European Maritime Safety Agency

Copernicus Maritime Surveillance Service

Second User Group Report

V0.1

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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).

The CMS service supports monitoring of human activity at sea for a range of functions, including amongst others, fisheries control, maritime safety and security, law enforcement, customs, marine environment pollution monitoring, and support to international organisations and other functions.[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 assessing feedback on the use of the service, gathering operational requirements, and generating new ideas, a User Group was hosted at EMSA's premises in Lisbon, on 20 June 2019. This second Copernicus Maritime Surveillance User Group comprised a mixture of presentations, break-out sessions, and plenary feedback.

The workshop was aimed at both policy-makers and operational staff of administrations with responsibilities at sea, including those who are already users of the CMS service, as well as potential new users. In total, the workshop was attended by 55 participants. Representatives of 15 EU Member State administrations were present: Belgium, Croatia, Denmark, Finland, France, Germany, Italy, Latvia, Malta, Poland, Portugal, Romania, Slovenia, Spain and the United Kingdom. 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 Fisheries Control Agency (EFCA), European Union Border Assistance Mission in Libya (EUBAM Libya), European Union Naval Force (EU NAVFOR), 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

Helena Ramon Jarraud, Head of the Maritime Surveillance Services, EMSA, opened the workshop by welcoming participants. The agenda of the User Group was reviewed and some practical details related to the organisation of the day were provided. The members of the Copernicus team were introduced to the Workshop participants and a brief roundtable took place, providing an opportunity for all the participants to explain their roles and interests in the CMS service.

Figure 1: Workshop participants

3 Copernicus Maritime Surveillance Service

Pedro Lourenço, coordinator of the EMSA Earth Observation Services, delivered a presentation providing a brief overview of the Copernicus Maritime Surveillance Service.

The provision of Copernicus services is based on the processing of data collected from EO satellites and in situ sensors. 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 to provide full and open access to data and products to all interested stakeholders, the Security services (including the CMS service) are characterised by restricted access and are only delivered to authorized users. In contrast to other open-data services, the satellite products provided by CMS are also on-demand, i.e. delivered based on a specific user request. It should be noted that the Security services are free of charge at point of use to these authorized end-users.

The capabilities of Synthetic Aperture Radar (SAR) satellites (services under all weather conditions, capable of wide area monitoring and very broad set of resolutions) and optical satellites (more detail in terms of characterization and identification of specific targets) were presented. The six different function areas of the service (fisheries control, maritime safety and security, law enforcement, customs, marine environment pollution monitoring and support to international organisations and other functions) were described. It was noted that compared with the same period in 2018, the number of services delivered has increased by about 24%, with law enforcement and customs accounting for the majority of the services. The number of user organisations has been steadily growing too, and there are currently 36 user organisations registered and authorised to request services.

Selected examples of recent activations of the CMS service in several areas of operation were shown, including: monitoring of suspected illegal, unreported and unregulated fishing (IUU) fishing and during fish spawning closures; search and rescue (SAR) operations following Cyclone Idai; monitoring for safety purposes in oil and gas drilling operation areas; combined CMS and RPAS operations in Iceland; and, support for investigations of illegal scrapping of vessels.

Training activities have been important to ensure that users are familiar with EMSA’s operational systems, and ensure they benefit as much as possible from the CMS service. Workshops and User Groups also provide valuable opportunities to discuss user requirements and gather feedback on how to improve the service so that it addresses users’ needs.

4 Copernicus Maritime Surveillance Operational Use (Presentations from Users)

Three users of the CMS service - the UK's Marine Management Organisation (MMO), French Customs (Direction Nationale du Renseignement et des Enquêtes Douanières, DNRED), and the German Waterways Police - delivered presentations on their experiences of using CMS and provided 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, available to participants on the EMSA extranet.

4.1 The Marine Management Organisation (MMO)

Daniel Ward, Senior Marine Officer

The UK's Marine Management Organisation (MMO) is an executive non-departmental public body, with responsibilities (amongst others) for licensing and regulating marine activities in the seas around England and Wales. The MMO in partnership with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) delivers the Blue Belt Programme, which supports the protection of over four million km^2 of marine environment across the UK Overseas Territories. In the context of the Blue Belt Programme, MMO has been using the CMS service since October 2018.

Due to the very large maritime area under its responsibility and the limited number of on scene assets available, the MMO relies largely on technologies for remote monitoring to monitor vessels of interest. The MMO has been using CMS together with other satellite applications for risk-based and intelligence-led surveillance. Automatic Identification System (AIS) data is used to monitor vessels of interest and fishing fleets. The Automated Behaviour Monitoring (ABM) tools available through the Integrated Maritime Services (IMS) are also used to analyse sea encounters, speed anomalies, non-reporting and spoofing situations.

The presentation then focused on the use of CMS in three case study areas:

- Ascension Island: Operation Rose took place in Ascension Island during the highest risk period for IUU activities. Satellite images were delivered by CMS to support a patrol boat assigned to the area. The correlation of satellite vessel detections (VDS) with data from vessel tracking systems allowed for the optimisation of resources and the detection of suspect activity.

- British Indian Ocean Territory: different threats were present in the British Indian Ocean Territory. With limited asset capabilities in the region, the MMO relied on the use of SAR images primarily for the detection of non-reporting vessels.

- South Georgia and the South Sandwich Islands: in this area, the CMS service has been used to monitor the fishing of toothfish. The species is in high demand and IUU fishing is a major concern in the South Atlantic. From March to May, satellite images supported aerial and maritime assets in the area to target suspect vessels.

A review of user experience to date was give. Feedback on the level of service provided by EMSA was positive. In terms of the CMS service itself, there are a wide range of applications for which it can (potentially) be used, and as the MMO gains additional experience with CMS it will be possible to refine the use of the service to use it more effectively. It was noted that negative results (non-detection) can also be very useful for monitoring operations. However, there are some technical limitations, and the service should be used as one element in a broader toolkit. Overall, the

advantages provided by the service were highlighted as beneficial to the Blue Belt surveillance and monitoring operations.

Figure 2: Presentation delivered by UK MMO

4.2 Direction Nationale du Renseignement et des Enquêtes Douanières (DNRED)

Rodolphe Bencze, Analyst

The Direction Nationale du Renseignement et des Enquêtes Douanières (DNRED), French Customs authority is responsible for investigating customs-related cases in France and French overseas departments and territories. DNRED started using the CMS service in September 2018.

An example was given of how high-resolution optical satellite images might be used to identify a vessel target. DNRED was trying to locate a sailing ketch with specific characteristics (colour, cockpit location, pulpit details, masts, etc). The DNRED can therefore make best use of satellite products that acquire images at an angle, in order to better observe details that help in the identification of vessels of interest. For the vessel of interest in this specific case, DNRED requested four optical images through the CMS service, with different angles and different times of acquisition, to increase the probability of identification of the vessel through the observation of details. Unfortunately, on this specific occasion, some technical quality issues were encountered with the images and not all were delivered. Despite these issues with the optical acquisitions, in dialogue with the CMS team, it was still possible to obtain some useful information and shortlist two possible vessels of interest in one of the optical images.

Routine requests over areas of interest (AOI), and based on acquisition of SAR images, are used by DNRED to optimise the use of aerial surveillance assets, with the possibility of the latter being used to verify information on VDS targets from the EO acquisitions. This saves time for the aerial assets who can be sent directly to investigate non-correlated vessel detections.

For detection of smaller vessels, which are frequently what is needed for customs purposes, there is a trade-off between the resolution of the image and the size of the area of interest (AOI). In the north of

France, SAR images are frequently used (rather than optical, due to high levels of cloud cover which make optical difficult to use). The areas requested are 50 km x 50 km, with very high-resolution acquisitions.

Another issue which the DNRED has encountered in using the service, is that in busy traffic areas, there are many vessel detections, and the routes change quickly – especially for fishing vessels, which not only follow fishing patterns, but also switch their AIS on and off. It is therefore not necessarily easy to match a vessel detection with a target, or for aerial assets to locate the targets identified by VDS. As vessels are in constant movement, the fastest possible near real time (NRT) acquisitions are essential to allow assets to reach the AOI without delay.

DNRED is satisfied with the CMS service and finds it useful operationally, although it was noted that the service was not as easy to use as they had initially hoped, and that tests performed on routine requests showed that their processes had to be adapted to make best use of CMS (e.g. planning of flight paths of aerial assets).

Figure 3: Presentation delivered by DNRED

4.3 German Waterways Police

Arne Zilles, Waterways Police Reporting and Coordination Centre

The German Waterways Police has responsibilities in monitoring the coastal areas, waterways and harbours of Germany. Their duties include the surveillance of maritime traffic, inspection of ships and prevention of environmental crime at sea. The actions undertaken by the German Waterways Police are coordinated through the Reporting and Coordination Centre of the German Waterways Police within the Maritime Safety and Security Centre in Cuxhaven.

Prior to using the CMS service, the German Waterways Police had experience with using the CleanSeaNet (CSN) service for monitoring oil pollution in German waters. Several cases from this

experience were delivered in the first part of the presentation, highlighting how EO services can prompt further investigations resulting in criminal penalties being applied.

Use of the CMS service started in 2017, with satellite images being requested for law enforcement operations in advance of a major police operation in July.

The German Waterways Police used CMS during the Interpol '30 Days at Sea' environmental law enforcement operation, requesting optical images to monitor illegal beaching and ship scrapping in contravention of Regulation (EC) No 1013/2006. Weekly high-resolution optical satellite images were requested during this period to detect specific ships suspected of illegal beaching outside Europe, following analysis based on ship tracking data from the EMSA applications, amongst others. High resolution images provided detailed information on beached vessels, enabling identification and proof of illegal disposal.

Subsequently, the German Waterways Police has initiated further investigations using the same means. An example was given of a vessel which could be clearly identified on the high-resolution optical image, which was compared to photos of the vessel available from commercial and other sources. The track of the vessel revealed that it had travelled from Europe without stopping in another port *en route*.

Figure 4: Presentation delivered by German Waterways Police

5 Break-out sessions

Breakout sessions during the morning and the afternoon provided an opportunity for attendees to ask questions, participate more actively and share ideas on topics of particular interest and relevance to their tasks. The size of the break-out session groups varied from 12 to 24 participants.

5.1 Introduction for new users

The session focused on an introduction to the service for potential new users. A brief introduction to the CMS service was delivered, addressing basic questions and providing some key information for potential or new users who were not yet very familiar with the details of the service.

The scope of the service was presented, and an overview given of function areas. The available portfolio of satellites for CMS services were introduced, as well as the main characteristics and specifications of the products available.

The procedures in place to support users in requesting CMS services were explained. Once a potential user contacts the EMSA Copernicus team to request access to the CMS service, a set of operational procedures are initiated, starting with user registration, followed by making specific requests, and ending with the delivery of the requested services. It was highlighted that only authorised registered users can access to the service. The tasking and delivery of EO products was further developed, underlining in particular when the short notice requests should be used. Users were reassured that on more technical matters, such as the selection of satellites or sensors, the CMS team is best placed to make these decisions based on the operation and target details provided by the user.

The EMSA portal was referenced as the tool used to visualise images. Potential users were made aware of the importance of delivering feedback on the products delivered, as means to improve the service.

Following the presentation by the CMS team, a round of questions and debate took place. The items were listed below were discussed.

- Permissions and limitations related to the distribution of satellite images to third countries was discussed.
- The use of satellite images in judicial procedures. Participants were informed that EO products have been used in the past as supporting evidence, although it depends on the legal framework of the country in question.
- The possibility to access archive information.
- The need for confidentiality regarding certain EO services in support of some operations.
- The combination of Remotely Piloted Aircraft Systems (RPAS) with the CMS service. It was explained that RPAS interface integrates both sources of information and a recent example of a joint activation of the CMS service with RPAS in Iceland was shown.
- IMS training sessions take place at EMSA, and these include an EO component. If required by the user, EMSA can also provide national training to all operators of a given institution or in a given country.
- Participants also asked about monitoring land areas and inland vessel traffic monitoring, both of which are out of scope of the service.

5.2 Feedback on use of the services (CMS&IMS) from existing users

The breakout session followed a structure which led users through a series of questions regarding their experience with CMS and IMS, and their suggestions for improvement.

1. Providing feedback on the vessel detection service (VDS) detections

A brief overview was given of how users of the EMSA CSN service, based on their observations from on scene assets, give feedback on the oil spill detections displayed on the EMSA interface. It was suggested that a similar feedback mechanism could be developed for vessel detection. It was clarified that this feedback is primarily to enable EMSA, through the contracted service providers, to improve the vessel detection product; i.e. the feedback is on the accuracy of the positive (or negative) vessel detection result and details associated (whether it is a vessel or other object, heading of the vessel, etc), and not to provide operational feedback (such as whether a vessel was engaged in illegal activity for example).

It was agreed that a feedback mechanism would be a useful feature. Parameters for providing feedback could include: vessel type, vessel length, and vessel heading. Furthermore, it was noted that it could be important to have the possibility to insert feedback on the image itself, for example to draw attention to a 'missed' vessel detection. Specific symbology may have to be developed in accordance with the type of feedback information provided.

2. Integrating EO layers and other data

There was interest from the group in extending the feedback to the correlation results.

EMSA provided information on the upcoming 're-correlation' function, whereby there is a possibility to correlate vessels again once more recent vessel position data has been ingested in the system. Users responded positively to this development. Nonetheless, the importance of being able to do manual correlation analysis was restated.

In response to needs expressed by some users, EMSA explained that a 'Get Track' (where the track of a correlated vessel is shown, from the correlation back in time) and an 'Area Query' (for vessels in the area) centred on the VDS and at the time of the acquisitions, was also being developed.

3. Automated behaviour monitoring (ABM)

Participants in the breakout session noted that it would be interesting to develop ABMs based on VDS. The ABMs could include:

- uncorrelated targets in an AOI
- the possibility to have an active list of vessels of interest and to receive an alert if these vessels are correlated with VDS on an EO acquisition.
- an alert based on 'missing' VDS when a vessel is reporting position information from an area covered by a satellite acquisition (linked to the possibility of AIS spoofing).

In general (in relation to existing ABM in IMS, as well as for consideration for future ABM), participants emphasized the importance of having some key information linked to the VDS (e.g. vessel type and length with confidence level) in an operationally useful way (ABM email alerts). It was noted that if this information, along with coordinates, can be immediately passed to assets on scene it can help operators decide which targets to investigate further, whereas if the operator has to access the EMSA portal to find this information it is much less useful.

EMSA agreed to forward the IMS points of contact to the CMS workshop participants in order to further discuss ABM proposals.

4. Service and interface improvements

At the end of the session, general comments and feedback were collected.

Participants who had attended trainings and webinars reported that these are very helpful. It was noted that EMSA should make further efforts to ensure that CMS users obtain training not just on the CMS service, but on the further features of the IMS.

It was noted that the quality of VDS should be improved, for example vessels close to each other should be better discriminated, and it should be ensured that VDS layers are not displaced. Participants also expressed interest in having the possibility to obtain multitemporal analysis, for example linking VDS across different images, if they are from same target.

There was considerable interest in upcoming feature detection.

5.3 Break-out session: Understanding Earth Observation data

The session on EO products at EMSA went into more detail on the products available, focussing on the different types of data that EMSA can deliver and its characteristics. Differences between optical and SAR were explained and the advantages and disadvantages of each were highlighted. The compromise between image resolution and image coverage was also explained. The majority of the information presented is available for reference in the presentation delivered during the User Group and made available to users, as well as in the CMS Product Catalogue.

The delivery times and the process followed at EMSA between receiving a request until the image is delivered was also discussed. The questions raised by the participants were related to issues such as the measurement of vessels (length, heading) and how to visualise the images and interact with them.

New user requirements were also raised during the discussions. These are listed below.

- A functionality to see and analyse time series of satellite images and to overlay VDS information from these.
- Capability to upload user data to the EMSA portal.
- Possibility to download the image bands, not only the RGB (Red-Green-Blue) product.
- When a correlated vessel is shown in VDS, show also the source of the correlation (AIS, vessel monitoring system, etc).

6 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.

Helena Ramon Jarraud, Head of Maritime Surveillance, 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 their experiences of the benefits and drawbacks of the service.

List of Annexes

Annex 1: Acronyms and abbreviations

ABM	Automated Behaviour Monitoring
AIS	Automatic Identification System
AOI	Area of Interest
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CMS	Copernicus Maritime Surveillance
CSN	CleanSeaNet
DG GROW	European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SME (Small and Medium Enterprises)
DNRED	Direction Nationale du Renseignement et des Enquêtes Douanières
EC	European Commission
EFCA	European Fisheries Control Agency
EO	Earth Observation
EU	European Union
GMES	Global Monitoring for Environment and Security
IMS	Integrated Maritime Services
IUU	Illegal, Unreported and Unregulated fishing
JRC	European Commission – Joint Research Centre
KLM	Keyhole Markup Language
MAOC (N)	Maritime Analysis and Operations Centre – Narcotics
MMO	Marine Management Organisation
NRT	Near Real Time
RGB	Red Green Blue wavelengths
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

Annex 2: Agenda

Chair: Helena Ramon Jarraud, Head of Maritime Surveillance, EMSA

Thursday, 20 June 2019

Time	Agenda Item
09:00 – 09:30	**Registration and coffee**
09:30 – 09:40	**Welcome and opening**
09:40 – 10:00	**Copernicus Maritime Surveillance Service** - **Service overview and results**
10:00 – 11:00	**Copernicus Maritime Surveillance Operational Use** - **Fisheries Control: UK Marine Management Organisation (MMO)** - **Customs: French Customs** - **Law Enforcement: German Waterways Police**
11:00 – 11:30	*Coffee break*
11:30 – 12:45	**Introduction to parallel sessions** *(participants should attend **one session in the morning** and **one different session in the afternoon**)* **Parallel sessions (1)** - **Introduction for new users** o Presentation of the CMS service, the process for requesting access, questions and answers - **Feedback on use of the service from existing users** o Discussion and feedback from users on how to improve the service, use of the EMSA portal/interface, integration of EO and other data, ABMs - **Capabilities of Earth Observation data** o Presentation and discussion of the main characteristics of E.O. data (orbit, coverage, resolution, etc) and how to make best use of CMS products
12:45 – 14:00	*Lunch break*
14:00 – 15:15	**Parallel sessions (2)** - **Introduction for new users** - **Feedback on use of the service from existing users** - **Understanding Earth Observation data**
15:15 – 15:45	*Coffee break*
15:45 – 16:30	**Plenary feedback**
16:30 – 17:00	**Summary and conclusions**

Annex 3: Participant list

Name	Organization	Country
Yves Maekelberg	Agency for Maritime and Coastal services, Shipping Assistance Division	Belgium
Vesna Poslončec-Petrić	Faculty of Geodesy, University of Zagreb	Croatia
Zlatko Carevic	MRCC Rijeka	Croatia
Martin Veicherts	Arctic Command	Denmark
Keld Qvistgaard	Danish Meteorological Institute	Denmark
Martin Ahl	Royal Danish Navy	Denmark
Mikko Leminen	Finnish Border Guard	Finland
Rodolphe Bencze	DNRED	France
Pierre Roty	French Navy	France
Gabriel Aronica	Ministry for the Ecological and Solidary Transition - Maritime Safety Division	France
Arne Zilles	German Waterways Police	Germany
Francesco Proietti Sterbini	Guardia di Finanza	Italy
Giuseppe Casamassima	Guardia di Finanza	Italy
Kristaps Zidens	International Transport Development Association	Latvia
PierreBartolo	Ministry for Home Affairs and National Security	Malta
Andrzej Kalata	Maritime Office Gdynia	Poland
Afonso Matos	Coastal Maritime Vessel Traffic Service - Portugal Maritime Administration	Portugal
José Luiz Moutinho	Atlantic International Research Centre	Portugal
Ana Faneca	Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos	Portugal
Paulo Joaquim	Direção-Geral de Recursos Naturais, Segurança e Serviços Marítimos	Portugal
Oprescu Mircea	Romanian Border Police	Romania
Ciprian Marius Ciopa	Romanian Naval Authority	Romania
Iulian Ichim	Romanian Naval Authority	Romania
David Ivancic	Slovenian Maritime Administration	Slovenia
Jorge Diaz De Junguitu	Dirección Adjunta de Vigilancia Aduanera	Spain
Pedro Alberto Alonso	Dirección Adjunta de Vigilancia Aduanera	Spain
Beatriz Gomez Miguel	Guardia Civil	Spain
Úrsula Sánchez-Reseco López	Guardia Civil	Spain
José Manuel Allegue Bueno	SASEMAR – Sociedad de Salvamento y Seguridad Marítima	Spain
Alejandro Cervantes	Spanish Armada	Spain
Daniel Ward	Marine Management Organisation	United Kingdom

Peter Smith	Maritime and Coastguard Agency	United Kingdom
Rui Meneses	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW)	
Guido Ferraro	European Commission (EC)	
Harm Greidanus	European Commission (EC)	
Sven Tahon	European Fisheries Control Agency (EFCA)	
John-Marco Cecchini	European Union Border Assistance Mission in Libya (EUBAM Libya)	
Veli-Matti Piuva	European Union Border Assistance Mission in Libya (EUBAM Libya)	
Diego Canovas-Canovas	European Union Naval Force (EU NAVFOR)	
Enrique Villegas	European Union Naval Force (EU NAVFOR)	
Ana Carreira	Maritime Analysis and Operations Centre (Narcotics) – MAOC (N)	
Kaitlin Meredith	United Nations Office on Drugs and Crime (UNODC)	
António Rocha	European Maritime Safety Agency (EMSA)	
Catrin Egerton	European Maritime Safety Agency (EMSA)	
Helena Ramon Jarraud	European Maritime Safety Agency (EMSA)	
Michela Corvino	European Maritime Safety Agency (EMSA)	
Paula Marti	European Maritime Safety Agency (EMSA)	
Pedro Lourenço	European Maritime Safety Agency (EMSA)	
Ricardo Vicente	European Maritime Safety Agency (EMSA)	
Sónia Antunes	European Maritime Safety Agency (EMSA)	
Yann Le Moan	European Maritime Safety Agency (EMSA)	

http://copernicus.eu

European Maritime Safety Agency
Praça Europa 4
1249–206 Lisboa Portugal
Tel +351 21 1209 200 / Fax +351 21 1209 210
emsa.europa.eu