellite acquisition). EMSA explained that the use of CMS for ice monitoring is limited to support to safety of navigation in ice conditions, for example it can be used to support safe passage through areas of rapidly changing ice, and to detect ice sheets and icebergs in NRT.

IV. Overview for 2019

António Rocha, Project Officer for Data Acquisitions and Service Development, EMSA, gave a quick overview of the new services for 2019. New contracts have been agreed, and once they are in force delivery of SAR images and VAP in Europe will be reduced from 30 to 20 minutes. For optical images, delivery will be reduced from 40 to 30 minutes. There will be a feature detections service, wake detection and change detection to improve the maritime picture. Users will get a report showing what has changed between one acquisition and the next, for example, in a fish farm. There will also be a simplified activity report. In the case of the feature detection, there will be a polygon highlighting the feature, e.g. ice. This feature can also be used to detect containers, with layers of different colours.

SASEMAR emphasised that it should be clear when containers or any other objects which are not vessels have been detected.

V. Satellite images as legal evidence

One of the participants asked whether CMS could send a representative to national law courts to testify and provide information about how the system works, giving more weight when cases are brought to court. EMSA cautioned that national legal systems vary greatly, and this sort of evidence may not be accepted by legal authorities. However, EMSA would like to encourage users to give feedback when cases are brought to court, as it is important to see what kind of follow-up results from the service provided. If needed in a legal context, EMSA is willing to support Member States in further detailing elements and aspects of the satellite products delivered in the context of CMS related operations.

6.2 Break-out session: Future requirements for maritime surveillance

The breakout session on future requirements for maritime surveillance was chaired by Leendert Bal.

The session discussed various new and emerging satellite technologies - some of which are under development, and others which are still only ideas – to assess whether they would have any potential for use in functions related to maritime surveillance.

I. Ship signal/radar detection

Some military satellites already have ship radar capability, and there are currently multiple commercial providers developing this capacity for civilian use. This could be useful to detect vessels at sea which are not transmitting signals.

A number of participants stated that this could be a useful feature for detecting vessels with the AIS switched off. One participant queried whether this technology could be used to detect military vessels from the signature of the radar, indicating that for military organisations, this is something they should be more aware of from a security perspective.

There was a short discussion noting that technology already exists for receiving radio signals by satellite.

It was agreed that if the possibility of satellite radar detection becomes available in the civil domain, it would be an interesting development for EMSA to pursue for the Agency's users.

II. High resolution thermal infrared sensors

Infrared detection is possible from aircraft, but not yet from satellite. There is some R&D ongoing to see whether detection from satellite would be possible.

There were a number of doubts expressed about the capacity for satellites to offer infrared detection. Participants in the group agreed that the technology in this area is still too immature to be considered as a serious prospect.

III. Video

It was noted that there are already satellites in operation that have the capacity to take short video. The question was posed to the group of whether this could be an interesting function for the maritime domain, and participants were challenged to describe potential use cases.

A participant from the fisheries sector queried whether it could be used to detect discards of fish, or to capture fishing vessels with gear in the water. In response, it was noted that catching the action of the vessel at the particular moment of satellite overpass would be a matter of luck rather than systematic use.

One participant noted that it could be interesting to catch illegal activities, but only if it were possible to place short-notice requests 30 minutes in advance of the acquisition – with tasking times of 48 hours or more, it is not likely that the resulting videos would be useful. This led to a short discussion on tasking times, which is a subject that EMSA discusses regularly with providers, as it faster tasking times are a constant request from users.

The European project AWAKE was mentioned, which uses a series of still (optical and radar) images to look at dopplers and wakes and thereby detect the speed of the vessel, though the application is limited.

IV. Satellite phone and GSM (Global System for Mobile communications) location detection

Tests are now being done from aircraft to detect the presence of GSM or satellite phone signals, and locate where they are coming from. This would provide evidence of the presence of people in a certain location, such as at sea, although of course there would be no indication of the vessel type, etc. Currently this technology is not developed for satellite, but EMSA expressed an interest in knowing if it would be valuable for users.

The question was posed of how much detail would be possible? For example, could this kind of technology detect two vessels ten miles apart communicating with each other? In response it was stated that by using this technology from aircraft, this would be possible, and so by satellite it probably would be too.

One participant asked whether there would be a constant stream of information, or if it would have to be tasked for specific operations. EMSA replied that initially such a service, if there was demand, would probably be offered on an ad hoc basis where there were appropriate use cases to test it; new services are initially very costly, and so a permanent service would probably not be possible.

With regard to the type of satellite, one participant asked whether it would be stationary or orbiting. It was explained that the distance of geostationary satellites would be too great, so the technology would have to be aboard an orbiting satellite.

There was a short discussion on personal data. EMSA clarified that this further information is beyond the remit of EMSA, whose sole role would be to detect the existence of activity at sea, not to monitor actual communications.

V. In-situ data (non-EO data)

The EMSA RPAS service was presented. It is currently not possible to offer RPAS services on a permanent basis, although this could change if, for example, it came under the remit of Copernicus in future as a complementary in-situ tool.

In response to questions from participants, it was explained that EMSA is finalising some tenders for new contract, which will include vertical take-off and landing. EFCA was involved in the tender evaluation, and from 2019 the service will be offered via EFCA for fisheries control purposes. The types of RPAS available, and the form of service provision, whereby a Member States requests an appropriate RPAS for a period of time to undertake specific operations, was explained. Denmark remarked on the positive experience they had had of RPAS with sniffer capabilities.

The potential of High Altitude Pseudo-Satellites (HAPS) was also discussed. These are very much under development. Two large European consortiums are developing two different types of HAPS; one has a frame structure, but limited payload (approximately 5kgs) while the other is a balloon with capacity for higher payload, but it takes longer to change position and is difficult to keep steady in one location especially in high winds. The possibility of using these platforms as relay stations for communications was also discussed.

Participants were asked their opinion of these possibilities, and in general agreed there was considerable potential for these tools to complement those already available for surveillance.

VI. Information and questions

Regarding new data intelligence capabilities, EMSA provided the information that a project has just begun, to explore whether some IMS data can be transferred to the cloud. With more than 20 million ship positions per day, the application will be faster if the data is in the cloud, and it also allows for more calculations to link data together. Copernicus generates a lot of space data, which is impossible to treat manually Better use of data may also involve harnessing data intelligence solutions.

One participant provided information on an app for leisure yachts being rolled out in Australia and the Pacific islands, where those who have not registered voluntarily may be more subject to checks; and on the detection of halogen lights by satellite to detect fishing activity.

In response to a question about the new generation of satellites, participants were informed that the Sentinel-1 line will continue to be built with the same characteristics, with the likely addition of an AIS payload. Regarding a question on the use of CosmoSkyMED, EMSA explained that the Agency is not currently using the satellite because the military priority makes it difficult to guarantee that a high proportion of images will be delivered, which is fundamental for EMSA users.

6.3 Break-out session: How to benefit from the CMS service

The session started with a brief introduction by the moderators on the advantages of CMS for prospective users followed by a tour de table.

The following areas were discussed:

I. Access to the service

Doubts about EO procedures and participants were addressed, and users were briefed on how to request acquisitions from CMS:

- Users should contact the Copernicus Maritime Surveillance team at EMSA on Copernicus@emsa.europa.eu.
- Initial steps include discussion of operational requirements, configuration of user accounts to access EMSA systems, and identification of users who are authorized to activate the service.
- Access is provided via EMSA's IMS to the EMSA portal (web interface) or to system-to-system interfaces.

II. Confidentiality and priority of acquisitions

Reservations related to the privacy of the requested data were raised by several members, who asked about the status of disclosure of the CMS acquisitions. It was clarified that the default policy is to share the data between authorized users registered in the system, according to data access rights. However, at the request of the user, acquisitions can be concealed from other authorized users (this process requires further preparation).

The issue of prioritisation of requests was also addressed. EMSA explained that there is no discrimination, and that no user is granted priority as a default. Prioritisation is related to the user requirements and the feasibility of the request, with emergency requests taking precedence. Otherwise, images are acquired on a first-come, first-served basis.

III. Coverage

Users asked about CMS coverage in overseas territories. The global reach of the service was explained, emphasizing that not only European waters are served but also non-European waters of

interest to European users. It was noted there may be delays in the delivery of overseas acquisitions due to downlink constraints.

IV. Data availability

Users from customs authorities emphasized the need to access historical data. They are interested in accessing long-term data (more than 5 years), particularly AIS and correlated VDS data.

V. Function specific questions and requirements

There was a short discussion touching on issues of interest to users related to the various function areas covered by CMS. These included:

- Maritime safety and security
  - Detection of debris (from vessel wrecks or accidents).
  - Detection of oil spills (linked with accidents).
  - Detection and distinguish vessels from icebergs (operations in the Artic).
- Fisheries control
  - Use of very high resolution optical for intertidal fisheries monitoring (fish farms).
  - Fish cages and static rigs detection using radar was considered an important value adding product.
  - Support to fisheries control operations should be channelled through EFCA. The request is sent to EFCA and the product is delivered directly to the end user.
- Customs
  - CMS considering extremely relevant in support to the European Anti-Fraud Office (OLAF)'s Joint Customs Operations (JCOs).
- Marine pollution monitoring
  - Detection of ice pollution.
- Multi-purpose/cross function:
  - Detection, tracking and identification of non-reporting targets is a cross functional capability useful for a wide range of activities.
  - Combination of SAR images with optical (cross queueing/pin-pointing) was deemed relevant.

7 Conclusions

Following the break-out sessions, the participants gathered together again in plenary and the main conclusions from each of the break-out sessions, as summarised in the previous chapter, were presented.

Leendert Bal, Head of Operations, EMSA, thanked participants for their contributions during the workshop. Special thanks were offered to the users who presented case studies, providing concrete examples of how the service is being used in practice and first impressions of benefits and drawbacks.

List of Annexes

Annex 1: Acronyms and abbreviations

ABM	Automated Behaviour Monitoring
AIS	Automatic Identification System
AOI	Area of Interest
DG GROW	European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SME (Small and Medium Enterprises)
EC	European Commission
EEAS	European External Action Service
EEZ	Exclusive Economic Zone
EFCA	European Fisheries Control Agency
EFTA	European Free Trade Association
EO	Earth Observation
EU	European Union
EU SatCen	European Union Satellite Centre
GMES	Global Monitoring for Environment and Security
HAPS	High Altitude Pseudo-Satellites
IMS	Integrated Maritime Services
JACO	Joint Arctic Command
JCOs	Joint Customs Operations
JDP	Joint Deployment Plan
JRC	European Commission – Joint Research Centre
MAOC (N)	Maritime Analysis and Operations Centre – Narcotics
NRT	Near Real Time
OLAF	European Anti-Fraud Office
RPAS	Remotely Piloted Aircraft Systems
SAR	Search and Rescue
SAR	Synthetic Aperture Radar (satellite sensor)
UNODC	United Nations Office on Drugs and Crime
VDS	Vessel Detection System
VMS	Vessel Monitoring System

Annex 2: Agenda

Chair: Leendert Bal, Head of Department: Operations

Tuesday, 09 October 2018 EMSA Conference Centre

Time	Agenda Item
09:00 – 09:30	**Registration and coffee**
09:30 – 09:35	**Welcome and opening (EMSA)**
09:35 – 10:05	**Copernicus Maritime Surveillance Service** - **Overview of Copernicus Programme (DG-GROW)** - **Overview of Copernicus Maritime Surveillance Service (EMSA)**
10:05 - 10:20	**Integrated Maritime Services (EMSA)**
10:20 - 11:00	**Copernicus Maritime Surveillance Operational Use (Presentations from Users)** - **European Fisheries Control Agency (EFCA)** - **Icelandic Coast Guard (Landhelgisgæsla Íslands)**
11:00 – 11:20	*Coffee break*
11:20 – 13:00	**Copernicus Maritime Surveillance Operational Use (Presentations from Users)** - **Portuguese Navy (Marinha Portuguesa)** - **Maritime Analysis and Operations Centre – Narcotics (MAOC (N))** - **Spanish Customs Authority (Departamento de Aduanas e II.EE.)** - **Danish Defence Command (Værnsfælles Forsvarskommando)** - **United Nations Office on Drugs and Crime (UNODC)**
13:00 – 14:20	*Lunch break*
14:20 – 14:30	**Introduction to break-out sessions (EMSA)** *Relocation to break-out session rooms*
14:30 – 15:30	**Break-out sessions:** 1. **Improving CMS: feedback and discussion on the current use of the service with existing users** 2. **Future requirements for maritime surveillance: new technologies, new ideas, new policy directions** 3. **How to benefit from the CMS service: open Q&A for prospective users**
15:30 – 15:45	*Return to Conference Centre; rapporteurs' preparation*
15:45 – 16:15	**Plenary feedback**
16:15 – 16:40	*Coffee break*
16:40 – 17:00	**Summary and conclusions (EMSA)**

Annex 3: Participant list

Name	Organization	Country
Yves Maekelberg	Agency for Maritime and Coastal services, Shipping Assistance Division	Belgium
Elisaveta Peneva	Sofia University St. Kliment Ohridski	Bulgaria
Zdravko Seidel	Ministry of the Sea, Transport and Infrastructure	Croatia
Keld Qvistgaard	Danish Meteorological Institute	Denmark
Kjeld Gaard-Frederiksen	Defence Command Naval Staff	Denmark
Martin Ahl	Defence Command Naval Staff	Denmark
Ole Jorgensen	Fisheries Monitoring Centre	Denmark
Rasmus Kimer	Joint Rescue Coordination Centre of Greenland	Denmark
Jouni Vainio	Finnish Meteorological Institute	Finland
Niko Tollman	Finnish Meteorological Institute	Finland
Petri Savola	Centre for Economic Development, Transport and the Environment	Finland
Yves Damay	Direction des affaires maritimes	France
Birte Güldener	Bundesanstalt für Landwirtschaft und Ernährung	Germany
Hartmut Neumann	German Waterways Police	Germany
Iris Ehlert	Bundesamt für Seeschifffahrt und Hydrographie / Federal Maritime and Hydrographic Agency	Germany
Lutz Wessendorf	Bundesanstalt für Landwirtschaft und Ernährung	Germany
Torsten Witt	Federal Police Maritime Department	Germany
Snorre Greil	Icelandic Coast Guard	Iceland
Dario Cau	Italian Coast Guard	Italy
Raffaele Pizzolorusso	Agenzia Dogane e Monopoli	Italy
Walter Conti	Italian Coast Guard	Italy
Deniss Bickovs	Latvian Coast Guard service	Latvia
Viktors Bikovs	Latvian Coast Guard service	Latvia
Bogdan Rojek	Maritime Office Gdynia	Poland
Ana Trindade	Portuguese Navy	Portugal
João Eufrázio	GNR – Guarda Nacional Republicana	Portugal
João Neves	Portuguese Navy	Portugal
João Piedade	Portuguese Navy	Portugal
Luís Miguel Bessa Pacheco	Portuguese Navy	Portugal
Paulo Lourenço	Portuguese Navy, Maritime Rescue Coordination Centre Delgada	Portugal
Sérgio Carvalho	Portuguese Navy	Portugal
Marius Olariu	Romanian Naval Authority	Romania
Paul Neicu	Romanian Naval Authority	Romania
David Ivančič	Slovenian Maritime Administration	Slovenia
Primož Bajec	Slovenian Maritime Administration	Slovenia
Beatriz Gómez Miguel	Guardia Civil / Ministry of Interior	Spain
Jose Luis Rada Casas	Spanish Maritime Authority	Spain

Lopez Carrera	Agencia Estatal de Administración Tributaria	Spain
Maria Evangelina Díaz Delgado	SASEMAR – Sociedad de Salvamento y Seguridad Marítima	Spain
Anders Litzén	Swedish Coast Guard	Sweden
Mats Börje	Havs- och vattenmyndigheten (HaV) / Swedish Agency for Marine and Water Management (SwAM)	Sweden
Ulf Gullne	Swedish Maritime Administration	Sweden
Darco Erkens	Nederlandse Voedsel en Warenautoriteit / Netherlands Food and Consumer Product Safety Authority	The Netherlands
Daniel Ward	Marine Management Organisation	United Kingdom
Lauren Melley	UK Border Force	United Kingdom
Neil Chapman	Maritime and Coastguard Agency	United Kingdom
Neil Palmer	National Maritime Information Centre	United Kingdom
Peter Smith	Maritime and Coastguard Agency	United Kingdom
Rui Meneses	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW)	
Sérgio Bryton	EC-Joint Research Centre (JRC)	
Evaldas Kristopaitis	European Border and Coast Guard Agency (FRONTEX)	
Sven Tahon	European Fisheries Control Agency (EFCA)	
Marcello Moretti	European Union Satellite Centre (EU SatCen)	
Rafael Zurita	European Union Satellite Centre (EU SatCen)	
Pierre-François Ferri	Maritime Analysis and Operations Centre (Narcotics) – MAOC (N)	
Paulo Gomes da Silva	Maritime Analysis and Operations Centre (Narcotics) – MAOC (N)	
Shanaka Jayasekara	United Nations Office on Drugs and Crime (UNODC)	
Leendert Bal	European Maritime Safety Agency (EMSA)	
Helena Ramón Jarraud	European Maritime Safety Agency (EMSA)	
Pedro Lourenço	European Maritime Safety Agency (EMSA)	
Catrin Egerton	European Maritime Safety Agency (EMSA)	
António Rocha	European Maritime Safety Agency (EMSA)	
Ricardo Vicente	European Maritime Safety Agency (EMSA)	
Paula Marti	European Maritime Safety Agency (EMSA)	
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