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ANNEX 1

ANNEX

to the

COMMISSION IMPLEMENTING DECISION

on the adoption of the Work Programme 2019 and on the financing of the Copernicus Programme

ANNEX
Copernicus Work Programme 2019

Table of Contents

1. INTRODUCTION

This document constitutes the annual work programme adopted by the European Commission in conformity with Art. 12 of the Copernicus Regulation.

The Copernicus Regulation defines the fields that may be covered by actions. With a view to the funding available in 2019 and in order to optimise the available resources, the Commission proposes to concentrate the 2018 work programme on the following fields funded by budget lines 02.0601 and 02.0602:

The first part of the work programme is dedicated to the continuity and further implementation and improvement of the various Copernicus components.

This addresses the Service Component:

(1) The Land Monitoring Service;

(2) the Marine Environment Monitoring Service;

(3) the Atmosphere Monitoring Service;

(4) the Climate Change Service;

(5) the Emergency Management Service;

(6) the Security Service, with its three components for border surveillance, maritime surveillance and Support to EU external actions.

For the Copernicus services component, the activities planned for 2019 will ensure the continuity with the previous Copernicus work programmes since 2014. Substantial efforts will be devoted to optimise the synergies between the various components of the Copernicus services, as appropriate, and to enhance a common user experience across all programme elements.

The Space Component (including construction, launch and operation of satellites and ground segments, data access and dissemination, consolidation of user requirements).

The further evolution of the Copernicus Space Component in 2019 is ensured via the Copernicus Agreements with ESA and EUMETSAT for the continued development, launch, as well as initial and routine operation of the Sentinel satellites and the Ground Segments. Activities in 2019 will cover in particular the operations of Sentinels-1A and B, -2A and B, -3A and B as well as Sentinel 5p. In addition, preparations will continue for the launches and operations of subsequent Sentinels and for the construction of the first Sentinel C- and D-Units to the extent already foreseen in this programme period.

For the In-situ Component the focus is on the continuation and ramp-up of the activities from the previous years.

As in previous years, there are some smaller activities targeted at the evaluation of the programme or specific aspects thereof.

The second part of the work programme addresses the application and the exploitation of Copernicus data and information (including possibly space data from other sources).

A first strand of activities aims at fostering and improving the access to, the exchange and dissemination of data and information. This comprises elements, such as evolution of the Space Component's ground segment, the access to contributing mission's data, the fostering of platforms for data and information access and value added for end users.

Secondly, at this stage of programme implementation, with most infrastructure elements in place and operational, a particular emphasis will be given to promote the uptake and use of space-related data and services in order to maximise their societal and economic potential. Uptake of the products at all levels, from EU to national, regional and local level will receive special attention.

Lastly, communication and outreach activities will continue to be carried out at programme level to complement the corresponding activities at the level of the services and the space component.

The Commission will continue in 2019 to ensure the complementarity, consistency and links between Copernicus and other programmes such as Horizon 2020 or ESA programmes. In order to create effective links and to benefit from research, the Copernicus work programme and longer term implementations will be communicated to Horizon 2020 participants, to ensure that research and development in the Horizon 2020 space research domain will be able to support the long term evaluation of operational services and future Earth Observation technologies. The focus will be on topics of evolution of both the service and the space components, in particular preparing the ground for Sentinel evolution proposals.

Complementarity and consistency will continue to be ensured also with other EU actions and instruments, as stated in the Copernicus regulation "Copernicus should be implemented consistently with other relevant Union instruments and actions, in particular with environmental and climate change actions, and instruments in the field of security, protection of personal data, competitiveness and innovation, cohesion, research, transport, competition and international cooperation, and with the European satellite navigation systems (Galileo and EGNOS). Copernicus data should be compliant with Member States' spatial reference data as well as with implementing rules and technical guidelines of the infrastructure for spatial information in the Union established by Directive 2007/2/EC of the European Parliament and of the Council. Copernicus should also complement the Shared Environmental Information System (SEIS), as referred to in the Commission Communication of 1 February 2008 entitled: Towards a Shared Environmental Information System (SEIS), and Union activities in the field of emergency response. Copernicus should be implemented in accordance with the objectives of Directive 2003/98/EC of the European Parliament and of the Council (2) on the re-use of public sector information, in particular transparency, the creation of conditions conducive to the development of services, and contributing to economic growth and job creation. Copernicus data and Copernicus information should be available freely and openly to support the Digital Agenda for Europe, as referred to in the Commission Communication of 26 August 2010 entitled: A Digital Agenda for Europe."

The Commission will also ensure that relevant synergies between the 2019 Copernicus Work Programme and the 2017-2019 Work Programme of GEO (Group on Earth Observations), including the proper implementation of GEO flagships and GEO initiatives will be promoted in compliance with the statement of the Copernicus regulation: "Copernicus should be considered as a European contribution to building the Global Earth Observation System of Systems (GEOSS) developed within the framework of GEO".

The budget for 2019 relating to the Copernicus Regulation amounts to EUR xxx,xxx,xxx under budget lines 02.0601 and 02.0602. The activities, their indicative costs and milestones described in this document set out the expected progress in the various areas. Cumulative changes within or between the allocations to the specific actions not exceeding 20% of the maximum contribution are not considered to be substantial, provided that they do not significantly affect the nature and objective of the work programme.

2. INDICATIVE BREAKDOWN OF 2018 BUDGET

Copernicus Budget 2018 (taking into account the EFTA states contributions)
Activities under Budget Line 02 06 01
1. Indirect Management:
Land Monitoring Service (Pan-European and Local)
Marine Environment Monitoring Service
Atmosphere Monitoring Service
Climate Change Service
Security Service (Maritime Surveillance)
Security Service (Border Surveillance)
Security Service (Support to External Actions)
In-situ coordination
Ground Motion Spatial Database
2. Direct Management:
Land Monitoring Service (Global)
Emergency Management Service
In-situ Reference Data
Programme Evaluation
User Uptake, Digital Market and Downstream Services
Communication and Outreach
Internationalisation of Copernicus
Activities under Budget Line 02 06 02
1. Indirect Management:
Space Segment Development
Sentinel Operations (S1-2-3)
Sentinel Operations (S3-J3)
Ground segment data circulation, dissemination & network
Access to data from Copernicus Contributing missions
Remuneration and Internal Cost (ESA)
Remuneration and Internal Cost (EUMETSAT)
2. Direct Management:
Space Component Evolution
Space Surveillance and Tracking (SST)
Grand Total

3. PART 1 – COPERNICUS COMPONENTS

3.1. Section 1: Services Budget Line 02 06 01

3.1.1. ACTION 1: Land Monitoring Service (CLMS)

The objective of the Land Monitoring Service is to provide users in the field of environment and terrestrial applications with relevant information based on space data combined with data from other sources. It addresses a wide range of policies such as environment, agriculture, regional development, transport and energy as well as climate change at EU level. At global level it answers to European commitments in International Conventions. The Land Monitoring service focuses on the priorities defined by a broad consultation of key users within the EU institutions and agencies (addressing a broad variety of policies, such as environment, regional development, enlargement, development, humanitarian aid) as well as outside, the Copernicus User Forum, the National Focal Points of the European Environment Information and Observation Network (EIONET), the National Reference Centres (NRCs) and international stakeholders, including UN institutions.

This action is composed of three activities:

- Pan-European Coverage and Local Land;
- Global Land Component;
- Global Sentinel Analysis Ready Data.

3.1.1.1. Pan-European Coverage and Local Land

Context of the service

The EU pan-European and local land monitoring service is building further upon the successful implementation of the GMES/Copernicus Initial Operations (2011-2014) of the land monitoring service (or 'GIO land') during which a broad portfolio of land monitoring products was created, based on High Resolution satellite imagery and covering the full geographic extent of 39 European countries, an area of roughly 6 M km2 area, i.e. the 28 EU member states, 4 EFTA countries, 6 Balkan countries and Turkey. Throughout the portfolio, the land monitoring service aims at maintaining and updating time series of products, in order to be able to support change monitoring, which is a critical requirement to support many Community policies with a direct or indirect impact on the environment.

For the implementation of the Copernicus land monitoring services, the EEA builds upon its network of its member and cooperating countries, EIONET (European Environment Information and Observation Network), of which the National Reference Centres Land Cover takes part in the production of land cover datasets, as well as various verification and enhancement activities. Furthermore, the strong involvement of experts from the European countries is equally exemplified by the work of the EAGLE group (EIONET Action Group on Land Monitoring in Europe) on harmonisation and development of land monitoring concepts, data models, and transformation tools.

Finally, the land monitoring service continues to make use of the relevant EU initiatives such as the INSPIRE Directive and the Shared Environmental Information System (SEIS), the EEA networking with its Member and Cooperating Countries (EIONET) and close cooperation with EU institutions and bodies, as well as results of the Copernicus pre-operational projects especially GEOLAND 1 & 2 (land monitoring services), Reference Data Access (RDA), the

EAGLE working group (EIONET Action Group on Land monitoring in Europe) and HELM (Coordination Action 'Harmonized European Land Monitoring').

Image data sources used by CLMS

Input imagery for CLMS has been organised initially according to a 3-yearly update cycle, since the requirement of full coverage of the pan-European AoI, due to cloud cover, needed 3 years to reach this objective. So called reference years are therefore also the years during which the bulk of the satellite image acquisition for the land monitoring service are used, initially via Copernicus Contributing Missions (CCM), meanwhile predominantly via Sentinel 2 and more recently increasingly as well Sentinel 1 SAR data in the HR domain,

The VHR data stemming from the Copernicus Contributing Missions are the main source of input for the more detailed local component products.

In order to match image acquisitions with the information services, preferentially, all data shall be acquired in the reference year. In any case, the majority of the AoI shall be covered within the reference year. However, data acquisition could start the year before the reference year and the reference year +1 shall only be used for limited gap-filling.

Although this requirement is still valid for many of the CLMS products, the update cycle of Sentinel data introduces a shift of paradigm that enables the CLMS to move from mono- or bi-temporal geostatistical image classification techniques into full time series analysis, as an innovative way of information extraction.

Overview of the CLMS portfolio

The operational **pan-European** land monitoring portfolio includes:

- High Resolution and Very High Resolution satellite image mosaics over Europe in false colour infrared, respectively true colours, following a 3-yearly update cycle;

- The Corine Land Cover (CLC) product (time-series CLC1990 up to CLC2018 following a 6 yearly update cycle);

- The follow-up product suite for CLC, code-named CLC+, composed of a CLC-backbone, CLC-core, CLC+ and CLC-legacy products, in essence refining spatial resolution to the 0.5-1ha range, building upon an object oriented data model, allowing a better separation between Land Cover (LC) and Land Use (LU), as well as more flexible enrichment with MS data sources. This new product suite started its first deployment in 2018, and will be rolled out in view of operational use by 2021;

- A set of High Resolution Layers (imperviousness, forest (tree cover density, forest type), grassland, wetness and water and small woody features). These HRLs provide complementary thematic content, i.e. characteristics of 5 land cover classes, but with a finer spatial resolution of 1 ha versus 25 ha for the CLC; (time series (2006-2009 (imperviousness only))-2012-2015-2018 following a 3-yearly update cycle and synchronised with CLC);

- A High Resolution phenology product over EEA39, following the vegetation cycle in a continuous mode and with yearly updates of intra-seasonal information;

– Pan-European reference products: a High Resolution surface model (EU-DEM), fully integrated with a VHR hydrography network (EU-Hydro). These products serve as references for use by the Copernicus services. The two datasets, originating from the GMES preparatory action 2009 are covering the full territory of the EEA39 and are maintained and further improved by the inclusion of data from national/regional sources;

– The European Ground Motion database (EU-GMS): this product will provide consistent, regular and reliable information regarding natural and anthropogenic ground motion phenomena all over Europe. The main objective is to measure ground and infrastructure displacements, including, for example, landslides and subsidence.

The operational **local** land monitoring portfolio covers subsets of the European territory and focuses on so called hot spots, i.e. areas that are prone to very specific environmental or societal pressures, threats or problems. It creates tailored land cover and land use information from Very High Resolution (VHR) satellite imagery, typically with a spatial resolution of 2.5m and includes:

– The Urban Atlas (UA), harmonised land cover and land use maps, initially over 305 European urban areas for the reference year 2006, and extended to 695 Functional Urban Areas for the reference year 2012, now being further extended to cover the full EEA39 area, and will then reach 850 FUAs (time series 2006-2012-2018 including change mapping whenever possible); Height information has been included on the downtown areas of EU-28 capitals, which will gradually be extended to other major FUAs in the EEA39. Furthermore, the Eionet NRC/LCs will enrich the product with selected LU information.

– The Riparian Zones (RZ), i.e. transitional areas occurring between land and freshwater ecosystems, consisting of three complementary product groups which provide detailed information on the state and characteristics of riparian zones across the EEA39 countries: very-high resolution land cover/land use within a buffer zone along large and medium-sized European rivers, a modelled delineation of Riparian Zones and Green Linear Elements; (time series 2012-2018 including change mapping).

– A subset of Natura 2000 protected sites mainly composed by semi-natural and natural grasslands providing LC/LU reference years 2006, 2012 and change mapping.

– The Coastal Zone (CZ) monitoring product, providing LC/LU information in VHR on a 10 km wide coastal strip, with a dedicated nomenclature taking stock of the specific habitats along the coastline and the vulnerability of the coast ecosystems. This product is being implemented in close cooperation with the Copernicus Marine Environment Monitoring Service. Add-on information to the LC/LU mapping, addresses aspects of coastal dynamics such as erosion monitoring, or water quality variables at river mouths (the latter being inserted in EU-hydro), so as to feed into the pre-littoral modelling as performed in CMEMS.

– The Snow & Ice (S&I) service, which, following a 2018 workshop on user requirements, product specifications and quality requirements, is being implemented in 2019.

Dissemination, communication, awareness raising and user uptake

Users can have access to all land monitoring products via the Copernicus land portal https://land.copernicus.eu which functions as a single point of access, including the global land component as well, from where one gets re-directed to JRC global land activities.

A range of communication and awareness raising activities will be undertaken concerning the pan-European and Local Land monitoring activities. The focus will be on communication activities that aim directly at a broader user uptake potential for the land monitoring services. Furthermore, EEA will participate and support the EC in the Copernicus network of communication officers.

EAGLE

From a methodological perspective, the land monitoring service continues to support the EAGLE activities, serving a double aim of a) transformation of national LC/LU systems to European ones such as CLC, and b) testing the deployment of a new approach for a European LC/LU nomenclature concept in line with INSPIRE and the FAO Land Cover Classification System (LCCS) and Meta Language (LCML).

Continued support to the EAGLE activities. Whereas the theoretical basis for the EAGLE concept has been elaborated under GIO Land, the continuation of the work consists in thorough testing of the operational feasibility of the proposed approach (already started in 2016), and of developing tools that facilitate disassembling national/regional nomenclatures and re-assembling them towards a common European nomenclature, such as CLC. 2019 will further apply the EAGLE concept in the CLC+.

Support to the EU European Neighbourhood Countries policy

CLC mapping in the six Eastern Partnership countries. During the period October 2016 - March 2017, feasibility studies, with visits, were conducted in the partner countries to establish the basis for cooperation for this land cover/land use mapping exercise. Resulting from the findings of these feasibility studies, the second phase of the implementation has been initiated in 2018 to cover the development of country-specific plans for the pilot mapping exercises, a first training course for national teams, support for the identification of/access to input data/imagery needed, checking of results/quality control, a second training on mapping of CLC-changes and helpdesk/support functions throughout the whole exercise. This supporting activity, implemented with support from the Eionet European Topic Centre Urban Land and Soil Systems, will be continued in 2019.

Rationale and aspects of service evolution

High Resolution Layers

In terms of workflow and products only minor fine-tuning changes in the HRL production for the reference year 2018 are being implemented, based on the lessons learnt from the 2015 production series. The use of Sentinel-1 data is getting incorporated in the production processes for HRLs, the SAR data enables the HRL Forest to be enriched with information on forest structures and gap-filling of HRLs. Information on surface texture helps to improve the distinction between different types of forest. Textural analysis is applied as well in the HRL grassland, in order to improve the usefulness of this product to support the modelling of agro-environmental indicators and information on intensity of agricultural management practices.

High Resolution Phenology

More emphasis will continue to be put on the bio-geophysical parameters which are being used as a baseline for the HRL production; In the same context, the S2 data now allow for the production of a HR phenology service product, which exploits the high acquisition frequency and spectral richness of S2, which radically changed the possibilities to generate highly relevant and accurate phenology data. Proper processing of Sentinel-2 data allows the generation of daily HR vegetation index trajectories as well as parameters that summarize the growing seasons as well as biological productivity during the seasons.

The increased resolution of phenological data will allow for a much more detailed assessment of vegetation responses to disturbances, e.g. droughts, storms, insect infestations, or human influence. It will be possible to monitor effects on plant functional types, like agricultural fields or forest stands.

Moreover, HR phenological information will contribute to the improvement of the quality of existing HRL Copernicus products relating to grasslands and wetness and may give additional input to e.g. the characterization of riparian areas. Productivity metrics linked to the growing season will strongly support mapping and assessing land degradation. Phenology data will also be useful for improved estimation of the carbon uptake and as a planning tool for climate mitigation and adaptation measures through indicators such as changes in the start, the end or the length of the vegetation growing season. It will directly be used for the mapping and monitoring of ecosystem services, thus supporting priority objective #1 of the Union's 7th Environmental Action Programme: "to protect, conserve and enhance the EU's natural capital" and halting the degradation of ecosystem services aiming at "no net loss" within the EU 2020 Biodiversity strategy.

Assessing high resolution productivity trends of European landscapes and mapping high spatial and temporal resolution land use changes will also feed into the Sustainable Development Goals of the UN Rio+ 20 initiative achieving a land degradation neutral world. This goes along with objectives as set out for greening the Common Agricultural Policy (CAP), such as the 5% ecological focus area, in particular: land left fallow, buffer strips, agroforestry, afforestation, short rotation coppice or nitrogen fixing crops, some of which can be made measurable through applying land accounting techniques on the basis of land monitoring change products.

Towards CLC+

The evolution of a generic LC/LU product at pan-European level such as CLC capable of coping with the policy challenges for the coming decade in need of more detailed better structured and more frequently updated data has resulted into a new product suite, codenamed: CLC+. Amongst other, the new LC/LU product is expected to support the LULUCF reporting obligations (obligatory for the MS from 2021 onwards, but with support from EEA), at 0.5 ha MMU, and building upon the EAGLE concept facilitating not only a much more analytic mapping of phenomena at the earth's surface but enabling as well more complex querying, easy enrichment of the data and flexible combination with other datasets. The roll out of the CLC+ for the reference year 2018 started in 2017 with an intensive consultation of the user community and the start of the production in 2018 of the CLC-backbone product. The production of the CLC-backbone will continue in 2019, and is intended to reach a final phase by end 2020.

The CLC-backbone, together with other LC/LU products, also from the MS, will feed into a CLC-core (the grid based graphical central engine of the product suite), from which tailored

instances such as CLC+ or CLC-legacy (for the continuation of the traditional CLC time series) will be derived. This 2nd step will be deployed in close cooperation with the Eionet NRC/LCs.

The maintenance of the EU-Hydro and EU-DEM reference datasets.

The EEA will continue maintaining the datasets in the frame of the existing framework service contracts. Maintenance may be reconsidered if an overarching solution would be found for a high resolution high quality DEM as programme level solution, to be made available for multiple purposes, amongst other the ortho-rectification of Sentinel 2 imagery and of CCMs, as well as use by the Copernicus services.

Towards a pan-European Ground Motion database (EU-GMS)

The main objective of the EU-GMS is to measure ground displacements, including landslides and subsidence, as well as deformation of infrastructure. The ground motion will be derived from time series analyses of Copernicus Sentinel-1 data using PS (Persistent Scatterers) and DS (Distributed Scatterers) radar interferometry approach. This will be complementary to Global Navigation Satellite Systems (GNSS) and other in-situ observations. The European Ground Motion database will also provide tools for visualization, interactive data exploration and user uptake elements (protocols and best practice examples) for further ground investigations.

EU-GMS will provide ground motion time-series information with full spatial and temporal resolution over land areas of the Copernicus participating states. Ground motion products provided by the Service will be updated every 12 months (TBC).

The service will be consistent, standardized, interoperable, and harmonized across national borders supporting European and national level policies. EU-GMS will complement national existing and emerging initiatives, and serve as a foundation for more in-depth national and regional ground motion studies and collaborations. As such, it will provide a wider context of operations and will reduce the cost for access to ground motion data through economies of scale.

Targeted application areas are mainly within natural risk mapping and asset management. EU-GMS will enable uptake and downstream action for the benefit of end users communities including geological surveys, road, railway and mining administrations, regulators and planners, public authorities at European, national, regional and municipality level, citizens of Copernicus participating states, industry and academia.

Coastal Zones

Although Integrated Coastal Zone Management (ICZM) principles are increasingly being adopted in the management of coastal areas, progress has not been uniform. The European Commission estimated in 2012 that implementation of ICZM was only about 50 % across the EU as a whole. In order to overcome these shortcomings, the European Commission in 2013 issued a proposal for a new directive. Following the debates in the EU institutions, the proposal was modified and adopted as Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning. The most important feature of the directive is the requirement for countries and groups of countries to prepare maritime spatial plans, which have to be based on accurate information if they are to help inform the policy process. There is therefore a need to improve the quality of the data used to measure the health of our coastal environment.

One of the most important improvements is the creation of geospatial data. Most of the information currently compiled by Member States about their coastal regions is socio economic in nature and does not contain location data that would help pinpoint precisely where certain environmental changes are happening. This is the point where the CZ products have the objective to contribute to fill the knowledge gap, whilst at the same time ensuring that the land side of information becomes useful for the CMEMS modelling work at the sea side of the coast line.

Snow & Ice

A major issue when setting up a snow & ice service remains the requirement of high reliability of the service: national and regional institutions operating on snow & ice insist on a high level of reliability and a guaranteed long term service, without which they would not be interested in adapting their processing chains.

One of the key issues is the NRT availability of data, especially for alert services such as the avalanche monitoring. In such cases the product has to be ready not later than 'the next day' after acquisition, which may require further discussion with ESA in order to find feasible solutions.

The Global Land component is providing daily snow cover extend at 1 km resolution on Europe based on MODIS and soon on Sentinel 3. Several other services mostly on hemispherical level and up, also deliver very valid data, and from these experiences it can be derived that the step to a Pan-European level becomes feasible in the Sentinel high resolution era. However, reliable cloud masks especially for S2 (any sensors which do not have the required bands e.g. thermal) remain a problem to be addressed, so as to better distinguish between clouds and snow. Discussions with experts in the domain claim that this is basically a matter of selection and testing of existing algorithms in the variety of European landscapes under snow cover to then take a decision for the operational implementation.

SC/FSC: It needs to be specified which type of SC/FSC has to be calculated, for hydrological aspects the below canopy is important (as in GlobSnow and Cryoland), for albedo studies the top of canopy is more relevant (as the MODIS snow product). The first is also a better base for other products such as SWE. The Global Land component is also delivering SWE at 5 Km resolution for Northern Hemisphere.

In the high resolution snow product development, consistency with Global Land mid resolution snow products will be ensured. Moreover, complementary will be assured allowing quality improvement of both product types.

Operational production summary for 2019

The operational activities for the **pan-European land monitoring** 2019 will focus on:

(1) The finalisation of the HRL Small Woody Features 2015, which suffered from the late completion of the VHR2015 input image coverage;

(2) The production of the HRLs (imperviousness, forests, grasslands, wetness-water, small woody features) for the reference year 2018;

(3) The continuous production of HR phenology;

(4) The continuation of production of the CLC-backbone as part of the CLC+ suite of products (1st phase);

(5) The design of the CLC-core grid database as part of the CLC+ suite of products (2nd phase).

The estimated budget foreseen for this activity is EUR XXXXX

(6) The organisation of the call for tender for an operational pan-European Ground Motion database (EU-GMS)

The estimated budget foreseen for this activity is EUR XXXXX

The operational activities for the **local land monitoring** will continue focusing on:

(1) Ensuring the completion of UA2018, including change mapping;

(2) Ensuring the completion of RZ2018, including change mapping;

(3) The finalisation of the first phase CZ2018 product.

(4) The operational and continuous production of HR S&I

The estimated budget foreseen for this activity is EUR XXXXX

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

The post-processed space data and intermediate products extracted for the Pan-European coverage (bio-geophysical parameters, including a first series of the phenology product);

The five thematic HRLs updated with land cover characteristics (artificial surfaces, forest areas, grassland, wetness and water):

(1) Two products with limited change (as compared to 2012): forest (but with new change products), and imperviousness;

(2) Products with significant modifications – new baselines: grassland and a combined wetness and water product;

(3) A re-analysis and harmonisation of time series: imperviousness;

(4) New products: small woody features (SWF) based on VHR image data

(5) The national CLC 2018 datasets, on-going integration to the European dataset;

(6) The kicked-off CLC+;

(7) Operationally available pan-European reference datasets;

(8) The on-going or completed CLC pilots in the six European Neighbourhood countries;

(9) The on-going extension of Urban Atlas 2012 from EU28 and EFTA states towards EEA39;

(10) The inclusion of height information in selected Urban Atlas down town areas;

(11) The on-going extension of the mapping of Riparian Zones;

(12) The on-going mapping of Natura 2000 sites;

(13) A first series of the intermediate snow and ice monitoring products;

(14) A first series of coastal zone monitoring products;

INDICATORS

(1) Total area covered by cloud free mosaic of multi-temporal satellite imagery;

(2) Total area covered by the high resolution bio-geophysical parameters;

(3) Number and area of high resolution layers produced for each land cover characteristics theme;

(4) A set of documents, tools and continues support services by the EAGLE group;

(5) Extent and characterisation of riparian areas, Natura2000;

(6) Extent and characterisation of Urban Atlas including extent of height dimension information delivered for FUA of the Urban Atlas areas;

(7) Passed (partial) validation/quality control of the intermediate or completed products: HRLs 2015, CLC 2018;

(8) Operational availability of the Copernicus land portal;

(9) Number of downloads and page/WMS views of the validated land cover datasets;

(10) Results of user uptake and satisfaction evaluation (including positive feedback from the EIONET).

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Environment Agency (EEA), in line with the Commission's Delegation Decision C(2014)9030 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Completion of the HRLs 2018 production	Q4/2019
National CLC 2018 datasets	Q1/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Pan-European and European local land	Art 58 (1) (c)	2019	xx.xxx.xxx

3.1.1.2. Global Land Component

In 2019, the Global Land component will be consistent with the activities of the previous Work Programme. The WP 2019 will thus ensure the continuity of the activities and the already committed evolution of the Global Land component service elements. Product continuity and the improvement of persistent time series are essential for most of the downstream applications. Focus will also be placed on transition of global scale products to the Sentinels, and the A and B units of 1, 2 and 3 enter full operational status.

Global biophysical variable systematic monitoring

The first objective will be the delivery in near real time of bio-geophysical terrestrial variables which are of high priority for ensuring the continuity of support to EU policies. The activity will produce a set of biophysical variables relevant for crop monitoring, crop production forecast, carbon budget, biodiversity, water availability and quality, cryosphere and climate change monitoring at worldwide level, as well as additional biophysical variables relevant for environmental monitoring purposes at the global and continental scale. In 2019, the Global Land component will continue production of mid-resolution (300m) products and will provide at 100m resolution, a global dynamic land-cover product. Following ramping-up activities started in 2017, planned biophysical variables will be under operational production such as, inland water levels, inland water temperature and turbidity/trophic index and cryosphere variables related to snow area extent, snow water equivalent and lake ice extent, as well as phenology and evapotranspiration. The Global Land activity will take further advantage of the mid resolution high revisiting frequency satellites such as Sentinel 3, and both the A and B units enter full operations, and is thus complementary to high resolution activities carried out by EEA over Europe. The Global Land systematic monitoring activity offers a complete mid resolution Earth coverage compared to the targeted high and very high resolution coverage of the Pan-EU and local activities. The maturity of the new variables will be monitored, assessed and calibrated at high resolution, and concerted evolution activities will be undertaken to bring the products to operational status in short term. The Global Land component product portfolio approved in 2016 is developed in response to user feedback as well as in order to bring the overall scope of the Service component coherent and more consistent with the description in the Copernicus Regulation. The dialogue with the main user categories and international communities, including GEO and United-Nations is maintained through biannual meetings in order to ensure the variables are fit-for-purpose for various EU policies and EU commitments to international treaties and conventions. Furthermore, in support of product algorithm improvements and of quality assessment, the in-situ component will continue to provide ground observations relevant to the global scale bio-physical products. Ground observation collection will be coordinated with and will take advantage of existing international activities and programs, in liaison and collaboration with the Copernicus In situ component managed by EEA.

Global Hot Spot monitoring

The second objective is to provide detailed land cover and thematic reference information on specific areas of interest for EU outside the European Union territory, particularly in the domain of the sustainable management of natural resources. WP 2019 will see a continuity of the WP 2017-2018 activities dealing with protected and key landscape areas in Africa. The activities will also be extended to the support to forest monitoring (REDD+) and EU supported Rural Development projects. Coverage will not be limited to Africa. The list of areas of interest

will be extended in collaboration with DG DEVCO, DG CLIMA, EU Delegations and EU Member States if interested considering field activities currently carried out in this context and in partnership with relevant programs/institutions. Tailored land cover and land cover change maps will be produced on protected areas and their surroundings, to support development activities, and to areas of interest to REDD+ key user communities, including DG DEVCO interest. This REDD+ support exercise will follow international guidelines and agreed specifications (GFOI). The products will also be assessed and will respect defined quality standard.

This fifth year of the implementation of the Copernicus Regulation will address the following areas:

(1) Biophysical variables production;

(2) Acquisition and archiving of the space data;

(3) Pre-processing of mid-resolution space data, including composite generation;

(4) Production of biophysical variables in a timely manner;

(5) Cataloguing and archiving of all generated products, including historical data;

(6) Data Dissemination System improvement in line with Copernicus data policy;

(7) Maintenance of service production and service continuity;

(8) Implementation of service evolution to mid-resolution sensors;

(9) Provision of globally distributed ground-based measurements for satellite product validation;

(10) Independent validation and quality control of the service;

(11) Communication and outreach activities to link users with operational service;

(12) An estimated budget of EUR 4 000 000 is foreseen for these activities;

(13) Hot Spot Monitoring;

(14) Acquisition and archiving of high and very high resolution space data;

(15) Data pre-processing, including where relevant compositing and biophysical variables generation;

(16) Production of satellite products: image mosaics, tailored Land cover – Land use maps for biodiversity monitoring and derived information, such as land cover change;

(17) Cataloguing and archiving of all generated products;

(18) Data and Product disseminated in line with Copernicus data policy;

(19) Independent validation and quality control of the service;

(20) Management of User requirement and service evolution;

(21) Communication and outreach activities to link users with operational service;

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Number of contract successfully executed;

(2) Number of bio-geophysical variables and high resolution products produced;

(3) Service availability: number of on-time deliveries;

(4) Results of the validation/quality control of the process;

(5) Efficiency of data access system;

(6) Number of in-situ sites and diversity of ground-based measurements for validation

(7) Uptake and use of the variables by institutional services and other institutions;

(8) Results of user satisfaction evaluation.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to DG JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Acceptance of the deliverables	Q1/2019 - Q4/2019
Quarterly Implementation report	Q1/2019- Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Land Monitoring Service - Global Land	Procurement	2019	XXXXXX

3.1.1.3. Global Sentinel Analysis Ready Data

ESA has started end of 2017 the operational implementation of a S2 Level 2 operational pre-processing service under the Copernicus ground segment.

Based on this, the production of Sentinel 2 Level 3 products include spatially and temporally resampled to e.g. monthly global mosaics or on-the-fly generated mosaics of areas of interest have been launched beginning of 2018. The production and dissemination system will be fully operational by mid-2018. This activity will continue in WP 2019. The Analysis Ready Data (ARD) are in support of user communities such as REDD+ and Agriculture, as well as for environmental assessment with specific variables such as e.g. surface water occurrence and inland water quality monitoring. Interoperability between S2 and Landsat 8 will be searched, and the EC will take advantage of its 2018 chairmanship of CEOS to ensure that synergies are exploited with our international partners. The service should offer in level 3 the whole archive of Sentinel 2 level 2 atmospherically corrected data.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Space data acquired and archived;

(2) Level 3 Sentinel-2 data produced in a timely manner;

(3) Catalogue and archive of all generated products following existing standard;

(4) Data disseminated through an improved web site portal, in line with following Copernicus data policy;

(5) Production service maintained;

(6) Service evolution defined;

(7) Independent validation and quality control of the service.

INDICATORS

(1) Number of processed scenes and data volume produced, as well as used by end-users;

(2) Service availability: number of on-time deliveries;

(3) Results of the validation/quality control of the process;

(4) Delivered volume of Level 3 data and products;

(5) Results of user satisfaction evaluation.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to DG JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Acceptance of the deliverables	Q1/2019 - Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
L3 Products & Mosaicking	Procurement	2019	XXXXXX

3.1.2. ACTION 2: Marine Environnement Monitoring Service (CMEMS)

The backbone of the Marine Service relies on a distributed architecture of Productions Centres both for space and in situ observations (Thematic Assembly Centres or TACs) and for modelling/assimilation (Monitoring and Forecasting Centres or MFCs). A Central Information System (CIS) manages interfaces and data flows between the producers (MFCs/TACs) and more than ten thousands users. 2019 will be run in continuity of the 2018 activities which would have seen the start of the phase II of CMEMS service.

The main objectives of phase II are the continuity of service, increase user uptake, continuous improvements, full uptake of Sentinel capabilities, upgrade of products and services based on phase I outcomes and user feedbacks.

The 2019 activities are mainly concentrated on:

- The inclusion of Sentinel3B data in all relevant Thematic Assembly Centres,
- The inclusion of HF radar near real time data in the In Situ Thematic Assembly Centre,
- The continuity of operations of ocean physics information services with improvement in spatial resolution of the ocean forecasts,
- The scaling up of the operations related to biogeochemistry models in all regions,
- A significant effort to increase user uptake.

2019 will be also an important year to scale up the development of the Ocean Monitoring Indicators (OMI) supporting both GCOS, IPCC and SDG international developments. While the Ocean State Report (OSR) is still published on an annual basis, series of data and products used for its publication will be made available digitally on the CMES portal for the scientific and policy communities, at global scale and EU scale whenever relevant.

In parallel and in support of these tasks, the entrusted entity Mercator Ocean will carry out other actions not described here but strategic for the future:

- The transition to cloud technologies for the management of the CMES productsion and its new information and dissemination system;
- The preparation of the evolution of the service for the next MFF benefiting also from its European shareholders,
- The enhancement of CMEMS visibility at international level thanks to the publication of the Ocean State Report, the publication of Ocean Monitoring Indicators in support of SDGs implementation, the contribution to GEO.

3.1.2.1. Phase 2 Operations

Operational production and service elements

With respect to the production and service capacity, both MFCs/TACS renewed in 2018 will be in full operations including new ones like the Multi Observations TAC. Sentinel 3B will be fully integrated in the production. Near Real Time Sea Ice thickness derived from CRYOSAT and SMOS will join the Sea Ice TAC. Radar HF measurements will be included to the In Situ TAC. Results from some service evolution R&D projects run from 2016 to 2018 will be

considered for inclusion in the operations like the production of the global micro nekton delayed mode product in the MFC GLO.

The new dissemination system based on cloud technologies and centralised for all TACS and MFCS will be in place to increase the performances of access to CMEMS products online.

With respect to the CMEMS existing product offer, the evolution of the service content will be focused on improving product quality, improving product consistency (especially of reprocessed time series and reanalyses) and improved quality assessment and the development and delivery of some ocean monitoring indicators based on TACS and MFCs production + international scientific review.

The V5 development started in 2018 will be released for operations in Q2 2019 with the following major improvements:

- The operations of both S3A and S3B in real time and delayed mode for altimetry, ice, SST and colour,
- Significant improvements in BGC products such as inclusion of BGC in-situ data (from ARGO), operations of new chlorophyll algos and possible assimilation in BGC models,
- The development and operations of more ocean monitoring indicators (sea level rise, heat content, pH …). In particular, a first global observed gridded pH product will be delivered for ocean acidification monitoring,
- Further improvements on wind, waves and current products, sea ice automated products (best answering to EMSA requirements for new polar services),
- First operations of ensemble data assimilation in the global,
- The continuation of significant development for the global MFC (new global ocean-atmosphere coupled model, better ocean/wave interaction, ocean color data assimilation, significant update of NEMO for HR),
- Improvements in assimilation, resolution of regional MFCs.
- The update of reprocessing and reanalysis with an additional year especially for all BGC reanalysis.

The Ocean State Report #3 will be published in Q1 2019 and Ocean State Report #4 will be prepared during 2019 for publication in 2020.

The V6 development will start for a planned release for operations in Q2 2020 being potentially the last version delivered under the current MFF. The expected content will be based on

- the review of result from R&D service evolution projects (still from call 1) mature to move to development and operations;
- the outcomes of the second batch of the service evolution R&D projects;
- the R&D service evolution strategic plan.

Particular attention will be paid on CMEMS biogeochemical products (Chl-A, nitrates, pH, CO2 fluxes, O2) improvements in the context of the Marine Strategy Framework Directive (MSFD), ocean state/health assessment, climate and climate change studies. Evolutions to

develop in 2019 will obviously be driven also by results of market analysis launched in 2018 in Marine Renewable Energy sector and Maritime Insurance domains as well as by feedbacks derived from User Uptake projects, partnerships set up during previous years (Ocean Energy Europe, EARSC, NEREUS, CRPM,…)

The development of OMI supporting ocean state monitoring, variability and real-time indicators, indicators related to climate change frameworks will include the continuation of 2018 OMI (ocean heat content, sea level, sea ice), and specific developments for 2019 related to:

- New OMI (e.g. ph);
- Increased BGC and regional focus;
- Improve uncertainties, error quantification;
- Move to consistent plots;
- Enhanced link to European & international bodies (SDG, C3S, BAMS, WMO, WOA,GCP, ICES, MSFD, EUROGOOS …) and mobilise scientific networks.

Framework Service Elements

This two-fold program component started in phase 1 – "service evolution" for bringing in upstream innovation (data) and "user uptake" for downstream innovation (user) – will continue in 2019.

Regarding the R&D effort on service evolution, the second batch of service evolution R&D projects will be under development in 2019 with expected outcomes for Q1 2020. The following topics will be addressed

Regarding the user uptake effort, the second batch of 18-months duration CMEMS User Uptake projects selected early 2018 in order to promote demonstrations of coastal, operational CMEMS downstream services and to develop the elements needed for the implementation of these services will end in 2019 increasing the portfolio of published use cases.

Communication and Training activities, will be widely strengthened over 2018-2020.

- The focus for 2018-2020 will be the energy sector and EU outermost regions.
- To be more present in the Member States, the Marine Training Scheme set in 2018 will be continued.
- New partnerships signed by Mercator Ocean with trade associations and European maritime clusters such as NEREUS, CRPM, EARSC or Ocean Energy Europe will help scaling up the uptake of CMEMS products in specific sectors joining some of their specific events.
- The projects related to the development of marine services in African regions will be closely followed and supported in cooperation with DG GROW, DG DEVCO and the African Union.

– Participation to European and International events will be maintained in 2019 including possible relays and opportunities offered by DG GROW user uptake actions, and also taking into account any opportunities related to UN actions and SDGs preparation.

Marketing activities will be increased in 2019 to prepare the ground for the next MFF and evolution of the service tackling the space strategy priorities and the evolution of the MFF context. Business analysis will be therefore conducted. Work with Champion users will be investigated therefore.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Users will continue to benefit from a continuous and operational service, delivering up-to-date ocean information observation- and model-based products, with the support of a service desk and a refurbished and more attractive portal.

(2) The V5 will be delivered for operations in Q2 2019 without any service interruption.

(3) A new CMEMS website with advanced search mechanisms will be in place to offer a better service interface and improve service clarity and efficiency.

(4) Version 6 of the CMEMS system and service will be designed, to be released in Q2 2020.

(5) Larger set of users and stakeholders in Europe will have opportunities to interact directly with CMEMS thanks to the numerous training workshops organised in Eu regions on top of other planned events and conferences. Training sessions will address business companies but also public organisations as planned by the training scheme implemented in 2018.

(6) A specific effort will be made for better supporting MS actions with regard to the Marine Strategy Framework Directive (MSFD) with the delivery of biogeochemical products both on the global scale and regional scale and with some dedicated use cases demonstrating on how to implement it. CMEMS Ocean monitoring indicators will be largely promoted to support SDG implementation i.e. by EUROSTAT.

(7) The User Uptake program component will continue fostering initiatives to support innovations in the service area, continuing the efforts made during phase I of CMEMS.

Significant efforts will be maintained to draw the future content and priorities of the Copernicus marine service in the next MFF based on drivers given by the space strategy and the regulation under consultation (if available) The scientific component will take stock of progress made in CMEMS production centres (MFC/TAC), in Service Evolution R&D actions and also H2020 projects. Additional R&D resources will be devoted with the second batch of R&D running during 2018-2020. The user uptake component will also be completed with a second batch of calls for product integration and service demonstrations and uptake by users running from 2018 to 2019 and for which achievements and results are mainly awaited in 2019 to shape the future 2020 annual plan, preparing for the transition to the next MFF.

INDICATORS

The performance monitoring is based on the indicators description in the Technical Annex according to General Objectives (GO) of the Copernicus Programme:

(1) Completion of the integration of Sentinel-1, Jason-3 and Sentinel-3 observations in CMEMS products.

(2) Established coordination for marine in-situ observations with EEA, EuroGOOS and EMODnet. Improvement in terms of content and quality of the marine service portfolio (streamlining, number of products, product quality indices…).

(3) Smooth transition to a new CMEMS central information system. CMEMS Ocean State Report publication and uptake.

(4) Number of users (regular, new), users activity/data transaction accounting, User satisfaction. User Training and workshops, Infodays. Traffic on the CMEMS editorial website. Participation to events and symposiums. Coordinated actions with other services.

(5) Industry participation in CMEMS implementation. New procurements and participation of European entities. Innovation actions for space & service areas. Cooperation with professional clusters.

(6) CMEMS consistency with INSPIRE and Copernicus overarching rules. Meetings with EU stakeholders. Feedbacks on the clarity and relevance of CMEMS information. Product timeliness and service availability. Opinion polls on CMEMS service.

(7) Participation to GEO and other international events. Operational cooperation with international initiatives for marine (e.g. GOOS).

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with Mercator Océan, in line with the Commission's Delegation Decision C(2014)7271 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Annual Operational Review, V4 operations	Q2/2019
V5 Entry into Service	Q2 2019
Publication of Ocean State Report 3	Q1 2019
Design Review for CMEMS V6	Q3/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Phase 2 Operations	Art 58 (1) (c)	2019	xx.xxx.xxx

3.1.3. ACTION 3: Atmosphere Monitoring Service (CAMS)

2019 will be the fourth year with all the main CAMS operational architecture elements delivering service and products to the users, both by the entrusted entity (ECMWF) and by its contractors. In 2018, the process of re-procurement of the main CAMS service elements has been initiated and it will be completed in 2019 in order to allow delivery of the CAMS portfolio until the end of the Multiannual Financial Framework period and of the current phase of the programme. There is no significant deviation from the high-level objectives and principles set out in the Technical Annex of the Delegation Agreement.

The portfolio of products and services delivered by CAMS is organised into 4 main categories and 13 product groups, as outlined in the Technical Annex and the online catalogue. It has to be noted in this context that "analyses" or "re-analyses" refer to products which are obtained by combining different streams of observations using a modelling system: these correspond to 3D fields, which correspond to the best and most comprehensive picture one can have given the observations considered and taking into account their respective errors. These have been developed on the basis of the consultation of users or potential users, as well as on the assessment of the scientific and technical capabilities and available observations, in particular from Earth-Observation satellites. In 2018, a major step was the availability of the first data streams relevant for CAMS from the Sentinels (from Sentinel-5P and Sentinel-3), which will strengthen and improve most of the Service's products. Under CAMS, these products and services are delivered through the service architecture depicted below and validated through dedicated internal activities, as well as external review.

In 2019 the main novelties will be:

- the consolidation of the operational use of Sentinel-3 and -5p are the highest priority
- the continuation of the "use cases" programme that can support development of new and innovative uses of CAMS products
- the migration of the CAMS portfolio on the Climate Data Store (developed as part of the Climate Change Service)

CAMS core documentation is composed of four documents, which have evolved into their definitive form in 2018 and will be continually updated after. This documentation describes the evolving user requirements (User Requirement Database), their analysis in terms of short- to medium- (User Requirement Analysis Document) and medium- to long-term (Service Evolution Strategy) developments, as well as the portfolio of products and services.

This action is composed of one activity:

- Phase 2 Operations;

3.1.3.1. Phase 2 Operations

CAMS will be running in operational mode providing services and data products on routine basis according to its product portfolio. System upgrades will concentrate on short term improvements (in particular regarding the spatial and temporal resolutions of the global and regional components) enabling to enhance quality, system performance and user interaction. Analysis and assessment will be performed regarding new user needs and corresponding arising methodologies.

Crosscutting technical management will concentrate on the coordination of all the technical activities (both procured and delivered directly by the Entrusted Entity), maintenance of the four main CAMS documents (URDB, RAD, SES and SPP), the coordination technical dependencies from EUMETSAT tasks, liaison with Copernicus stakeholders and key user categories, especially in the policy sector. Further technical management coordination jointly shared between CAMS and C3S are procurement and contract management, communications, outreach and training activities as well as first level of support to the users.

The further description follows the definition of building blocks according to the Technical Annex of the Delegation Agreement and main priorities in the implementing year.

In Situ observation covers direct negotiated contracts with different in-situ networks. It will be established in order to strengthen and consolidate the in-situ observational data streams from a number of key international networks identified in the Delegation Agreement. Work will be in the area of Near-Real-Time data transmission, Quality Check / Quality Assurance and automatic flagging of the data and general improvement of the data flow (e.g. on metadata…) to cater for the specific operational requirements of CAMS. Conversely, through its automated data assimilation and monitoring processes, CAMS will report to these networks about data quality (missing data, suspected data issues…). The networks concerned are ACTRIS, EEA/EIONET, EAN pollen information, GAW, IAGOS, ICOS, and NDACC. The estimated budget foreseen for this activity is EUR XXXXXX.

Global processing corresponds to main modelling and value-adding chains focusing on the entire Earth. The global processing system will be operated in two modes to deliver the products required by the users for a daily/routine production for near real time analyses and forecast and for a re-analyses production stream providing multi-annual consistent datasets with a froze model/assimilation system. This service delivers information products in four thematic areas: greenhouse gases, reactive gases, aerosols, and fire emissions. Focused development activities are needed to continually upgrade the production system. In terms of satellite data specific efforts in 2019, the consolidation of the operational use of Sentinel-3 and -5p are the highest priority.. The estimated budget foreseen for Global production and system development is EUR XXXXXX.

Regional processing corresponds largely to main modelling and value-adding chain covering the European Union domain as well as the European Environment Agency's member states. This area can be covered with a higher spatial resolution (of the order of 10 km on the horizontal) and support in particular further modelling activities for sub-regions, as well as Air Quality monitoring and forecasting national activities. Service aspects are distinguished in respect to model, data assimilation, and ensemble processing developments. CAMS participates in the FAIRMODE community to contribute to the harmonization of regional modelling in Europe. The estimated budget foreseen for Regional production is EUR XXXXXX.

Supplementary services are relative to applications processing, services and products that are provided in addition to (and are built on top of) the main global and EU/regional processing outputs. The products ranges are: products in support of policy users (annual European air

quality assessment reports, daily "green scenarios" forecasts and source-receptor calculations to infer the origin of air pollution); solar radiation products; global greenhouse gases surface flux inversions (net fluxes of CO2; emissions of CH4 and N2O); climate forcings related to atmospheric composition changes since the pre-industrial period. The estimated budget for seen for this is EUR XXXXXX.

Activities for validation and in support of production: cover the provision of data describing global anthropogenic emissions, regional anthropogenic emissions, the ad-hoc satellite data processing. Further, the a-posteriori validation of global and regional products, as well as validation in the selected areas of the Arctic and the Mediterranean. Interaction with the scientific communities of emission and air quality modellers to allow external scientific review of CAMS products and methodologies. Interaction with emission modelling community to contribute to the harmonization of emission inventories, among others by participating in the FAIRMODE initiative in Europe and in IGAC/GEIA activities at the international level. The estimated budget foreseen for this is EUR XXXXXXX.

Outreach and dissemination comprise communications and a range of activities in support of the users and activities targeted at enhancing further the uptake of CAMS products. Among these, CAMS implements a programme of "use cases" that can support development of new and innovative uses of CAMS products. One of the key activity is also to continually and actively gather expression of needs and feedback and maintain the CAMS User Requirements Database (URDB) and the User Requirements Analysis Document (URAD). In 2019, an activity of high importance will be to finalise the migration of the CAMS portfolio on the Climate Data Store, which has been developed as part of the Climate Change Service. The estimated budget foreseen for this is EUR XXXXX.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) In 2019, CAMS will continue to be fully operational. Most of the Service's architecture elements will be retendered between 2018 and the first half of 2019, for running until the end of 2020;

(2) ECMWF CAMS teams will be in place and effectively working to manage expenditure and technical aspects, such as further improvement of the products offered by the service, as well as to deliver ECMWF's contribution to technical activities;

(3) The four key documents of CAMS established in earlier years will be continuously updated to describe the evolving user requirements (User Requirement DataBase), their analysis in terms of short- to medium- (User Requirement Analysis Document) and medium- to long-term (Service Evolution Strategy) developments as well as the current portfolio of products and services;

(4) Use cases projects as well as training activities will continue in 2019;

(5) The fourth CAMS General Assembly will take place (tentatively) in Quarter 2 of 2019 and will gather CAMS providers, users and stakeholders in a single 3-day event.

INDICATORS

The actual reporting will be done using the following indicators (but keeping at least one in each main category), considering technical feasibility of automation and affordability.

(1) KPI1 Service availability

(2) KPI2 Products usage

(3) KPI3 Products quality

(4) KPI4 User support

(5) KPI5 User Statistics

(6) KPI6 Service audience

(7) KPI7 User engagement

(8) KPI8 User satisfaction

(9) KPI9 Contracts

(10) KPI10 Deliverables

(11) KPI11 Data usage

The Performance Targets (PT) associated with these KPIs will be adjusted based on the experience of 2018 ("experimental" phase).

Implementation Method

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Centre for Medium-Range Weather Forecasts (ECMWF), in line with the Commission's Delegation Decision C(2014)7271 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Annual Implementation Review	Q2/2020

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Atmosphere Monitoring Service – Phase 2 Operations	Art 58 (1) (c)	2019	XXXXXX

3.1.4. ACTION 4: Climate Change Service (C3S)

In 2019, the Copernicus Climate Change Service will have transitioned to an operational status. This means that although some components will still be in development or consolidation phase, the bulk of the activities will have reached an operational status, with routine production and delivery of data and services

The Climate Data Store (CDS) infrastructure and its toolbox developments will have been completed and most of the C3S products will thus be accessible through the CDS.

By the end of 2018, global reanalysis, multi-model seasonal forecast products, gridded Earth Observation products (CDRs and ECV products) from satellite and insitu observations, and most SIS climate impact indicators will be discoverable and accessible via the CDS. In 2019, the access to climate projections (global and regional) will be consolidated. In addition series of adaptors will continue to be developed to allow the users to access climate related products generated by other organisations such as NOAA, or EUMETSAT SAFs. ERA 5, the fifth generation of ECMWF atmospheric reanalyses of the global climate, will be available from 1979 to near real time. Its extension to 1950s will be performed during 2019. Multi-model seasonal forecasts will include and be based on products generated by seven models, i.e., five models operated in Europe and two other models, contributing in kind, from the USA and Japan, respectively. Discussions are currently taking place with Canada to consider adding their model in the C3S multi-system. The production and access to twenty two Earth Observation Essential Climate Variables (ECVs) products will be made possible via the CDS. A large fraction of these products will be associated with quality assessments provided by activities deployed in the frame of the Evaluation and Quality Control (EQC) function.

In 2019, the Sectoral Information System will be operational. As an operational Service, C3S ambitions to become an enabler of downstream climate services, by providing or brokering high quality and sector relevant climate data and indicators, good practices, tools and by supporting compelling use cases. This is what the operational SIS be about: between five to ten use cases a year will be proposed, that will demonstrate the business case and end-to-end feasibility of specific sectoral information, while sustained sectoral climate indicators and underpinning high quality data will be routinely produced, in particular for the remaining sectors identified in the delegation agreement between the Commission and ECMWF and that had not been addressed so far (biodiversity, fisheries, etc.) A continuous user engagement and proactive training and education actions will continue, as it is key for the success of this component of the Service.

The main objectives in 2019, while still in line with the consolidation of the required building blocks and establishment of the procedures to ensure effective organisational flow between these blocks (the Service is only 3 years old), significantly focus on the operational product delivery and user uptake. This holds as well for the outreach component of the Service, with the consolidation of the State of Climate reports for Europe (the first one will have been produced in 2018) and a strong coordination with EEA and its Climate-adapt unit to ensure a coherent message, and an ambitious training programme to promote the uptake of C3S products to a wide variety of users. C3S is a user-driven Service and user engagement will continue throughout 2019, with the participation to Copernicus national user forums, the organisation of industry days and organisation of workshops dedicated to specific emerging needs.

The contribution of ECMWF to the WMO GFCS PAC ensures that the C3S products and related activities are fully contributing to this international framework. The interfaces and linkages between GFCS and C3S are described in a white paper that has been finalised at the beginning of 2018. The capabilities offered by the C3S have already been identified by Commission DG for International Cooperation and developement (DEVCO) as well as

initiatives such as GMES & Africa, as a future major purveyor of climate products and analyses that should be made accesible to the WMO Regional Climate Centers of the African, Caribbean and Pacific region. Links with EEA will enable the uptake and consistent access of climate information products by the Commission DG for Climate action (CLIMA). The coordination with other Services will continue be consolidated to ensure consistency, complementarity and limit overlaps. Discussions are underway to consider brokering products that are not directly produced by C3S, from other Services (e.g. ocean salinity and acidity from CMEMS), or cross reference the different porfolios.

Progress has been achieved in the development of the four main C3S documents (User Requirement Database, User Requirement Analysis Document, Service Product Portfolio, ServiceEvolution Specification Document), but are not at the level of an operational status, as mechanisms for review by the EQC function are still being established. The target is to have these documents fully operational in 2019. The User Requirement Database (URDB) will log every requirement or request from users, while the User Requirement Analysis Document (URAD) will include an assessment of the technical/budgetary feasibility of the requirement expressed and can serve as a basis for discussion and decision at the User Forum or Copernicus Committee level. The URDB and the URAD will also serve as a basis for coordinating the activities between the F4P (Fitness for Purpose) function established by the Commission and the Service itself, represented by its EQC function. The F4P is managed by DG JRC and is tasked to analyse and assess some of the C3S deliveries on demand from DG GROW, primarily looking for providing a complement to the EQC outcomes and hence avoid duplication. Progressively, and following the current ITTs proposed at the time of writing, the EQC function will be regrouped into two main activities: EQC for CDS and EQC for SIS.

Last but not least, the Service Evolution Specification Document will give a multi-year outlook on the plans.

3.1.4.1. Transition to Operational stage

The technical management of the C3S will involve the coordination of all the technical activities, both externally and internally. This includes in particular the maintenance of a risk register and contingency planning regarding the critical risk areas. These tasks cover the production of technical activities, the continued liaison with the Commission and other Copernicus Services, the liaison with the climate service community and the operation of the Joint Support Function for C3S and CAMS that coordinates the procurement and contract management at technical level. The expert panel set up by the Commission will continue its advisory role throughout the year. This advisory role will be especially critical as the C3S reaches an operational stage.

This year, activities will address the following areas:

C3S infrastructure:

2019 will be dedicated to consolidate the C3S infrastructure. This includes:

Provision of computing support for reanalysis (global and regional) and seasonal forecast productions;

Implementing concrete actions including training and user uptake with the Global Framework for Climate Services (GFCS);

Monitoring procured development activities;

Co-developing and integrating technical solutions for the C3S portal and the CDS; develop an ambitious training programme to increase the usage of the CDS and its toolbox

Acquiring and cataloguing data for the CDS;

Finalising the integration of the CAMS portfolio (this activity will start in 2018) into the CDS;

Continuing activities related to the development of the DIAS platform (Data and Information Access Services), in partnership with EUMETSAT and Mercator Ocean.

Ensuring support for the delivery of all CDS outputs;

An estimated budget of EUR XXXXXXX is foreseen for these activities.

Climate Data Store (CDS):

A particular miestone in year 2019 will be the consolidation of the operationalization of the CDS infrastructure and its toolbox. The CDS catalogue and access to climate data will be further developed with priority on climate change monitoring and data requirements for development of sectoral applications (including new SISs and Use Cases). ECMWF will continue to implement data management practices needed to support the rapid growth of the CDS catalogue expected in 2019. These include:

Data management and governance to allow a seamless access to the CDS catalogue while expanding the observational component of the catalogue. This component includes the production of re-analysis and gridded Earth Observation based ECVs, which will build upon the expertise acquired by the European community within the ESA Climate Change Initiative (CCI) and other similar activities in Europe, e.g., EUMETSAT SAF's, and worldwide, e.g., the SCOPE-CM network. This activity will be carried out in full coordination with ESA's Climate Change Initiative (CCI) programme and with EUMETSAT Climate SAF(s) in order to avoid duplication and ambiguity;

Extending the production of the global atmospheric reanalysis for climate monitoring (ERA5) back to 1950s;

Initiating the preparation for the follow-up global coupled reanalysis (tentatively called ERA6)

Providing access to observations (climate archives, observation networks, gridded-in situ products, data rescue activities) via the CDS;

Expanding access to and intercomparing climate monitoring products via the Climate Monitoring Facility;

Producing regional re-analysis production for Europe and the Arctic zone;

Consolidating and expanding the generation of multi-model seasonal forecast products based on up to 7 models, including documentation and tailored products;

Populating the CDS catalogue with products delivered by the climate projections (this component supports access to one Earth System Grid Federation (ESGF) node in Europe, the generation of climate projection multi-model products, and the definition of a roadmap toward a reference set of climate projections for Europe (EUCP).

Last but not least, and based on recommendations from the user community to be gathered in 2018, developing a prototyping activity around a decadal prediction offer (noting that a fully operational decadal prediction service is out of scope for this MFF, as specified in the the delegation agreement between the Commission and ECMWF).

An estimated budget of EUR XXXXXX is foreseen for the CDS related activities.

Sectoral Information System (SIS):

The SIS operations will continue covering the bridging of the Sectoral Climate Impact Indicators (SCIIs), the ECVs and the tools that have been developed as part of the SIS proof of concept contracts into the operational phase. Such a bridging will be a combination of dataset accessibility and support as well as the definition of workflow able to reproduce the products, tools and interfaces that are currently available through the running projects. Most of the transition should be completed in 2018, but there may be finalisation activities remaining. In addition, provision and maintenance of workflows and applications, as well as development of use cases will be an important part of the activities in 2019. SIS activities include:

- Finalising seamless transition toward the operational phase of relevant SCIIs and associated demonstrators;
- Delivering a set of global and regional operational services built directly upon the CDS infrastructure;
- Documenting the value chain from native climate data (i.e. Earth Observation and model simulations) to tailor climate information for each sector; Promoting good practices for climate services
- Procuring and managing new tailored sectoral activities to address additional user requirements and promote a healthy evolution of the service (biodiversity, fisheries, tourism,..);
- Supporting up to 10 Use Cases to promote the value and develop the business case for tailored sectoral climate services
- Ensuring that SIS addresses requirements from institutional users such as EEA and DG-Climate Action and provides tools to enable uptake by the downstream market.

A total cost of EUR X.XXX XXX is estimated to support the SIS related activities.

Evaluation and Quality Control (EQC):

The EQC activities have focused so far on identifying and engaging with communities of practice (on the user side), and with establishing networks of expertise (on the supply side). Building upon the results of the EQC workshop organised in June 2017 a new set of EQC activities have been or are in the process of being opened, in particular the consideration for a centralised EQC function overseeing all quality assurance mechanisms put in place for the operational phase of the Service. The decision has been to have, as an operational Service, two main EQC activities, one for the CDS and one for the SIS. Meanwhile, EQC activities specifically addressing the quality assurance of the ECV and reanalysis products, multi-model seasonal forecast and multi-model climate projection products that have been put in place in Q3 2017, will continue in 2018 and beginning of 2019. Specific activities to consolidate the fitness for purpose of the URDB and URAD for monitoring the services will continue, as mentioned above. EQC activities include:

- Continuing user engagement based on communities of practice

- Consolidating networks of expertise for EQC of all elements of the service, via specific procured activities; in particular:
    - Providing a fully comprehensive quality assurance process for the CDS content
    - Providing a fully quality assurance process for the SIS content, including workflows and applications
    - Raise the status of URDB/URAD/SES documents to an operational status

The overall estimated budget for EQC activities is estimated to be EUR XXXXXX.

Outreach and Dissemination (O&D):

The outreach and dissemination component will continue to grow as products and climate data store facilities become available. C3S will have greater insight into the needs of its audiences and this will continue to govern its communication approach and activities. The refreshed C3S website (which goes live in 2018) will address these requirements, and further adjustments and evolutions may be needed in 2019. The interactive State of the Climate Report card will continue to evolve to provide editorial content and analysis on significant climatic events, providing information of interest to non-scientific audiences including the media, and the production of an annual State of Climate report (first version will be done in 2018) will become routine. The media continue to be an important audience and press-outreach an important part of the communication mix for C3S. C3S will continue to hold briefings around Europe using other events as opportunities for and milestones around which we can issue press releases. C3S will also seek any opportunities around national user forums or events to promote our products and services. The very successful partnership with Euronews is likely to be continued in 2019. Last, a major training ITT has been published in 2018 for a contract that will run until the end of 2020. 2019 will be dedicated to develop comprehensive training material and and elearning modules, with the goal of addressing various potential users, from institutions to SMEs, policy-maker and industry audiences. It is expected that these training activities will feed into the C3S support to audiences outside Europe, such as the WMO GFCS.

In addition, and following a brainstroming workshop with key stakeholders to revisit the "attribution science" state of play and whether an operational attribution component to C3S should be considered and the extent of its ambition, it was agreed (and in compliance with the delegation agreement), to design prototyping activities as early as 2019, towards an operational Attribution component of C3S by 2021.

Specific activities therefore include:

- Supporting the European Commission in raising the profile of the Copernicus brand and the Copernicus programme;
- Raising awareness of the Copernicus Climate Change Service (alongside the Copernicus Atmosphere Monitoring Service), in particular ;
- Increasing interactions with the service whether through participation in events/or access to its data and tools;
- Streamlining the process for populating the content for the State of Climate Assessment and reports;

– Providing comprehensive training to facilitate uptake of the CDS and SIS contents and development of downstream activities

– Prototyping an attribution component as part of the C3S portfolio (a fully operational attribution service is outside the scope of this MFF).

This will be achieved through a participation in events (existing and bespoke), website development and social media activity, content creation, news media briefing and media planning, and media purchases (hardcopy publications and online), and training module developments.

The budget for the O&D platform is estimated at EUR XXXXXX.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) The C3S will be fully operational in 2019 for most of its components;

(2) Four main strands of the C3S datasets will be produced routinely in 2018, namely the earth Observation based ECV products, the global atmospheric reanalysis, the multi-model seasonal forecasts and the provision of multi-model climate projection products;

(3) Sectoral indicators delivered by the Sectoral Information System will be made available from the C3S, and the SIS will cover the bridging of the Sectoral Climate Impact Indicators (SCIIs), the ECVs and the tools into the operational phase;

(4) Well-defined and operational procedures will ensure that the information delivered to end users is fully traceable, quality controlled and disseminated to the satisfaction of users;

(5) The profile of the Copernicus brand will be raised and the information and training about the C3S products and activities and products will be consolidated.

INDICATORS

(1) Successful completion of the intended workshops in 2019.

(2) Successful completion of at least 90% of the intended Invitation To Tenders, in terms of contracted values.

(3) Climate Data Store fully functional, including its toolbox, serving global reanalysis, multi-model seasonal forecasts, ECV products, climate projections at global and regional levels and other datasets as they become available.

(4) ERA5 (1950 – present) global reanalysis is in production.

(5) A near-real time data service based on ERA5 outputs is available.

(6) The new climate.copernicus.eu website is available to users for more than 95% of the time in 2019.

(7) Completeness and timeliness of all the production lines (this applies in particular to the ECV and reanalysis productions).

(8) Effectiveness of user support to queries (e.g. time to answer).

(9) Headline skill scores (quantitative), covering the quality of some key products. This will be based upon the verification and validation results by the EQC function put in place during the proof of concept stage.

(10) Number, variety and geographical distribution of users (as an indicator of a successful pan-European Service).

(11) User satisfaction (measured as a combination of user feedback to support service and an analysis of URDB documents developed by the EQC).

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Centre for Medium-Range Weather Forecasts (ECMWF), in line with the Commission's Delegation Decision C(2014)7271 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Acceptance of the deliverables	Q1/2019-Q4/2019
Quarterly Implementation Report	Q1/2019-Q4/2019
Annual Implementation Review	Q2/2020

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Climate Change Service – operational stage	Art 58 (1) (c)	2019	XXXXXXXX

3.1.5. ACTION 5: Emergency Management Service (CEMS)

The objective of the Copernicus Emergency Management Service is to support users in the field of crisis management, notably the Civil Protection, Humanitarian Aid and External Action communities by providing them with information based on space data combined with other sources of data, taking into account national capacities. It addresses disasters caused by natural hazards (floods, forest fires, droughts, earthquakes, tsunamis, volcanic eruptions, landslides, storms, etc.), as well as man-made hazards (industrial accidents, oil spills, etc.), inside and outside the EU.

This action aims to ensure the continuity of activities started under the GMES Initial Operations (GIO) programme and pursued under the previous years Copernicus work programmes. In particular, the main objective in 2019 is to continue the mapping and early warning operations of the Emergency Management Service and enhance synergies between mapping and early warning. In addition, possible developments (evolution) of the service will be considered. Activities are carried out in close coordination with the Emergency Response

Coordination Centre (ERCC) of the European Commission DG ECHO for the validity of EMS activations through the Civil Protection network and Humanitarian Aid users, as well as with support from the European Space Agency (ESA) for optimisation of access to satellite data.

The Emergency Management Service will focus on the priority activities defined with guidance from the Copernicus Committee and the User Forum. Synergies with the other Copernicus services and activities will be sought, notably the Security Service, the Land Monitoring Service, the Climate Change Service, the Atmospheric Monitoring Service and the in-situ component. .

This action is composed of the following activities:

- EMS Mapping Service,
- EMS Early Warning Service – Floods
- EMS Early Warning Service – EFFIS and GWIS (European Forest Fire Information System and Global Wildfire Information System)
- EMS Early Warning Service – Droughts.

3.1.5.1. EMS Mapping Service

Mapping in support of crisis management inside and outside the EU is comprised of the following priorities:

Ensure the continuity of the operational mechanism for delivering on-demand mapping products during the emergency response phase, i.e. maps produced in rapid production mode (service module Rapid Mapping) to show the impact, to assess the damage and to follow the evolution of the disaster in the hours and days after the crisis, as well as geographic reference maps made available in rapid mode providing basic topographic features on areas affected by the disaster, in particular on infrastructure, settlements and key natural resources. Ensure an optimal integration of the Early Warning tools in order to speed further the outputs of the Rapid Mapping service.

Support to the other phases of the crisis management cycle, i.e. the prevention, preparedness and recovery phases, inside or outside the EU, by providing on-demand pre-disaster or post-disaster mapping products, including refugee/IDP (Internally Displaced Person) camps maps under a non-rapid production mode (service module Risk & Recovery Mapping). Particular attention will be devoted to the domain of Disaster Risk Reduction, which has received significant international attention.

Validation of the outputs of the previous two activities (service module Mapping Validation). The validation will continue in the same way as in the preceding period including the most relevant disaster cases. The aim of validation is to support continuous improvement of the emergency service in the context of the service evolution.

As continuation of the framework contracts which started in 2015 and 2016, new framework contracts will start in February for Rapid Mapping, Risk & Recovery Mapping and will be prepared to start in January 2020 for Validation.

In addition, an operational aerial component will provide imagery to the Mapping services in situations when the level of detail cannot be satisfied by space borne sensors. Envisaged are two framework contracts with manned and unmanned platforms. The FWC for the manned

platform allowing flights with following sensors: RGB/NIR, LIDAR, hyperspectral and oblique imagery. The unmanned aerial platform will be limited to RGB/NIR imagery and UAV Lidar.

Other activities will relate to the further development of the service. In particular, on the basis of the overall experiences, user feedback and validation outcomes, alternative/recent methodologies, the technical feasibility check and prototyping of possible new products as well as the definition of ideas and recommendations will be explored. Furthermore, the connection with early warning systems will be further developed. Geospatial web services for RM and RRM data dissemination will be set up overall aiming at facilitating access to the service outputs and integration in user workflows.

Outreach and communication activities in liaison with key stakeholders to promote the activities of the service. In particular, the Rapid and Risk & Recovery Mapping services will continue to support the uptake of regional and international users (e.g. specific calls for expression of interest for Risk & Recovery Mapping).

These activities will be carried out as much as possible in coordination with the Member States and international partners, including UN-SPIDER, the International Charter Space & Major Disasters, the African Union, the Committee on Earth Observation Satellites (CEOS) working group (CEOS WG) on Disasters and the International Working Group on Satellite Emergency Mapping (IWG-SEM), in order to optimise the extent and the performance of the service. In particular, the Commission is negotiating an agreement of cooperation with the International Charter for emergency response and is an active member of the IWG-SEM and of the CEOS WG on Disasters (participation in regular meetings, contribution to activities aiming at optimisation the exchange of information, involved in the definition of guidelines and standards, etc.). The European Commission is continuously extending its network in the disaster risk management domain as it recently became a member of the Global Partnership on Space Technology Applications for Disaster Risk Reduction (end of 2016) and of the Global Alliance of Disaster Research Institutes (GADRI, March 2017). Furthermore, the Mapping services are contributing to the GEO work programme and in particular to the Community Activity on Earth Observation for Disaster Risk Management.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Operation of a 24/7/365 service handling activations by users and service coordination tasks;

(2) On-demand mapping in rapid mode in support to emergency response to crises and disasters inside and outside the EU, delivered to users within the demanded time frame and with a predefined set of cartographic products;

(3) On-demand mapping in non-rapid mode in support to other phases of the disaster cycle (prevention, preparedness, recovery, etc.) inside and outside the EU;

(4) Catalogue, archiving and dissemination of all generated products;

(5) Validation and quality control;

(6) Continuous development work for the integration of newly available input data and response to user requests and findings from wider research activities;

(7) Communication and outreach to link existing and new users with the operational service;

(8) Exploit synergies and establish links with the other CEMS service components EFAS, EFFIS and drought (e.g. exploit early warning systems for rapid mapping).

INDICATORS

(1) Rapid Mapping service reliable 7/24/365;

(2) Number of Rapid Mapping activations. Overall, per disaster type, per activating entity, disaster location;

(3) Number of maps produced by the Rapid Mapping service module;

(4) Timeliness of map production by the Rapid Mapping service module: time (average and median) between the activation and the first crisis product delivery;

(5) Number of Risk & Recovery Mapping activations;

(6) Number of maps produced by the Risk & Recovery Mapping service module;

(7) User uptake (incl. product downloads) and communication activities;

(8) Overall user satisfaction.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Acceptance of the deliverables	Q1/2019-Q4/2019
Quarterly Implementation Report	Q1/2019-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
EMS Mapping Service	Procurement specific contract under framework contract)	2019	XXXXXX

3.1.5.2. EMS Early Warning and Monitoring Service – Floods

The EMS Early Warning and Monitoring Service for floods consists of the European & Global Flood Awareness Systems (EFAS & GloFAS). The activities foreseen within the frame of Copernicus in 2019 cover operational flood forecasting at European and global scale with the

aim to provide relevant stakeholders with complementary, added value information to improve preparedness and response to floods. EFAS is operational since 2012 and covers geographical Europe. It has currently more than 60 partners consisting of international, national and regional hydro-meteorological, civil protection or environmental authorities. GloFAS became operational in 2017. It is establishing links to national hydro-meteorological services - especially in South America, Africa and Asia -, NGOs, humanitarian aid agencies and civil protection authorities. The operational EFAS and GloFAS activities include four distinct tasks:

Operating the EMS meteorological data collection centre: Collection and processing of meteorological in-situ data from national hydro-meteorological services and other relevant data providers to calculate the initial conditions at the beginning of the flood forecasts and for calibration and validation purposes for EFAS. This activity is streamlined with the data collection for the other early warning systems under Copernicus Emergency Management Service (EFFIS and droughts) and is linked to the Copernicus in-situ component.

Operating the EMS hydrological data collection centre: Collection of historic and near-real time river flow data, including automated data from National Hydrological Services, quality control and near real time transfer of data to the EFAS computational centre for updating real time forecasts and skill score calculations. Data are also used for verification of past flood forecasts, and calibration and validation of the hydrological model used for EFAS. This activity is streamlined with the data collection for the other early warning systems under Copernicus Emergency Management Service (droughts) and is linked to the Copernicus in-situ component.

Operating the EMS EFAS & GloFAS computational centre: Collection and pre-processing of numerical weather forecasts and observed data, collection of satellite information such as snow cover and soil moisture, calculation of initial conditions before the start-up of the forecasts, executing the hydrological model for EFAS & GloFAS with the ensemble meteorological inputs, post-processing of numerical model results and visualising them on a web interface. Final products are probabilistic flood forecasts for Europe and the global scale with a 15 day lead-time and related derived products including flood threshold exceedances, post-processed hydrographs, monthly outlooks and flash flood indicators. For EFAS, skill scores are calculated regularly and published in monthly bulletins which are made available on the Copernicus website. The operational EFAS covers an extended European domain including also rivers in southern and eastern neighbourhood countries.

Operating the EMS EFAS & GloFAS dissemination centre: twice daily analysis of the EFAS results and communication of EFAS flood information to the EU Emergency Response Coordination Centre (ERCC in DG ECHO) and national EFAS partners, management (and extension) of EFAS partner network, collection of feedback and information from flood events, organisation of annual EFAS workshops and provision of training on EFAS products to partners when necessary. Weekly overview reports of potential large scale floods at global scale based on GloFAS forecasts will be provided to the ERCC (see service evolution).

All activities will be carried out as much as possible in coordination with Member States and international partners, including the World Meteorological Organization, DG ECHO's Emergency Response Coordination Centre, and relevant GEO activities, in order to optimise the extent and the performance of the service.

Further development:

During 2019 the main focus will be on a continuous improvement of EFAS & GloFAS forecasts. This includes the upgrade with the latest available numerical weather predictions, improvements in the hydrological model, increase in spatio-temporal resolution, incorporation of more in-situ data, the post-processing of model output and a better linkage to

national/regional information. The improvements will be done taking into account the user feedback collected during the EFAS annual meetings, GloFAS workshops, individual trainings and other events.

The procedure to link early warning and rapid mapping will be further re-fined and tuned based on the experiences gathered during its first years of operations.

Further enhancement of data accessibility for EFAS/GloFAS: based on user requests received, data accessibility will be improved through the continued expansion of OGC web services for both flood early warning systems. Furthermore, data formats and storage will be adapted for its incorporation into the DIAS.

Synergies and links with other Copernicus services will be enhanced. This includes the continued integration of the EFAS and GloFAS model climatology and forecast archive data store for simulated variables such as runoff, snow and soil moisture (all essential climate variables) into the C3S Climate Data Store as complementary, added value information to C3S SIS Water. Furthermore, the possibilities of a closer collaboration with the EMS meteorological and hydrological data collection centers with C3S will be assessed. The close collaboration with the Copernicus in-situ component and the assessment of the integration of Copernicus Global Land Service products, i.e. satellite derived lake/reservoir and river water levels, will be continued.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Twice-daily pan-European flood forecast information with lead-times of 3-15 days. Information is complementary to available national information and provided to relevant entities indicated by the competent Member States authorities as national and regional hydrological services, participating States in the Civil Protection Mechanism, ENP and SNP countries, as well as the European Commission. Information will be provided for river floods and probability for flash floods. The information is available on a password protected web-interface accessible on 24/7 basis. In case of predicted floods, the relevant authorities and the Emergency Response Coordination Centre (ERCC) are informed via email;

(2) Daily global flood forecast information with lead times up to 30 days. The information is available on a web-interface accessible on a 24/7 basis. In case of significant large scale predicted floods at global scale, specific reports are delivered to the Emergency Response Coordination Centre (ERCC);

(3) A daily updated pan-European overview of on-going floods available on a public website;

(4) Daily reports to the ERCC with an overview of on-going and forecasted floods and flash floods in Europe;

(5) Weekly report to the ERCC with an overview of on-going and forecasted floods at global scale;

(6) Providing an indicator for EMS mapping satellite pre-tasking based on EFAS forecasts;

(7) Communication, training and outreach for existing and new users especially with regard to the newly established global service;

(8) Continuous service evolution based on user requests and newly available data or as a result from research activities.

INDICATORS

(1) Service indicator: Reliable 7/24/365 service;

(2) Number of timely EFAS flood and flash flood notifications sent out to national hydrological services, participating States in the Civil Protection Mechanism and the Commission. Target: flood notifications sent more than 3 days before event and flash flood notifications more than 12 hours before event;

(3) EFAS skill and performance scores including false/total warning ratio and hit/total warning ratio. Target: EFAS provides more skilful forecasts compared with the best available benchmarks;

(4) Evaluation of user satisfaction regarding the quality of the service. Target: User satisfaction is the same or higher as compared to previous year;

(5) Subscription and usage of EFAS and GloFAS. Target: Number of partners and number of users connecting to the web interfaces remains the same or is higher than in previous year.

(6) Indicator for satellite pre-tasking for an improved Copernicus EMS rapid mapping. Target: higher timeliness for rush mode with regard to floods.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Quarterly Implementation report	Q1-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Procurement of EFAS and GloFAS operations	Procurement	2019	XXXXXX

3.1.5.3. EMS Early Warning and Monitoring Service – Wildfires

The European Forest Fire Information System (EFFIS) and the Global Wildfire Information System (GWIS) consist of a modular web geographic information system that provides near

real-time and historical information on wildfires and wildfire regimes in the European, Middle Eastern and North African regions, in the case of EFFIS, and wildfire information and wildfire regimes at the global level in the case of GWIS. The concept of wildfires comprises that of forest fires but extends fires in other land covers that have a high impact in some regions of Europe and globally.

Wildfire monitoring in EFFIS comprises the full fire cycle, providing information on the pre-fire conditions and assessing post-fire damages. EFFIS includes, starting from the pre-fire state, the following modules: (1) Fire Danger Assessment, (2) Rapid Damage Assessment, which includes the (2.1.) Active Fire Detection and Burnt Area Mapping, (2.2.) Fire Severity Assessment and (2.3.) Land Cover Damage Assessment, (3) Emissions Assessment and Smoke Dispersion, (4) Potential Soil Loss Assessment, and (5) Vegetation Regeneration. Additionally, two other EFFIS modules supporting fire monitoring are the (6) Fire News module and the (7) Voluntary Geographic Information module. Additionally, two other EFFIS modules supporting fire monitoring are the (6) Fire News module and the (7) Voluntary Geographic Information module. Additionally, at the core of EFFIS lies the so-called Fire Database, which includes detailed information of individual fire records provided by the EFFIS network countries. Currently data in the database comprises nearly 2 million records provided by 22 countries.

Within the first module of EFFIS, meteorological and numerical weather prediction data are processed daily at the global scale, while the second module processes optical satellite image data on a daily basis to produce fire danger forecasts and information on active fires and the perimeters of burnt areas in the European, Middle Eastern and North African regions.

The Global Wildfire Information System (GWIS) constitutes a contribution of Copernicus to GEO (Group on Earth Observations) as it is a Global Initiative under the GEO Work Program 2017-2019. GWIS is being developed following the guidelines of EFFIS in Europe. Currently, it is composed of modules on (1) Fire Danger Assessment, (2) Active Fire Detection, (3) Burnt Area Mapping, which is complemented with data from other Copernicus services in the areas of monitoring of burned areas (in synergy with the Global Land Cover), (4) Wildfire Emission Assessment in synergy with the Copernicus Atmospheric Monitoring (CAMS). Tools for the assessment of fire seasonality and impact at regional and global levels are being developed.

The activities under the current Copernicus programme will cover pre-operational forest fire monitoring activities for Europe including, at least, the first two modules and the sequential implementation of wildfire monitoring modules at the global scale.

Overall, the activities in EMS EFFIS/GWIS will include:

(1) Fire Danger Prediction. The methods are based on the processing of meteorological Numerical Weather Prediction datasets (NWP) for the computation of fire danger forecasts and fire danger anomalies. and use in-situ data from national meteorological services and other relevant data providers for calibration and validation of fire danger predictions. Results of the above will include the computation, with a resolution of 9 to 25 km, of: (1) daily fire danger forecast 1 to 10 days ahead, (2) the computation of fire danger anomalies and historical ranking (percentiles) and (3) the provision of seasonal and monthly fire weather forecasts, i.e. temperature and rainfall anomalies that are expected to prevail over European and Mediterranean areas during the 4 weeks and the next 6 months. The former anomalies are updated every week while the later anomalies are updated monthly. Work on the seasonal fire danger forecast is on-going and will be published when ready;

(2) EFFIS - Active fire mapping and near real-time monitoring of burnt areas. Location of active fires, as detected by satellite imagery and the accurate mapping of fires of approximately 30 ha or larger and updated information on their perimeters will be provided twice daily based on medium (approx. 250-300 m ground spatial resolution) imagery. Additionally, a seasonal high-resolution burnt area map will be produced on the basis of high spatial resolution imagery (approx. 20-30 m ground spatial resolution) for the European, Middle East and North-Africa region, i.e. that covered by EFFIS Active Fire and Burnt Area Mapping;

(3) Additionally, other EFFIS modules that are currently not fully operational, which are mentioned in the above paragraphs, will be further developed;

(4) Further integration of single-fire event information, including: (1) fire danger forecast in the next 10 days, (2) evolution of the fire perimeter in the days previous to the alert and (3) forecast of the fire evolution to support pre-tasking of the Copernicus EMS Rapid Mapping to enhance timeliness for Rapid Mapping with regards to fires;

(5) As mentioned above, effort will be made on developing probabilistic forecast of fire danger and the computation of long-term fire danger forecast;

(6) GWIS – Fire Danger Forecast – In addition to the Fire Weather Index (FWI) computed in EFFIS, with a time forecast of 10 days, other indices of wide use e.g. in the USA and Australia will be computed and tested at the global scale;

(7) GWIS - Active fire mapping at the global scale on the basis of existing satellite imagery, including that from the Sentinels 1, 2, and 3. Work will focus on the mapping of active fires, elimination of false alarms as well as on the characterisation of fire regimes, globally;

(8) Furthermore, GWIS modules that are not fully operational will be further developed. This activity will be supported by the NASA GEO project proposals approved in 2017;

(9) Further development of synergies with other Copernicus services regarding forest fires such as those of Atmospheric Monitoring and Global Land Cover towards a full integration of data and services in GWIS;

(10) Maintenance and update of the EFFIS Fire Database to support the calibration and validation of other EFFIS products and services and publication of environmental impact of forest fires in Europe as regards Natura2000 sites, forest fire emissions, etc. in collaboration with other Commission services;

(11) Maintenance and further development of dissemination services:

- Enhancement of the EFFIS web-information system to maintain and adapt the information flow from the service providers to EFFIS and from EFFIS to the Emergency Response Coordination Centre (ERCC) of the European Commission DG ECHO;

- Further development of the EFFIS/GWIS metadata to feed the Copernicus Data Information and Access Service and the GEOSS Common Infrastructure.

Dissemination services will be developed and implemented by external contractors within the JRC premises to ensure compatibility of EFFIS Copernicus products with those of other EFFIS modules and the seamless development of services in EFFIS and GWIS.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) A daily updated fire danger map of the current day and forecast for 1 to 10 days ahead using weather forecast data, provided as layers with 6 classes (very low, low, moderate, high, very high and extreme) with a spatial resolution of about 9 km to 25 km and daily fire danger anomalies at the same spatial resolution. The fire danger classes are the same for all countries and maps show harmonised information of the spatial distribution of the fire danger levels;

(2) A weekly updated pan-European overview of prevailing fire weather forecast for the following 4 weeks. A monthly update overview of prevailing fire weather forecast for the following 2 months;

(3) Daily maps of active fires (up to 6 daily updates) and medium-spatial resolution maps of burnt areas (2 daily updates) in the European, Middle East and North Africa region and seasonal high-spatial resolution maps of burnt areas for the same region;

(4) Daily reports to the ERCC with an overview of fire danger conditions, active fires and the extent of burnt areas during the core of the fire season in Europe (March to October);

(5) Weekly reports to the ERCC on fire danger and fire activity in Europe, Middle East and North Africa;

(6) Provision of fire danger forecast and active fires at global scale;

(7) Provision of alerts for critical fires based on fire danger forecasts, active fire mapping, burnt area maps, fire perimeter evolution and potential damage to support pre-tasking of the Copernicus Emergency Management Service Rapid Mapping;

(8) Operation of the (1) fire danger forecast and (2) active fire mapping and near-real time monitoring of burnt areas 7/24/365 in synergy with the EMS Mapping service;

(9) Annual meeting of the Global Wildfire Information System partnership in collaboration with GEO (Group on Earth Observations) and the GOFC (Global Observation of Forest Cover) Fire Implementation Team.

INDICATORS

(1) Service indicator: Reliable 7/24/365 service;

(2) Number of timely EFFIS/ GWIS fire forecasts;

(3) Accurate wildfire activity and fire impact information uploaded in EFFIS/GWIS;

(4) Detailed reports sent to forest fire services, participating States in the Civil Protection Mechanism and the Commission;

(5) Skill and performance scores including recalibration of the fire danger forecast according to fire occurrence and burnt areas;

(6) Results of analysis of system usage and access to services;

(7) Evaluation of system performance for the support of EMS Rapid Mapping pre-tasking for critical fires.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Quarterly Implementation report	Q1-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
EFFIS Operations	Procurement	2019	XXXXXX

3.1.5.4. EMS Early Warning and Monitoring Service – Droughts

The Drought Observatory consists of modular web mapping services and information systems that provide near real-time information on droughts and their likely evolution in Europe (EU, accession and neighbouring countries) and globally. It includes a European and a global component, where the European component provides more detailed assessments due to the higher detail of input data. The likely impacts are or will be assessed for different economic sectors.

The European Component (EDO) provides efficient methods for monitoring and forecasting droughts at European scale by integrating information from continental, regional (e.g. Drought Management Centre for South Eastern Europe, DMCSEE), national and River Basin information systems (e.g. aquifer levels and trends for France, agricultural drought indicators for the Czech Republic or drought alert levels in the Ebro Basin). It is a distributed system, where data and indicators are handled at each spatial scale by the responsible authorities (stakeholders) and visualised through Web Mapping services within EDO, thus providing a one stop entry for drought information at different scales across Europe. A few core indicators are to be provided at all levels according to common standards as agreed by the stakeholders, in order to allow for a homogeneous overview at European level. With increasing detail, additional, locally important indicators can be added as needed. EDO is complementary to regional, national and local drought information systems since it provides for a European-wide harmonised monitoring for a cross-boundary problem.

Currently EDO provides a suite of drought indicators, including daily, 10-daily and monthly updated maps on the occurrence and evolution of drought events, as well as a 7-day forecast of soil moisture. Medium to long-term forecasting is under development using probabilistic ensemble methods. EDO provides information through different modules:

(1) **A monitoring and mapping module** that allows for the visualisation of the spatial and temporal evolution of droughts using different indicators for rainfall, snow pack,

temperature, soil moisture, groundwater, river flow, and vegetation health. Indicators are calculated from in-situ measurements (meteorological data, groundwater), model outputs (soil moisture, river flow), and satellite data (vegetation stress, soil moisture, land surface temperatures). Selected indicators are combined into alert levels for agriculture and ecosystem impacts. Combined indicators for other sectors (e.g., energy production, waterborne transport, public water supply) are under development. These combined indicators target decision-making levels, while the specific indicators are typically used by the expert analyst;

(2) **A forecasting module** that provides forecasts of selected drought indicators. Currently only soil moisture is covered. In the future meteorological indicators will be added;

(3) **A data analysis module** that allows analysing and comparing temporal profiles of available indicators, their spatial comparison, and their aggregation to administrative units;

(4) **Analytical reports** for significant drought events, analysing their extent and severity as well as the potential impacts.

EDO is streamlined with other Copernicus EMS in that it uses data from the meteorological data collection for EFAS and EFFIS and the outputs of the EFAS distributed hydrological model in terms of soil moisture and river flows. These are then further processed into drought-relevant indicators. In reverse, various drought indicators can be used in the forest fire danger assessment in EFFIS. EDO at the same time feeds into the Global Drought Information System (GDIS) under development in the GEO Work Programme, where it is the node for Europe.

The Global Component (GDO) works in a very similar way to EDO, providing for the monitoring and in the future also forecasting of a suite of drought indicators at the global level. In addition, it includes a global analysis of societal exposure and vulnerability to arrive at an assessment of the dynamic drought risk and the likely impacts in different sectors. Currently the dynamic drought risk is implemented for agriculture. Risk indicators for other economic sectors are under discussion. GDO further provides tools for the automatic generation of analytical reports on the drought situation at sub-national administrative levels, including a first assessment of the number of affected people and land use types, as well as a hierarchical list of drought affected countries. GDO is complementary to GDIS in that it targets operational users with sector specific information and reporting tools and can provide input to the Global Wildfire Information System (GWIS) with specific drought indicators usable for fire risk assessment.

The activities under the current annual work programme will cover the development and pre-operational drought monitoring activities for Europe and globally, including the following modules:

Drought Monitoring and Mapping.

- Regular collection and quality checking of meteorological input data from various sources (e.g. EFAS, GPCC, ERA5) as input to the calculation of meteorological indicators for droughts and extreme temperatures;

- Regular collection of satellite data (e.g. MODIS, Sentinel) as input to the calculation of drought relevant land surface indicators (vegetation stress, land surface temperatures);

– Regular collection of EFAS and calculation of GLOFAS outputs of daily soil moisture and river flows as input to the calculation of soil moisture deficits and low flow indicators;

– Calculation and yearly updating of the long-term climatologies for all indicators (i.e., 20 to 30 year time series);

– Computation of various meteorological, agricultural and hydrological drought indicators from the above listed input data. All indicators are standardized and presented as anomalies;

– Testing of new indicators such as, for example, groundwater resources at global level from NASA's Gravity Recovery and Climate Experiment (GRACE) and follow-on missions, soil moisture content from the Soil Moisture and Ocean Salinity mission (SMOS), or land surface temperature, vegetation stress and surface water resources from the Sentinel-3 mission. The latter links closely to EFFIS and GWIS;

– Combination of selected indicators into combined indicators for assessing the dynamic drought risk and potential impacts for different sectors on the European and global levels.

Drought Forecasting.

– Implementation of short-, medium- and long-term drought and heatwave forecasting across the European continent and globally, based on C3S SEAS5 data.

Analytical Reporting

In case of major drought events, production of analytical reports and maps for distribution via the drought portal and directly to the ERCC:

Maintenance and further development of the dissemination services.

Maintenance and further development of the drought portal that provide access to the web mapping, the analysis tools and the analytical reports.

User Meeting

Organisation of a yearly user meeting to collect feedback on the system functionality and user friendliness.

Preparation of Transfer

Start preparations for transfer of operational processing components in 2020.

Dissemination services will be developed and implemented by external contractors within the JRC premises to ensure compatibility between and convergence of the various EMS services.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) 8-daily, 10-daily and monthly updated maps of drought occurrence in Europe and globally. All indicators are presented as standardised anomalies and as alert levels in the case of combined indicators. The spatial resolution of the maps depends on the indicator and ranges from 1 km for vegetation stress to 100 km for meteorological indicators at global level;

(2) Forecasts of the probable drought evolution from 7 days to a few months;

(3) Analytical reports of ongoing drought events in Europe and globally to the ERCC and distributed via the internet portals.

INDICATORS

(1) Service indicator: Reliable service, available 365 days and updated every 10 days;

(2) Timely provision of analytical reports to the ERCC. Analytical reports are requested by the ERCC and an analytical report is delivered within 5 working days;

(3) Statistics of the system usage (e.g. page views) and number of independent users accessing to services.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Quarterly Implementation report	Q1-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Drought Observatory Operations	Procurement	2019	XXXXX

3.1.6. ACTION 6: Security Service (CSS)

By aggregating space and in-situ data from global observations over land and seas, Copernicus is make a significant contribution to EU security needs, in particular in for border surveillance, maritime surveillance, EU External Action including humanitarian aid missions, conflict early warning and prevention and others.

Progress in the definition of services has been consistent, based on lessons learned from R&D projects and discussions held in the frame of GMES/Copernicus ad-hoc thematic working groups. These led to definition of baseline detailed service portfolio specifications, available as Technical Annexes to the Delegation Agreements.

Delegation agreements have been signed with Frontex and EMSA by the end of 2015, for the implementation of the support to border and maritime surveillance services, respectively. The year of 2016 has been used to set up Agencies capacities for service provision, to provide baseline user services and user up-taking activities. Delegation agreement with SATCEN was signed late 2016 with service provision since May 2017. Cooperation agreements (Service Level Agreements) between EMSA, Frontex and SATCEN have also been put in place to ensure cooperation between the agencies on issues of mutual interest.

2018 was used to consolidate service delivery and boost user-uptake. We also started to see tangible results and usage trends became available allowing to a 'fitness-for-purpose' exercise by the end of 2018 to steer future operations and service development in tune with policy needs.

In 2019, focus will be placed in further aligning results with users and policy needs. Additional user-uptake, mostly for SEA and CMS and serving Member States' specific needs will also be a priority.

The action is composed of three complementary activities:

(1) Border Surveillance;

(2) Maritime Surveillance;

(3) Support to EU External Actions.

3.1.6.1. Border Surveillance

This action aims at including space observations into Frontex and Member State's border surveillance operations. Users have been extensively consulted and technical recommendations produced. A concept for operations will continue to run in order to monitor the areas most affected by the migratory pressure basing on the needs. Frontex will work with Member States and relevant actors, making use of Earth Observation data and European industry capacities for increased situation monitoring and risk analysis of external borders. The provision of the service will provide added value to the implementation of Frontex coordinated operational activities in these areas.

Activities for 2019 will concentrate mainly on the provision of operational border surveillance services as foreseen in the Delegation Agreement through the Eurosur Fusion Services (EFS) . Furthermore, additional services will be developed through Service Evolution, in order to support the tasks envisaged by Copernicus for purposes of ensuring the implementation of the border surveillance component.

In 2019 Frontex will continue to provide following services:

(1) Coastal monitoring service

The Coastal Monitoring services are ‘on demand’ services which will be provided throughout 2019. The purpose of the Coastal Monitoring service is to provide MSs and Frontex with intelligence validation, change analysis and surveillance information on specific third countries coastal areas on a reliable and cost-efficient basis. Imagery analysis reports, vectorised data and imagery of coastal areas and objects of interest (infrastructure, vessels, lines of communication, human activity, etc.) will be delivered for both risk analysis and operational response purposes;

(2) Pre-frontier monitoring service

The Pre-frontier Monitoring services are 'on demand' services which will be provided throughout 2019.. The purpose of the Pre-frontier Monitoring is to provide MSs and Frontex with intelligence validation, change analysis and surveillance information on the land pre-frontier area on a reliable and cost-efficient basis. Imagery analysis reports, vectorised data and imagery of the pre-frontier area and objects of interest (infrastructure, vehicles, line of communication, land coverage, human activity, etc.) will be delivered for both risk analysis and operational response purposes;

(3) Reference mapping service

The Reference mapping services are 'on-demand' services which will be delivered during 2019. Reference mapping service delivers Very High Resolution (VHR) satellite imagery and vectorised data covering large (50 km x 50 km max.) specific third country areas identified through risk analysis. This imagery and vector data is required for current and future analysis of irregular migration and cross-border crime related activities;

(4) Surveillance of maritime Area of Interest (AoI) service

The Surveillance of maritime AoI service will be provided on a continuous basis throughout 2019. The service provides monitoring of designated maritime areas to detect, identify and track vessels/craft suspected or having been identified as being used for irregular migration or cross border crime using Earth Observation data combined with In-Situ Data provided by open source, and by platforms and sensors in a defined area over a period of time. The service aims at achieving the highest possible level of situational awareness in a given, predefined area. For 2019 it is foreseen to routinely deploy RPAS in support of gathering relevant in-situ data for this particular service;

(5) Vessel detection service

The Vessel detection service will be provided on a continuous basis throughout 2019. This service aims at detecting objects of interest (sea craft) at sea using Synthetic Aperture Radar on-board satellites. Objects detected are then correlated with available collaborative data from AIS and LRIT with the aim to categorize automatically as much detection as possible. For the correct implementation and exploitation of the Vessel Detection Service (VDS), each activation will be adequately planned and complemented with inspection with aerial or naval assets;

(6) Vessel tracking and reporting service

The Vessel tracking and reporting service will be provided on a continuous basis throughout 2019. This service provides a coherent and complete situational picture of the commercial fleet according to internationally agreed frameworks based on collaborative data. The service is ensured through combined terrestrial, satellite AIS, LRIT and VMS feed. It provides users with information required to monitor and track vessels of interest (collaborative). The operational objective is to support the users with all the information available in Frontex systems related to commercial and fishing vessels fleet;

(7) Vessel Anomaly Detection service

The Vessel Anomaly Detection service will be provided on a continuous basis throughout 2019. This service is addressed to stakeholders in the MS interested in activities of a specific vessel (collaborative) or within a specific maritime area. The

service provides a detection of atypical and suspicious behaviour of vessels. The service alerts are generated automatically the user whenever an anomaly is detected;

(8) Environmental information service

The Environmental information service will be provided on a continuous basis throughout 2019. The Meteo service generates the information about current and forecasted weather conditions and state of the sea. The service provides for the delivery of detailed atmospheric and oceanographic conditions for the indicated areas. Environmental information service aims to support operational planning, decision making processes, and satellite acquisition planning.

In 2019 Frontex will provide also the following operational services introduced in 2018 under the service evolution:

(9) Large Area Pre-frontier Monitoring service

The Large Area Pre-frontier Monitoring services will be made available to Frontex stakeholders as of 2018. This service provides an integration of Pre-Frontier monitoring with open source intelligence (OSINT) exploitation over large areas (above 500sq.km) that were identified as key migratory or cross-border crime areas;

(10) ProDetect service

ProDetect services will be made available to Frontex stakeholders as of 2018. The ProDetect service delivers an initial assessment identification of locations and specific irregular migration and cross-border crime indicators of activity over large terrain swaths. The service is delivered based on pattern indicators defined by risk analysts for early warning detection. The identified areas and objects are validated by the requestor and, if required, further analysed with regular monitoring services;

(11) MUSO Migration Analytical Assessment

MUSO Migration Analytical Assessments will be made available to Frontex stakeholders as of 2018. This service provides a socio-economic baseline and initial analysis on a specific area, activity and/or an organized criminal group associated with irregular migration or cross-border crime activities. It is based on multiple sources with satellite imagery analysis and OSINT as compulsory data sources for this service.

Depending on the results of the Ship Wake Detection service evolution results, this service might be chartered as operational in the course of 2019.

In addition to the operational tasks, in 2019, Frontex will continue to work on the development of additional and improved services through the Service Evolution mechanism, in order to support the tasks resulting from the EBCG and Eurosur Regulation supplemented by Copernicus for purposes of ensuring the implementation of the border surveillance component. This work will include development of SAR wide area land monitoring service (delivering frequent change detection reports over large areas, using SAR (ie. radar) imagery), Permeability studies (analyses of the terrain permeability), as well as further investigation of additional platforms and sensors potentially adding value to the Border Surveillance Service and the application of emerging technologies, such as Big Data processing and AI.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Provision of data and products in an operational environment, in line with the EFS service catalogue;

(2) Management of service provision contracts and related infrastructure;

(3) End user support and adequate training;

(4) Preparatory activities for service evolution.

INDICATORS

(1) Seamless integration of Earth Observation derived information in Border surveillance operations;

(2) User up-taking and quality of service indicators based on user feedback.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation. This activity is entrusted to the European Border and Coast Guard Agency (FRONTEX), in line with the Commission's Delegation Decision C(2015)4340 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Annual Service Performance Review	Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Border Surveillance	Art 58 (1) (c)	2019	XXXXXX

3.1.6.2. Maritime Surveillance

The objective of the Copernicus Maritime Surveillance Service (CMS) is 'to provide information in support of the security challenges of Europe improving crisis prevention, preparedness and response capacities, in particular for maritime surveillance, through detection and monitoring of trans-regional security threats, risk assessment and early warning systems, mapping and monitoring of border areas'. EMSA, as the Entrusted Entity, is responsible for implementing this task in the period 2016-2020.

EMSA operates and manages a suite of systems, which receive, process, and distribute information on vessel traffic reports (LRIT, SafeSeaNet), satellite monitoring (CleanSeaNet),

and Port State Control (Thetis). The services produced by these systems are shared with Member States and the Commission, to supplement and enhance national capacity for vessel traffic monitoring, Port State Control, and maritime pollution preparedness and response. EMSA has developed a platform to ensure the performance, availability and reliability of all the maritime information systems it hosts. This platform can also integrate and combine different types of data, including data provided by the end user, to produce customised services tailored to user requirements, according to their respective access rights. These services are used to obtain a clearer picture of a broad range of activities in the maritime domain, building a common picture across EU maritime interests. Enabling governmental and institutional organisations to make use of EMSA's systems avoids duplication of effort, overlapping infrastructures and unnecessary expenditure.

The CMS service is one component of these broader Integrated Maritime Services offered by EMSA that can be accessed by national administrations with responsibilities at sea, as well as relevant EU bodies and institutions. It provides additional Earth Observation information through existing EMSA applications, and 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 2019, the service will continue with the work already begun by reinforcing and enhancing services developed during 2018 for users in the different user communities served. These include:

- Fisheries control;
- Maritime Safety and Security;
- Law enforcement;
- Marine Environment;
- Defence;
- Other (i.e. support to international organizations, anti-piracy).

It is expected that the user basis will continue to grow substantially. In addition, potential new users identified during 2018 will be encouraged to submit user requirements, and initial service plans may be set up for these.

(1) Fisheries control service

EMSA provides support to the European Fisheries Control Agency's (EFCA) coordinated Joint Deployment Plan operations (JDP) for monitoring fisheries activities in selected areas of interest. Copernicus Maritime Surveillance provides a crucial component to integrated services for fisheries control by delivering information on fisheries control activities, including non-reporting vessels, in near real time to fisheries control authorities. Fish traps and fish cages are also detectable by satellite providing additional value in the fight against IUU. These services are tailor-made to the requirements of Member States users and thus will be adjusted accordingly in 2019;

(2) Maritime safety and security service

Earth Observation (EO) products can be analysed on a routine basis enhancing the maritime picture for traffic safety purposes and for information to navigation. EO can support search rescue operations in remote areas where conventional assets are not easily deployed (or take substantial time to reach the area of operations). Moreover the location of missing vessels and/or vessels in distress in remote areas can be done using EO information. While radar can be used to detected the vessel, very high resolution optical can be used to identify the ship. For support to Maritime Security Earth Observation (EO) products can be analysed on a routine basis enhancing the maritime picture for maritime surveillance purposes, particularly in areas where vessel reporting information is sparse. Systematic monitoring using EO is used to determine patterns of life and better enable operations in the area of interest;

(3) Law enforcement service

CMS is offered to Law enforcement and customs authorities in Member States, and this user community presents significant growth in terms of services delivered and number of users. Earth observation assets provide a unique capability in terms of detection of non-reporting vessels which are usually the ones targeted by law enforcement and customs authorities. Combination between high resolution radar for wide area monitoring with very high resolution optical for target identification brings significant value to operations, particularly in areas where other assets cannot be used;

(4) Marine environment service

Since 2007 EMSA has been operating a satellite-based oil spill and vessel detection service, CleanSeaNet. SAR satellite images can be used to detected oil spill discharges at sea and the results are made available in near real time to end users, increasing efficiency of conventional oil spill detection assets (i.e. aircraft).

Copernicus will strengthen CleanSeaNet's monitoring capabilities by enhancing coverage in areas of European interest, as defined by the users of the service. An enhanced marine pollution monitoring service is already provided by Copernicus in terms of monitoring of the Arctic region. During 2019 these operations will potentially be extended to support Member States areas of interest concerning overseas territories;

(5) Defence

In 2019 CMS will extend its support to defence and external security user communities regarding maritime surveillance operational support. CMS can add substantial value in particular for remote and wide area monitoring not limited to the seas around Europe but extend globally, in areas of European interest. The monitoring of global maritime traffic is done by using combined cooperative tracking systems (AIS, LRIT, VMS and S-AIS) with space based sensors in the detection, identification, tracking and characterization of non-cooperative targets.

In addition to the abovementioned, operational tasks EMSA will work on further developing its services, in order to address users' operational requirements and align with the planned service evolution activities. In 2019 this evolution will include enhanced vessel detection and analysis products (vessel type classification, wake detection, etc.), activity detection, feature detection and change detection. Moreover, the delivery timeliness of earth observation products will be improved (quasi real time of 20 minutes for SAR products and near real time 30 minutes for optical products). Additionally developments linked with analytics to support maritime surveillance operations, including characterization of patterns of life, will be initiated, with user requirements gathering and service design activities.

Finally, in 2019 EMSA will continue to organize a yearly Copernicus Maritime Surveillance User Group, dedicated workshops for specific user communities and trainings on EMSA operational systems used in the delivery of Copernicus Services.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Provision of services in line with the Implementation Plan 2019;

(2) Management of service provision, procurements, contracts and related ICT infrastructure;

(3) Training to end users;

(4) Communication and user up-take activities;

(5) Identified service evolution activities;

(6) Reporting.

INDICATORS

(1) Timely establishment of operational service provision;

(2) Technical quality of service provision;

(3) User uptake, consistent increase in usage;

(4) Service evolution.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation. This activity is entrusted to the European Agency for Maritime Safety (EMSA), in line with the Commission's Delegation Decision C(2015)3006 final..

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Semestrial report	Q3/2019
Yearly report	Q1/2020

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Maritime Surveillance	Art 58 (1) (c)	2019	XXXXXX

3.1.6.3. Support to EU External Actions

After the start of the initial operations early May 2017 and the ramp-up during 2017 for reaching full operations in Q4/2017, the Service reached almost its full capacity during 2018.

The user activations are also expected to increase due to the user uptake activities accomplished in 2018 aimed at raising users awaress and engagement. To further enhance uptake, two users workshops will be held in the first and second semesters 2019; furthermore, the service website will provide information on the Service and brochures and other informative material on service operations will be distributed.

Procurement

During 2018, the SatCen completed the awarding, via competitive calls for tenders, of the four contracts for the performance of the following activities (Phase 1 of the procurement within de Delegation Agreement):

- Geospatial Production (awarded in April 2017);
- IT Infrastructure Development for Copernicus Support to EU External Actions
- (first contract awarded in February 2018);
- Service Evolution for Copernicus Support to EU External Actions;
- User Uptake Support for Copernicus Support to EU External Actions (three lots awarded between December 2017 and February 2018).

The Geospatial Production call for tenders was followed by the ones on Support to User Up-take, IT Infrastructure Development and Support to Service Evolution.

All framework contracts have a duration of two years. For the IT Infrastructure Development a two-phases approach has been chosen. Firstly a two-months contact has been awarded for a consultancy aimed at proposing a suitable solution. Secondly, a contract has been awarded via Open Tender with the aim to develop the Infrastructure itself.

Regarding the IT Infrastructure Development it is foreseen to have by the end of 2019 an IT platform for the service supporting activation order, production and delivery functionalities ready for being introduced step by step in the operational workflow.

In the framework of the User Uptake Support two user's workshops will be organised, promotion material will be updated and distributed and the website will be up and running.

The Service Evolution will enable to tailor and renew the 3.1.6.3. Support to EU External Actions Portfolio based on the user's feedback for 2017 activations onward and on previous activities started in the frame of the G-SEXTANT project.

In 2018/Q3 the preparation and signature of new ITTs (e.g. for Geospatial Production) has started in order to be in position to awards contracts for the period covering January 2019 up to 2020/2021.

Portfolio

In 2019 the Satellite Centre will continue to provide the portfolio of the Copernicus Support to EU External Actions (SEA) Service composed of the following products:

(1) Reference Map

Reference Maps are high quality cartographic products including a wide range of observable features. The different layers of information include basic types such as road network, boundaries, hydrography, terrain, etc.

The information contained in the Reference Maps is meant for orientation, local navigation, strategic decision making and logistic deployment.

Depending on the circumstances, the information layers in the Reference Map may be enriched with specific layer required by the situation;

(2) Road Network Status Assessment

The Road Network Status Assessment provides users with a map containing different type of information on the status of the road network. Mobility through a road network is a critical issue during crisis management and this product is specifically tailored to provide the users with up-to-date information of the status of the network.

The product delivered in preparedness mode can provide additional information on events affecting mobility, such as the impact of wet seasons in tropical regions.

This information is designed to support the planning of logistic operations in the field;

(3) Conflict Damage Assessment

The Conflict Damage Assessment product uses change detection in order to provide visual interpretation containing information on distribution of damage in a crisis area.

In urban areas, the urban blocks will be colour-coded to show the intensity of the damage. In dispersed areas, a heat map will be used to represent the damage, with grading colours to highlight how different sections of each area have been affected.

This product is useful to identify the distribution of damage after a conflict in a given area;

(4) Critical Infrastructure Analysis

Various elements can be considered as critical infrastructure, but in general these are defined as man-made or natural structures of which the disruption, destruction or alteration may have a severe impact on the security of States and citizens.

The product will identify the most relevant components of an infrastructure (e.g. power plants, industrial sites, transportation facilities such as harbours and airports) considered to be critical, and assess their operational status. The objective is to identify the elements that make the infrastructure critical in any given crisis;

(5) Support to Evacuation Plan

The Support to Evacuation Plan provides geospatial information to support the evacuation of EU citizens from crisis areas. The products developed, based on a preliminary analysis performed in accordance with the types of risks associated with a particular location, include information such as potential rally points, helicopter landing areas, and evacuation points and routes;

(6) Non-EU Border Map

The non-EU Border Map provides users with the possibility of acquiring information specific to support decisions about non-EU border issues. The Non-EU Border Map can help users to support decision making regarding smuggling, displaced population flow during crisis, patrol planning, etc;

(7) Camp Analysis

Camp analysis is a product oriented to support decision making regarding displaced population (either internally displaced or refugees). The products is focused on characterizing the facilities of a camp, identifying dwellings and buildings with other functionalities and eventually providing estimated spans of population.

The products can be applied as well to identify changes in a given camp in order to detect trends in the population;

(8) Crisis Situation Picture

The Crisis Situation Picture is a product designed for the overall assessment of the severity of a conflict/crisis and its consequences. In order to fulfil this purpose, the products is composed of a collection of ancillary information regarding the crisis. The ancillary information found is then collected, homogenized and prepared in a seamless picture (composed of situation maps and optionally a report). The exact type of information will depend on the crisis, but the following are examples:

- Distribution of ethnic/religious groups in the area.
- Estimation of population in the requested area (and its distribution).
- Boundary information, including previous boundary layouts.
- Location of specific assets in the area.

(9) Activity Report

The activity report is a product focused in providing the user with an analysis of a given human activity. Different human activities may leave different footprints and for this reason the product is very flexible and can be applied to a variety of situations. In particular, the following are the most optimal:

- Monitoring construction of a given facility.
- Identify indicators of activity/abandonment of industrial or transportation facilities.
- Monitor changes of goods in open storage areas (such as harbours).
- Identify pattern of usage/abandonment of residential areas.

In addition, as a result of the Service Evolution, new products will most likely be included in the portfolio offer (following the procedures defined by Commission). Some examples of potential new products that could be considered within the framework of the service evolution are:

- Live country Profile: Up to date overview information of the country, extending the geographical information to include human geography data (ethnicities, religion, census, etc.), Open Source geotagged data from Social Networks, historical data, etc;

– Project evaluation support: Monitoring of European funded development projects with the purpose to support auditing and management;

– Cultural Heritage monitoring: Monitoring of damages to world cultural heritage in areas affected by armed conflicts;

– Natural Resources Indicators: Monitoring of exploitation of natural resources in states where such exploitation is potentially linked to conflict, such as illegal timber logging and mining;

– Border Permeability: Analysis of land border areas to create analysis of permeability, potentially usable for border patrol planning;

– Illegal Crops monitoring: Monitoring of illegal crops and illegal crop risk analysis.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Operational services 2019 onwards;

(2) Follow up of procurement for the Service implementation;

(3) Initial operation of SEA IT platform.

INDICATORS

(1) Service Availability / Reactivity;

(2) Service Performance;

(3) Quality Assurance;

(4) User Satisfaction;

(5) User Uptake.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation. This activity is entrusted to the European Union Satellite Centre (SatCen), in line with the Commission's Delegation Decision C(2016)5698 final.

OPERATION TINMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Full operation of services	Q1/2019
First User Workshop	Q2/2019
Second User Workshop	Q3/2019

Initial Operations of the IT platform		Q3/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Support to EU External Actions	Art 58 (1) (c)	2019	XXXXX

3.2. Section 2: Space Component Budget Line 02 06 02

The European Commission is responsible for the Copernicus Programme and the coordination of the different components, including the Space Component.

The Copernicus Space Component (CSC) will ensure an autonomous capacity of space borne observations for the European Union. The Copernicus Space Component consists of a Space Segment of satellite missions and a Ground Segment supporting these missions. The Space Segment comprises two types of satellite missions, the families of dedicated Sentinels, and other missions providing data to Copernicus, i.e. the Copernicus Contributing Missions (CCM). The Ground Segment operates the Sentinel missions, receives data from the satellites, processes, archives and distributes them to the Copernicus services and user communities, and generates a coordinated data stream to satisfy Copernicus data needs.

Sentinel-1, Sentinel-2 and Sentinel-3 consist each of 4 satellites, whereby 2 units are needed to reach Full Operational Capacity (FOC) and 2 units ensure recurrent observation capacity. Sentinel-4 and Sentinel-5 consist of instruments to be hosted by the EUMETSAT meteorological missions Meteosat Third Generation (MTG-S) and MetOp-SG-A respectively. Sentinel-5p is a precursor satellite of Sentinel-5. Sentinel-6 consists of 2 units with Jason-3 providing continuity of observations between Jason-2 and Sentinel-6. User requirements for future observations beyond the currently defined Sentinel Missions are currently being collected, with the first iteration of requirements already available. This will result in the definition of complementary and continued observation capacities.

In addition, the Copernicus Space Component guarantees access to satellite data from third parties, called the Copernicus Contributing Missions.

After the Delegated Decision C(2014)7248 covering the period 2014 – 2020, the implementation of most Copernicus Space Component activities are delegated to ESA and EUMETSAT through the Agreements concluded with both organizations in October and November 2014 respectively. Coordination between ESA and EUMETSAT is managed through the Joint Operations Management Plan (JOMP). In line with the Regulation Establishing the Copernicus Programme, the Commission oversees and closely monitors the implementation of the delegated activities covered by the Agreements.

This chapter describes the CSC planned activities for 2018 and details the actions of both ESA and EUMETSAT as part of the activities elaborated in the respective Agreements. The deadlines and milestones listed are based upon the reports provided by the Delegated Entities.

3.2.1. ACTION 1: Space Segment Development

3.2.1.1. ESA

This action includes all activities related to the development of the Copernicus Space Segment. It includes the development of the satellite (manufacturing, assembly, integration and testing of the flight units, qualification and/or acceptance testing) and Phase E1 activities. Phase E1 entails an overall test and commissioning phase of the system and comprises launch activities, in-flight qualification and acceptance testing. Phase E1 ends with the successful conclusion of the In-Orbit Commissioning Review (IOCR), after which Satellite Operations are handed over to the operations teams.

The Copernicus Space activities of relevance to the 2019 Work Programme are:

- Development of the Sentinel-1, Sentinel-2 and Sentinel-3 C and D units
- Development of the Sentinel-5 B/C instruments
- Development of the Sentinel-6B Satellite

The development of Sentinel-4A, Sentinel-4B and Sentinel-5A, as well as Sentinel-6A (Jason-CS A) is not covered by the 2014-2020 MFF and is not further described in this WP 2019.

1. Sentinel-1C and 1D satellites

The Sentinel-1C and -1D satellites are identical units, responding to the same requirements as the Sentinel-1A and -1B satellites, maximising the re-use of qualified space components developed for the previous units. Further changes and enhancements are implemented for the Sentinel-1C and -1D satellites, compared to their predecessors, such as:

- The embarkation of an Automatic Identification System (AIS) instrument to augment the SAR payload data for ship marine traffic applications;
- The embarkation of a GNSS receiver that will be able to exploit (in addition to the current and future GPS signals) also the signals from the Galileo constellation;
- Modifications to comply with the latest applicable requirements on debris mitigation and casualty risk (resulting from satellite re-entry at end-of-life);
- Improvement of Spacecraft Monitoring Unit (SMU) Processing Capability to include second instrument management (LEON3 processor);
- Improvement of SAR Stability beyond requirements to sensibly increase product quality (new tile amplifier);
- New battery cells due to obsolescence;
- Improved Data Storage and Handling Assembly HW-to-SW I/F to increase its availability (Sentinel-1A/B in-orbit lessons learned).

The Sentinel-1 Satellite Production Review (SPR) concluded successfully in 2017, as such completing the Definition Phase (Phase C) and authorising the Manufacturing, Assembly, Integration and Test (MAIT) of the Sentinel-1C and 1D satellites. The main activities in 2019 will concentrate on:

– The continuation of the satellite assembly, integration and testing of the Sentinel-1C and -1D satellites;

– The delivery of the Optical Communication Payloads (OCP) C-unit and D-unit to the Prime Contractor; delivery review board in Quarter 1/2019 and Q3/2019, respectively;

– The delivery of the Synthetic Aperture Radar (SAR) instrument C-unit to the Prime Contractor; delivery review board in Quarter 3/2019;

– The update of the satellite-to-ground technical interface documentation, reflecting the embarkation of the AIS instrument and the GNSS receiver and support to ground segment adaptation, as required;

– The development of the AIS processor prototype;

– The upgrade of the Commissioning Phase Analysis Facility (CPAF);

– The procurement of the Sentinel-1C launch service.

2. Sentinel-2C and 2D satellites

The Sentinel-2C and -2D satellites are identical units, responding to the same requirements as the Sentinel-2A and -2B satellites, maximising the re-use of qualified space components developed for the previous units.

Compared to their predecessors, the Sentinel-2 C&D are almost fully recurrent with only minor differences in design:

– The embarkation of a GNSS receiver to exploit (in addition to the current and future GPS signals) also the signals from the Galileo constellation;

– Modifications to comply with the latest applicable ESA requirements on debris mitigation and casualty risk (satellite passivation);

– Introduction of dedicated moon observation manoeuvre for improved MultiSpectral Instrument (MSI) calibration;

– Changes driven by obsolescence or coming from Sentinel-2 A&B flight experience, e.g. Mass Memory Formatting Unit (MMFU) robustness improvement, solar array connectors to avoid accidental short-circuit, design optimization of SWIR front-end electronics and thermal design, others.

The Sentinel-2 Satellite Production Review (SPR) concluded successfully in 2017, as such completing the Definition Phase (Phase C) and authorising the Manufacturing, Assembly, Integration and Test (MAIT) of the Sentinel-2C and -2D satellites.

The main activities in 2019 will concentrate on:

– The continuation of the satellite assembly, integration and testing of the Sentinel-2C and -1D satellites;

– The delivery of the Optical Communication Payloads (OCP) C-unit and D-unit to the Prime Contractor; delivery review board in Quarter 3/2019 and Q4/2019, respectively;

– The delivery of the of the Multi Spectral Instruments (MSI) C-unit to the Prime Contractor; delivery review board in Quarter 4/2019;

– The procurement of the launch service for Sentinel-2C.

3. Sentinel-3C and 3D satellites

The Sentinel-3C and -3D satellites are identical units, responding to the same requirements as the Sentinel-3A and -3B satellites, maximising the re-use of qualified space components developed for the previous units. The Sentinel-3C and -3D satellites are almost fully recurrent of Sentinel-3A and 3B, with only minor differences in design, such as:

– The embarkation of a GNSS receiver that will be able to exploit (in addition to the current and future GPS signals) also the signals from the Galileo constellation;

– The implementation of a gyroless Altitude and Orbit Control Subsystem (AOCS), already implemented on A&B models except in the Initial Safe and Emergency Mode used at launch vehicle separation;

– Introduction of dedicated moon observation manoeuvre for improved Ocean and Land Colour Instrument (OLCI) calibration;

– Design improvement of Synthetic Aperture Radar Altimeter (SRAL) Instrument instrument: new LEON-2 processor, and uncompressed Open Loop Tracking Commands (OLTC); and

– The lessons learned from the Sentinel-3A&B programme have been taken into account for the Sentinel-3 C&D programme.

The Sentinel-3 Satellite Production Review (SPR) concluded successfully in 2017, as such the Definition Phase (Phase C) is completed and the Manufacturing, Assembly, Integration and Test (MAIT) of the Sentinel-3C and -3D satellites has been authorised. Accordingly, the main activities in 2019 will concentrate on:

– The continuation of the satellite assembly and integration activities of the Sentinel-3C and -1D satellites;

– The final AIT/AIV of the Sentinel-3C and -3D instruments with their respective deliveries in the 2019 for the C-units and end 2020/begin 2021 for the D-units:

  – Sea and Land Surface Temperature Radiometer (SLSTR)

  – Ocean and Land Colour Instrument (OLCI)

  – Microwave Radiometer (MWR)

  – SAR Radar Altimeter (SRAL)

  – Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS)

– The procurement of the launch service for Sentinel-3C;

– The update of the satellite-to-ground technical interface documentation, reflecting the embarkation of the GNSS receiver and support to ground segment adaptation, as required.

4. Sentinel-5B and -5C instruments

The Sentinel-5 project comprises the development and production of three instruments:

– The Sentinel-5 Proto-Flight Model (PFM), the Sentinel-5A unit, covered by ESA's GMES Space Component Programme (GSC segment 3); and

– The Sentinel-5B and -5C instruments, covered by the EU Copernicus programme.

All Sentinel-5 instruments (-A, -B and -C) cover the Near-InfraRed Band 2 (NIR-2) Spectral Range Extension. This will add the capability of retrieving the vegetation fluorescence product by means of an extension of the NIR-2 spectral range.

The assembly, integration and test activities regarding the Sentinel-5 instrument Structure and Thermal Model (STM) and the Electrical Function Model (EFM) were completed in 2017-2018. The Sentinel-5 Critical Design Review (CDR) took place in 2018.

The main activities in 2019 concentrate on:

– The completion of the Instrument Engineering Model testing and calibration activities

– The final deliveries of the Instrument sub-systems and units Proto-Flight Models (for the Sentinel-5A)

– The completion of the Instrument Proto-Flight Model (Sentinel-5A) assembly, integration and testing activities (AIT/AIV)

– The continuation of the Sentinel-5B and -5C sub-systems

– The start of the Sentinel-5B and -5C Instrument AIT/AIV

5. Sentinel-6B Satellite

The development of the Sentinel-6A satellite is co-financed by ESA and EUMETSAT. Under the Copernicus programme, the European Commission co-finances the recurrent Sentinel-6B unit together with EUMETSAT.

The main activities in 2019 are focused on:

– The continuation of the satellite assembly and integration activities of the Sentinel-6B satellite;

– The final AIT/AIV of the Sentinel-6A instruments with their respective deliveries in 2019 such as the:

  – Ku/C band Poseidon-4 radar altimeter,

  – GNSS Precise Orbit Determination (GNSS-POD) receiver,

  – Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS),

- Advanced Microwave Radiometer for Climate (AMR-C),
- Laser Retroreflector Array (LRA),
- GNSS-Radio Occultation (RO) receiver package.

– According to the parallel development strategy, the Sentinel-6B activities are lagging 6 to 9 months behind those of the A model.

6. Space Segment Launch Services and Phase E1 activities

There are no launch services activities envisaged in 2019.

The Sentinel-3B launch is currently planned to take place on 25 April 2018, meaning that Phase E1 activities dealing with the post-launch commissioning, will also be finished in 2018.

2018 Planned Space Segment Procurements

Regarding space segment procurements, all procurements have been initiated and placed. No further space segment procurements are foreseen for 2019.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Pursuit of satellites and instruments construction and respective industrial supervision;

(2) Conduct of the Satellite manufacturing phase (Phase D) of the Sentinel-1, Sentinel-2, Sentinel-3 and Sentinel-6 programmes;

(3) Conduct of the instrument manufacturing phase (Phase D) of the Sentinel-5 programme.

Note: Phase D includes the following major tasks: manufacturing, assembly and testing of the flight unit(s), qualification testing and associated verification activities, involving hardware, software and associated ground support, complete interoperability testing between the space-and the ground-segment, prepare acceptance data package, as required.

INDICATORS

(1) Number of recurrent units under development as compared to the overall Programme schedule;

(2) Number of Satellites in orbit in line with satellite in-orbit availability requirements;

(3) Number of missions having achieved Full Operational Capability in line with the mission requirements.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Space Agency (ESA), in line with the Commission's Delegation Decision C(2014)7248 final.

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Sentinel construction by ESA	Art 58 (1) (c)	2018	XXXXX

Pro memoria: The costs for the development of Sentinel-4A and Sentinel-4B instruments have been funded through the merged Segments 1 and 2 of ESA's GMES Space Component Programme, the costs for the development of the Sentinel-5A instrument has been funded by ESA as part of segment 3, the costs for the development of the Sentinel-6A instrument has been funded by ESA as part of segment 3 with some co-funding by EUMETSAT and contributions in kind from NOAA. Thus, these costs are not covered by the MFF 2014 – 2020 budget.

3.2.1.2. EUMETSAT

EUMETSAT will support ESA with the procurement of the recurrent Sentinel-3 C/D satellites including participation to space segment progress meetings and space segment reviews and assessments of impacts on the ground segment. The budget associated to this activity amounts to XXXX EUR and is entirely covered through the EUMETSAT internal costs (See Action 3).

3.2.2. ACTION 2: Space Segment Operations

This section documents the Space Segment Operations activities starting from the successful conclusion of the In-Orbit Commissioning Review (IOCR).

3.2.2.1. ESA

Sentinel-1 and Sentinel-2 entered into full operations in 2018 and operations will continue in 2019. Sentinel-5p and Sentinel-3 will enter into full operations in2019. Activities will therefore focus on the tasks and adaptations which are necessary to reach the full system capacity and to complete the gradual deployment approach.

In 2019, the Ground Segment operational interfaces would be further consolidated and adapted to support the DIAS first year of operations. Given that PDGS operations are at the source of the DIAS operations, it is considered of utmost importance that the overall PDGS operations and data flows are adapted to enable the DIAS operational paradigms and associated third party activities. ESA also intends to pursue initiatives to improve the current level of operational performances, and in particular to continue the effort of transparency in the management of data flows and product quality

In particular, during 2019, ESA will focus on:

– the routine operations of Sentinel-1 constellation and the Sentinel-2 constellation, and Sentinel-3 partim Land;

– the completion of the ramp-up phase of Sentinel-3B and the start of routine operations of the Sentinel-3 constellation, entering in Full Operational Capacity;

– the completion of the ramp-up phase of Sentinel-5p;

– relevant ground segment enhancement activities addressing multi-Sentinels functionality, small evolutions and new functions linked to user requirements, and studies and user data uptake activities;

– Extension/renewal of the different contracts associated to the operations of the Stations, PACs and network to cover the period 2019-2021.

The routine Sentinel operations (for Sentinel-1, -2 mission, Sentinel-3A mission Partim Land, Sentinel-5P mission) will cover the following activities:

– Operations of the PDGS mission specific facilities and services;

– System and Payload Data Management Centre (PDMC) Operations;

– Payload Data Ground Segment (PDGS) mission specific maintenance activities;

– Mission specific Flight Operations Segment (FOS) activities (for Sentinel-3A ESA will provide support to the EUMETSAT FOS operations);

– Post-launch spacecraft support activities.

Operations core functions will support the routine Sentinel operations, these will cover the following activities:

– Operations of the Payload Data Ground Segment (PDGS) facilities;

– Copernicus Space Component (CSC) System Operations;

– CSC Mission management;

– PDGS Maintenance activities.

The routine PDGS enhancements cover the integration and operational validation of small adaptations or upgrades to the PDGS systems in relation to e.g. minor system enhancements/modifications detected during commissioning, ramp-up and routine operations phases.

In addition, new user requirements may need enhancements of the PDGS system, these will be managed according to the joint Commission-ESA change management process.

Furthermore, ESA will conduct studies, analysis, user uptake measures and preparatory activities addressing technical assessments at system level. They are intended to support the preparation of programmatic aspects and to promote the uptake of CSC data. In 2018, activities exploring CSC benefits will continue with the progressive delivery of dedicated reports. The

publication collecting regional cases will be finalised and presented in a dedicated event (e.g. at the European Parliament).

2019 Planned Procurements

[to be completed]

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Successful operations of relevant Sentinel missions, in particular:

- Routine operations of for Sentinel-1, -2 mission, Sentinel-3A mission Partim Land, Sentinel-5P mission;
- Completion of Sentinel-5P ramp-up phase and start of routine operations;
- Completion of Sentinel-3B ramp-up phase and start of Sentinel-3 constellation routine operations;;

INDICATORS

(1) Missions having achieved Full Operational Capacity in line with end-to-end availability requirements;

(2) Number of Satellites in operations in line with satellite in-orbit availability requirements;

(3) Continuity of Service: end-to-end service availability for each Sentinel in operation.

(4) Implementation Method

(5) Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Space Agency (ESA), in line with the Commission's Delegation Decision C(2014)7248 final.

OPERATION TIMETABLE

2019 Space segment operations milestones and accomplishments

Key event(s) and milestones are planned during 2018 are listed below:

- Sentinel-3B: completion of ramp-up phase;
- Sentinel-3: start of full operational capacity;
- Sentinel-5P: completion of ramp-up phase and start of full operational capacity;
- All Sentinels: yearly routine operations reviews.

BUDGET

ACTIVITY	INSTRUMENT	TIME	BUDGET

		FRAME	(EUR)
Operations and maintenance of the Copernicus system Operations including Ground Segment operations, maintenance and enhancements	Art 58 (1) (c)	2019	XXXXXX

3.2.2.2. EUMETSAT

EUMETSAT will conduct the following actions related to the operation of the Copernicus space infrastructure:

- Manage and maintain the Sentinel-3 and Jason-3 operations teams. Complement, as necessary, by recruitment and/or procurement, the Sentinel-3 operations team.
- Maintain the operational qualification of the Sentinel-3 operations team.
- Complete the operations ramp-up phase of Sentinel-3B, support the Sentinel-3B Routine Operations Readiness Review (RORR), and start the dual Sentinel-3 routine operations phase.
- Operate the space and ground facilities and services providing acquisition, processing and re-processing, calibration and validation, archiving and dissemination of Sentinel-3A&B data and products, including S-3 A&B atmospheric products, in coordination with ESA.
- Perform Sentinel-3B data/products re-processing based on the outcome of commissioning and routine operations readiness reviews.
- Operate in cooperation with the Jason-3 partners the ground facilities and services providing acquisition, processing and re-processing, calibration and validation, archiving and dissemination of Jason-3 data and products.
- Deliver the operational data services and the provision of support to the Copernicus Marine Environment Monitoring Service (CMEMS) and the Copernicus Atmosphere Monitoring Service (CAMS), including the provision of Level 2P and global L3 Jason-3 and Sentinel-3 cross-calibrated products to CMEMS.
- Deliver the Sentinel-3 L2 marine data services to Africa as well as Sentinel-3 land data services to Africa in cooperation with ESA and provide related user support using the EUMETSAT multi-mission dissemination infrastructure and services.
- Deliver Sentinel-5P Near Real Time data services in Europe in cooperation with ESA and provide related user support using the EUMETSAT multi-mission dissemination infrastructure and services.
- Start to operate in partnership with the providers of CMEMS, CAMS and C3S services the ground facilities and services of the DIAS V1/2 platform, deliver the DIAS operational data services and operate as relevant the functions and interfaces implementing interoperability with other entities of the Copernicus ecosystem.

EUMETSAT will conduct the following actions related to the maintenance of the Copernicus space infrastructure:

- Complement, as necessary, by recruitment or procurement, the maintenance and engineering team.

- Maintain the operational qualification of the maintenance team to ensure their ability to continue supporting safely the maintenance of the Jason-3 and the Sentinel-3 ground segment and all related Ground Segment infrastructure and services under EUMETSAT's direct control.

- Complement, as necessary, and/or maintain all required maintenance arrangements with service providers or industry with the goal to secure the operational mission performance.

- Maintain the configuration of the relevant elements of the Copernicus infrastructure, including the Sentinel-3 and Jason-3 Ground Segments, the multi-mission infrastructure (e.g. dissemination, network configuration, data centre) and the DIAS platform, to continue supporting safely the operations of the Sentinel-3 and Jason-3 missions and the delivery of operational Copernicus data and information services.

- Operate the maintenance process to ensure timely correction of the anomalies identified, during the commissioning and in the course of the routine operations, in the Copernicus and multi-mission infrastructure for the operations of the Sentinel-3 and Jason-3 missions as well as for the provision of the other Copernicus operational data services (e.g. S-5P, S-3 land, DIAS).

- Ensure the provision of external operations support to Jason-3 operations, including industrial support to the space segment.

- Organise and support the yearly Ocean Surface Topography Science Team meeting (OSTST).

- Carry out the Jason-3 mission performance review (i.e. REVEX) with Jason-3 programme partners.

EUMETSAT will conduct (amongst others) the following actions related to the short term evolution of the Copernicus space infrastructure:

- Complement the evolution of the EUMETSAT Multi-Mission Infrastructure to continue supporting safely the operations of the Sentinel-3 and Jason-3 missions and other Copernicus operational data services.

- Complement the implementation of the changes to the EUMETSAT part of the Sentinel-3 Ground Segment to support the processing, archiving and distribution of additional products.

- Complement, as necessary, the bandwidth for dissemination and/or data access link capacity to ensure the performance of the data services and their associated evolutions during the operational phases, including S-3A&B L2 land products over Africa, S-5P NRT products, Jason-3 supporting products from CNES and S-3A AOD & FRP products.

– Implement or enhance the interoperability and related interfaces to other entities of the

– Copernicus ecosystem;

– Implement and test evolutions of EUMETSAT's multi-mission infrastructure to enable the DIAS platform to operate in coherence and synergy with other operational services and to support the delivery of Copernicus products to other DIAS.

2019 Planned Procurements

[to be completed]

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Effective and efficient management of Copernicus Space Component operations for Sentinels-3, Jason-3 and dissemination of Sentinel-5p;

(2) Production, calibration, validation, processing and archiving of Sentinel data and products, in line with user requirements.

INDICATORS

(1) End-to-end Availability of Sentinel Data Access Services

(2) Total Volume of data provided to Users

(3) Timeliness of Data delivery

(4) Number of registered users

(5) Data Centre User retrieval mean response time & order profiles

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European organisation for the Exploitation of Meteorological Satellites (EUMETSAT), in line with the Commission's Delegation Decision C(2014)7248 final.

OPERATION TIMETABLE

2019 Space Segment Operations Milestones

Activity	Timetable and Milestones
Completion of Sentinel-3A ramp-up	Sentinel-3 yearly Routine Operations Readiness Review (RORR)

Ramp-up phase for Sentinel-3B and start of routine operations of the Sentinel-3 constellation;	Start and nominal progress of ramp-up phase of Sentinel-3B, to be achieved two to four months after the IOCR
Start of Sentinel-5P operational Near-Real time data services via EUMETCast	Sentinel-5P first yearly operations review
Jason-3 nominal operations	Jason-3 Mission Performance Review (REVEX)

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Operations, maintenance and evolutions of the Copernicus Space Component elements implemented by EUMETSAT	Art 58 (1) (c)	2019	XXXXX

3.2.3. ACTION 3: Internal costs of ESA and EUMETSAT

3.2.3.1. Remuneration ESA and EUMETSAT

This action will provide the necessary funds for the remuneration of ESA and to cover for EUMETSAT's internal costs, in line with the relevant provisions of the respective Delegation Agreements concluded in Oct./Nov.2014. The ESA-related amount is based on a fixed lump-sum remuneration agreed under the terms of the EU-ESA Copernicus Agreement and covers both direct and indirect internal costs. The amount that covers the cost of EUMETSAT has two components: XXXXX EUR to cover the direct costs of EUMETSAT's technical experts who are directly involved in the operations and maintenance of the Copernicus satellites; and XXXXX EUR of indirect costs fixed to 7% of the total amount of direct expenditure (indirect + procured).

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Internal costs of ESA	Art 58 (1) (c)	2018	XXXXXXX
Internal costs of EUMETSAT	Art 58 (1) (c)	2018	XXXXXX

3.2.4. ACTION 4: Evolution of the Copernicus Programme

According to the Copernicus Regulation, the European Commission is in charge of the definition of the evolution of the CSC, based on user requirements,.

The preparation of the CSC evolution and definition of new generation of Sentinel missions has produced a first version of the User and Observation Requirements in 2017 which has been provided to the Space Agencies. Based on additional interactions with stakeholders and Member States, this activity continues in order to update these requirements in 2018 and 2019.

3.2.4.1. Maintaining the Technical Baseline

Copernicus is a user-driven programme (as indicated by Article 2 of the Regulation). In order to keep track of users' needs and evolve the programme, the Commission plans to initiate a Framework Service Contract. Tasks can be activated upon need by signature of specific contracts.

Gathering user requirements in particular for application groups cutting across the six Copernicus services, as well as completing the user requirements on information processing (Copernicus services). Iteration and update of the Technical Baseline as released in 2018 (Iteration and update of User Requirements, Service Specifications, Observation Requirements) during the interaction with Member States, as well as with ESA and EUMETSAT, considering in particular the output of the Phase A/B1 studies carried out by ESA on possible CSC expansion candidate missions.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Iterated and further consolidated technical baseline documents by mid 2020.

INDICATORS

(1) Timely availability of updated and quality checked user requirements in 2019

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Specific Contract placement	Q1/2019
Delivery of inputs/reports	Q4/ 2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Gathering User requirements	Specific Contract under new Framework Contract	2019	XXXXX

3.2.5. ACTION 5: Space surveillance and Tracking (SST)

3.2.5.1. Contribution to Space Surveillance and Tracking

The Legal Base for these activities is as follows: Art. 6(2)(c) of the Copernicus Regulation foresees among the activities of the Space Component the protection of satellites against the risk of collision, taking into account the Union Space Surveillance and Tracking (SST) support framework established under Decision No 541/2014/EU.

The activities include the services which shall be provided by the Consortium resulting from the implementation of the SST support framework within the meaning of Article 7(3) of Decision No 541/2014/EU and the EU SATCEN.

Decision No 541/2014/EU has identified the following beneficiaries for the award of grants:

- the designated national entities constituting the SST Consortium of Article 10 of Decision No 541/2014/EU, on the basis of Article 190(1)(d) of the Financial Regulation
- the EU SATCEN, on the basis of Article 190(1)(f) of the Financial Regulation.

The above services shall be provided in accordance with Article 5 of Decision No 541/2014/EU and, among others, shall comprise:

- the risk assessment of collision between spacecraft or between spacecraft and space debris and the generation of collision avoidance alerts during the launch, early orbit, in-orbit operation and disposal phases of spacecraft missions;
- the detection and characterisation of in-orbit fragmentations, break-ups or collisions;
- the risk assessment of the uncontrolled re-entry of space objects and space debris into the Earth's atmosphere and the generation of related information, including the estimation of the timeframe and likely location of possible impact.

Moreover, the implementation of this action shall be with due regard to the broadest possible participation of Member States in accordance with Decision No 541/2014/EU, its implementing acts and in line with the conditions specified therein.

Accordingly, the Copernicus Regulation (see Article 8 par.2(b)) will financially contribute to the costs of these services capable of providing such protection by allocating Copernicus budget to SST related activities. The Copernicus funds shall be used only for the provision of data and services and not for the purchase of infrastructure. This action will be complementary

to the first actions which were launched under the Copernicus Work Programme 2015 amounting to EUR 4.6 million. By virtue of Article 8(5) of the Copernicus Regulation a **multi-annual grant agreement** will be concluded in 2018 for the 2018-2020 budget between the Commission and the beneficiaries identified in Decision No 541/2014/EU (i.e. the consortium established under Decision No 541/2014/EU and the EU SATCEN). This 2018-2020 grant agreement will receive a total Union contribution of EUR 28,4 million, comprising of EUR 14,2 million from the Copernicus Programme and EUR 14,2 million from the European GNSS Programmes.

Without prejudice to the adoption of the upcoming annual work programmes, the contribution of the overall Copernicus budget for the period 2015-2020 (EUR 26.3 million) shall be indicatively broken down into annual instalments as follows:

Year	2015	2016	2017	2018	2019	2020	Total
(€million)	4.6	3.4	4.1	4.4	4.9	4.9	26.3

Hence, the annual instalments for 2016 and 2017 were respectively of EUR 3.4 million and EUR 4.1 million (equal to EUR 7.5 million for both years).

The annual instalments for 2018, 2018 and 2019 will be respectively EUR 4.4 million, EUR 4,9 million and 4,9 million.

Essential selection criteria:

- financial capacity of the applicant to maintain the activity throughout the period during which the action is being carried out
- operational capacity of the applicant to carry out the proposed work, based on the competence and experience of the beneficiaries.

Essential award criteria:

- The essential award criteria shall relate to the relevance, impact, quality, visibility, budget and cost-effectiveness of the proposed EU action.
- Expected Output of the Implementing Measure

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) The operation of a sensor function consisting of a network of ground-based or space-based existing national sensors to survey and track space objects;

(2) The operation of a processing function to process and analyse the SST data captured by the sensors, including the capacity to detect and identify space objects and to build and maintain a catalogue thereof; and

(3) The operation of a service function to provide SST services to spacecraft operators and public authorities.

(4) Facilitating broadest possible participation of Member States, whenever appropriate, in accordance with Article 7 of Decision No 541/2014/EU.

INDICATORS

(1) Availability of the sensor, processing and service functions.

(2) Increased participation of Member States

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation.

The Commission shall implement the budget through direct management mode by means of a multi-annual grant containing an overall budgetary commitment for the years 2018-2020 broken down into annual instalments awarded **without a call for proposals to an identified beneficiary**, which shall be the Consortium resulting from the implementation of the SST support framework within the meaning of Article 7(3) of Decision No 541/2014/EU as well as the EU SATCEN.

The maximum possible rate of co-financing of the eligible costs is up to 100% of the total eligible costs, without prejudice to the co-financing principle.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Space Surveillance and Tracking	Grant to an identified beneficiary	2018	XXXXX

3.3. Section 3 – In-situ component Budget Line 02 06 01

3.3.1. ACTION 1: In-situ coordination

3.3.1.1. In-situ coordination

The baseline overview of the Copernicus In Situ Component and fundamental cross-cutting elements will be further developed and consolidated in 2019.

In 2019 the EEA will continue to focus on three primary strands of activity:

– Overview. The EEA will maintain an overview of the Copernicus In Situ Component across and in collaboration with all six Copernicus Services. The overview shall help emphasising the importance of in situ data, identifying and solving critical data gaps, and support awareness raising activities;

– Awareness. The EEA will, in close collaboration with the Copernicus Services, improve stakeholders' knowledge and understanding of the Copernicus In Situ Component;

– Access. The EEA will improve access to critical in situ data for Copernicus Services by operating dedicated data portals and creating partnership agreements with selected data providers.

These activities will be carried out in close collaboration with the Copernicus Services and relevant in situ data providers.

The specific activities of this action will depend on the key activities outlined in the Delegation Agreement and the Copernicus Services' needs. The EEA will work closely together with the Copernicus Services to ensure that, in particular, cross-cutting present and future in situ data gaps are identified and efficiently managed to avoid duplication of effort, and to maintain an efficient division of tasks between the Copernicus Services and programme level as regards in situ data. Prioritisation and scheduling of activities will be done in close collaboration with the Copernicus Services in accordance with changing needs and boundary conditions.

Overview

The overview of the Copernicus In Situ Component is maintained and communicated by the EEA through a set of information products. The Copernicus In Situ Component Fact Sheets will be updated as necessary (one fact sheet per service component containing overall information on e.g. key in situ data requirements, data sets used, use cases, and in situ data gaps and other related challenges); and one major update of the Copernicus In Situ Component State of Play Report is scheduled for 2019 (a report summarising the current situation of the Copernicus In Situ Component on a service by services basis, including a description of main cross-cutting gaps, challenges and risks, and the expected evolution of the Copernicus In Situ Component). However, focus will be on detailed analysis of identified cross-service gaps, challenges, and risks and development of proposals for mitigating activities; including identification of needs for new research and development activities and guidance to on-going, relevant research projects. In 2019 the EEA will perform an initial analysis of the potential impact of the expected evolution of the Copernicus Space Component on the Copernicus In Situ Component. The analysis will specifically consider the Copernicus Greenhouse Gas Mission and associated requirements for in situ observations.

The exact scope of these analyses and supporting thematic reports will be identified and prioritised in cooperation with the Copernicus Services. If requested the EEA may provide expert support to the Copernicus Services in regard to the development and specification of new products and the resulting needs for in situ data; and in relation to evaluation of tenders or similar.

The Copernicus In Situ Component Information System (CIS2) will be maintained and updated with detailed information about in situ data requirements, gaps, and in situ data sets in use across the six Copernicus Services. The information will be traceable to the Copernicus Services' product catalogues, and will thus provide a detailed picture of the Copernicus In Situ Component as seen from the Copernicus Services' point of view. New and updated information will be quality controlled by the Copernicus Services before being released on a biannually

basis to the public. In 2019 focus will also be on the analysis and visualisation of the information available in CIS2.

Awareness

The EEA will continue to focus on awareness raising activities aiming at highlighting the functioning and importance of the Copernicus In Situ Component to all stakeholders, i.e. both users and providers of in situ data, and the significance of member states' contributions. To meet this objective the insitu.copernicus.eu website will be maintained and kept updated with information relevant to the Copernicus In Situ Component. In particular will the Copernicus In Situ Coordination Newsletter be updated on a regular basis. Furthermore, the EEA will take advantage of selected opportunities, e.g. conferences, workshops and user meetings, to inform about the current status and the expected evolution of the Copernicus in situ component. These awareness raising activities will be coordinated with the Entrusted Entities and the European Commission.

Access to data

The Copernicus Reference Data Access Node (CORDA) will be maintained and operated by the EEA. In 2019 focus will be on content management and in particular on making INSPIRE compliant data available via CORDA, including harmonised and downloadable INSPIRE Annex I data. Preparatory work as regards selected Annex II and III data sets will be initiated.

In parallel, EEA will ensure operational provision of up-to-date air quality data through the established Eionet core data flow. If access to other in situ data from Eionet core data flows is required, the EEA will cooperate with the relevant Copernicus Service(s) to find an appropriate solution.

The EEA will cooperate with relevant European networks and organisations such as Eionet, EuroGeographics, EuroGeoSurveys, EuroGOOS, and EUMETNET (involving the WMO) to exchange information and further develop and explore the partnership and data access agreements that have been concluded. Likewise the EEA will cooperate with other relevant coordination initiatives such as European Research Infrastructures (e.g. ENVRIplus), United Nations Initiative on Global Geospatial Information Management UN-GGIM (Europe), explore Copernicus International Agreements with the aim of improving access to relevant in situ data, and provide contributions to the GEO Foundational Task on GEOSS in situ earth observation resources.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) The dedicated data portals operated by the EEA, partnership and data access agreements with selected data providers, and gap analysis activities will improve access to critical in situ data for the Copernicus services;

(2) The overview of the Copernicus In Situ Component will be maintained and updated to appropriately reflect the status of the Copernicus In Situ Component across all six Copernicus Services. This will be achieved through the release of information products and the Copernicus In Situ Component Information System;

(3) The stakeholders' knowledge and understanding of the importance and functioning of the Copernicus in situ component will be improved.

INDICATORS

(1) The number of in situ data requirements registered in the Copernicus In Situ Component Information System increases 25 % from beginning of Q1 to end of Q4;

(2) The Copernicus In Situ Coordination Newsletter has been published twice in 2019. The number of subscribers of the Copernicus In Situ Coordination Newsletter increases 10 % from beginning of Q1 to end of Q4;

(3) The number of registered data sets, available to Copernicus services through CORDA, will increase with 10 per cent from Q1 to Q4.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Environment Agency (EEA), in line with the Commission's Delegation Decision C(2014)9030 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Release of version 2 of the Copernicus In Situ Component Information System	Q3/2019
Updated version of the Copernicus In Situ Component State of Play report available	Q2/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
In-situ coordination	Art 58 (1) (c)	2019	XXXXX

3.3.2. ACTION 2: Reference data provision for cal/val activities

3.3.2.1. Reference data provision for cal/val activities

This activity is aiming at provision of reference in-situ data for calibration and validation of satellite data. A special emphasis will be given in 2019 to the combined operational capability Sentinel-3a and 3b.

The task will be addressed through the delivery of high quality in situ bio-optical reference measurement and data analysis to assess the accuracy of satellite ocean colour data products from Sentinel 3 and synergistic third party missions. This will also involve, but is not restricted to, the operational deployment of the autonomous radiometers included in the Ocean Colour component of the Aerosol Robotic Network (AERONET-OC) and targeted oceanographic campaigns. Collaboration with European and international partners (e.g., ESA, EUMETSAT,

US National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Institute of Standards and Technology) will ensure that in situ sensors absolute radiometric inter-calibration, the necessary update of the relevant data processors, and the final quality control of the data products are going to be publicly accessible.

The support will cover the needed acquisition, operation and servicing of autonomous radiometers for multiple sites around Europe.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Multiple site bio-optical data

(2) Validation report

INDICATORS

(1) Timely availability of multiple site radiometer data for validation

(2) Timely completion of analysis in validation report

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Validation play report	Q3/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Cal-val data provision	Specific contract in existing Framework 2016 contract	2019	XXXXX

3.4. Section 4 – Copernicus programme evaluation Budget Line 02 06 01

3.4.1. ACTION 1: Expert Support

3.4.1.1. Expert Support

The Commission will make use of experts to support:

– The assessment of the technical and scientific feasibility of the objectives of the Copernicus programme and the proposed solutions in all the programme's components;

– The technical and scientific validation and review of the deliverables, solutions and results supplied by the operators of the Copernicus programme;

– The assessment of the implementation measures proposed or carried out by the operators of the Copernicus programme

– In assessing the objectives and solutions under paragraph a), the experts will consider the fitness of operational services and infrastructure to meet programme objectives, and the effectiveness of solutions put in place since the programme start in 2014. Experts will be asked to render recommendations on the work programmes, plans and scenarios or any decision concerning the objectives to be achieved by the Copernicus programme.

– Addionally, the Commission will continue to make use of these Experts to provided independent advace and analysis in the definition of baseline requirements for potential Copernicus evolutions, including space segement, ground segement, modelling and Service infrastucture.

– The validation and review of deliverables under paragraph b), solutions and results shall provide the concerned Copernicus Units with technically and scientifically sound reliable opinions on the work carried out by the operators, including by their service providers along the delivery chain. These opinions will support the concerned Copernicus Units with their decisions to pass for payment the requests submitted by the operators.

– The assessment to be provided under paragraph c) will provide an analysis of the effectiveness and improving the use and integration of Copernicus and earth observation data by public sector and other users. This will support the Commission in the adoption of the work or implementation programmes submitted by the Copernicus operators and will feed back into the setting and review of the programme objectives in paragraph a).

– These experts may also be used to provide expertise and advice in other relevant areas, such as the inter-comparison of Copernicus products and services with other global efforts, and with initial emphasis on the external fitness for purpose (F4P) Copernicus Climate Change Service support, the definition of requirements for the Data Warehouse, the definition and implementation of the Copernicus Web Portal, spatial data and information acquisition and processing, or standardisation. Furthermore, the experts may be asked to develop a forward vision on the challenges of the 'Big Data era' (possibly in concert with related H2020 projects and Linked Open Data technologies).

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Analysis, advice and recommendations in the form of written reports.

INDICATORS

(1) Number of experts solicited;

(2) Number of person/days contracted.

IMPLEMENTATION METHOD

Direct management in accordance with Art 58 (1) (a) of the Financial Regulation (sub-delegated to JRC).

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Expert support & assessment	Direct expert contracts	2019	XXXXX

3.4.2. ACTION 2: Performance studies and support

3.4.2.1. Performance studies and support

The Commission may find it necessary to support its assessments of the Copernicus programme through additional performance studies, targeted at the programme as a whole or at specific aspects thereof.

The aim is to assess achievements of the programme in an ongoing manner, review its implementation status, with respect to its objectives, the development and the evolution of all its components, the use of the resources, the market penetration and the competitiveness of the European downstream operators. The impacts of the Copernicus data and information policy on stakeholders, downstream users, business, as well as on national and private investments in Earth observation infrastructures are also going to be assessed. Furthermore, the evaluation will concern the governance and management structure performance and the international activities. Attention will also be paid to analysing and supporting the use and uptake of Copernicus/ earth observation data by public sector users as well as the operation of the Data Warehouse and the possible integration of additional data into Copernicus.

Further the Commission may launch support studies to further investigate the technical feasibility and the operational maturity of certain evolutions considered for the Copernicus programme and its components;

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Analysis, advice and recommendations in the form of written reports.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Specific Contract placements	2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Performance studies	Specific Contracts under Framework Contract	2019	xxxxxx

4. PART 2 – COPERNICUS SPACE DATA FOR SOCIETAL CHALLENGES AND GROWTH

This part shall cover four sections: Access, exchange and dissemination of data (1), User uptake, digital market downstream services and support measures for data exploitation and use (2), Communication and outreach (3), International visibility of Copernicus (4). Specific performance indicators are defined action by action.

Two overarching indicators shall apply to all sections:

- Total number of registered users (showing trends[1] and including a differentiation between public and private entities) and total number of active[2] users;
- Total volume of data disseminated and accessed.

4.1. Section 1 – Access, exchange and dissemination of data Budget Line 02 06 02

4.1.1. ACTION 1: Ground Segment Data Circulation, Dissemination and Network Services *Operations and Copernicus Data and Information Access Services (DIAS) activities*

4.1.1.1. ESA

Limited to the CSC operations entrusted to ESA, ESA will manage and coordinate the data circulation, data dissemination, data access and network services.

The procured network infrastructure and services interconnects the different centres through the data circulation capacity and provides access to external users through the dissemination capacity. The basis and benchmark of this activity are the Functional Requirements for the Copernicus Data and Information Access Services developed and approved by the Task Force on Copernicus Ground Segment and Big Data.

ESA will mainly focus on the continuation and improvement of the data circulation, dissemination and network services, including:

- Interconnection of the different centres through the data circulation capacity, for exchange of e.g. products, auxiliary data, monitoring information;
- Provision of access to external users of Sentinel core products through the dissemination capacity;
- Provision of general network services (e.g. network security services, remote access services, hosted processing[3], research and support services).
- The management of the Copernicus Data and Information Access Services (DIAS) in operation.

The Data Circulation, Dissemination and Network Services Commitment and Costs 2019 will cover in particular the following activities:

- Operations of the Data Circulation, Dissemination and Network Services: Activities include the data circulation and data dissemination operations. Furthermore, operations

1 Increase/decrease or change of profiles depending on available information

2 Active users are registered users who perform at least one complete product during the reporting period (quarterly or monthly)

3 To be implemented on DIAS resources

of the network services will be covered. This will also include deployment of enhanced functionalities, e.g. data dissemination adaptive and perfective maintenance, increased network bandwidth etc. in line with the Functional Requirements for the Copernicus Distribution Services and the Data and Information Access Services (DIAS).

– Operations of the Copernicus Data and Information Access Services (DIAS): Activities include the DIAS start of initial services addressing the provision of access to Copernicus data and information (so called back-office services). Offering of further functionality (so called front-office services) by the DIAS providers to third party and end users, although not funded under this Activity, will also be closely monitored and reported.

Considering the evolving user scenario, the CSC data circulation, data dissemination and network services operations is conducted according to a 'design to cost approach', i.e. within the limits defined in the related budget. In this respect, the process of continuous data dissemination enhancements, started in 2014, will proceed in order to further improve the reliability and quality of service, as well as to ensure the evolution of the data hub software to meet user needs.

The corresponding "*data dissemination enhancement step-1*" (see table and milestone below), covering the time frame 2014-2016, included implementation of numerous features such as integration of Sentinel-1A, -2A and 3-A data flows, deployment of a set of data hubs tailored to different use typologies, provision of the Data Hub software (DHuS) in an open source framework, and new user interfaces. This process will proceed with the so-called "*data dissemination enhancement step-2*".

ESA will implement Copernicus Data Information Access Services according to the 'Functional Requirements for the Copernicus Distribution Services and the Data and Information Access Services (DIAS)'. The scope of this activity encompasses the operation of four DIAS' under parallel industrial contracts with four industrial providers.

Planned Procurements

Title	**Description**	**Timeline**
Data Circulation, Dissemination and Network (H3)	Allocation for implementation of data circulation, dissemination and network services. In particular addressing data dissemination adaptive and perfective maintenance, increased network bandwidth	Q2
Data Circulation, dissemination and Network services - operations	Procurement: direct negotiation with relevant service providers and open tenders	Q2

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Pursuit of successful Sentinel data dissemination including towards the new DIAS providers;

(2) Start Copernicus DIAS initial services.

INDICATORS

(1) Data Circulation, Dissemination and Network

(2) Total volume of data made available and volume of data made available for each Sentinel in line with the CSC performance requirements;

(3) End-to-end service availability for the data circulation and dissemination capacity;

(4) Number of registered users per user category;

(5) For each Sentinel and aggregated on a monthly basis, number of users downloading Sentinel products;

(6) DIAS;

(7) Number of contracts signed and Service levels agreed;

(8) Volume of data accessible on the user access platform;

(9) Number of user initiatives in preparation;

(10) Measure of user satisfaction based on direct feedback.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Space Agency (ESA), in line with Decision C(2014)7248 final.

OPERATION TIMETABLE

Milestones and accomplishments

Activity	Milestone
Sentinel data used by the Copernicus services and distributed for users	Routine access to Sentinel data. Opening of Sentinel -3B and Sentinel-5P data access
Data dissemination enhancement Step 2	Completion of Sentinel data dissemination enhancement Step 2
Copernicus DIAS	Services on Copernicus DIAS

Explore and showcase CSC benefits	Publish reports and examples of Sentinels- derived socio-economic benefits

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Data Circulation, Dissemination and Network	Art 58 (1) (c)	2019	XXXXXX
Platform evolution of Copernicus data distribution	Art 58 (1) (c)	2019	XXXXXX

4.1.1.2. EUMETSAT

EUMETSAT will implement, in synergy and cooperation with Mercator-Océan and ECMWF, Copernicus Data Information Access Services according to the 'Functional Requirements for the Copernicus Distribution Services and the Data and Information Access Services (DIAS)'.

The scope of this activity encompasses a number of procurements related to the development of the DIAS benefiting from the experience of partners in EUMETSAT data and CAMS, CMEMS and C3S information. In 2018, the DIAS V0 was put into operations and procurements for DIAS V1 have started. Early 2019 DIAS V1 will be put into operations followed by DIAS V2 towards the end of the year.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Implementation of Data Information Access Services V1, V2

INDICATORS

(1) Volume of data accessible on the DIAS

(2) Number of satisfied users

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement, in line with Decision C(2014)7248 final.

OPERATION TIMETABLE

The baseline contracts duration will be two years plus two options of one year of extension.

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
DIAS	Art 58 (1) (c)	2019	XXXXXX

4.1.2. ACTION 2: Data accuracy, reliability, veracity and integrity for the benefit of users

4.1.2.1. Data accuracy, reliability, veracity and integrity for the benefit of users

An action will be undertaken in order to test the Copernicus data accuracy, reliability, veracity and integrity for the benefit of users. In this context Copernicus data shall be understood at large: data produced by the Sentinels plus others like reference data, in situ data, cartographic data, digital elevation models etc.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Implementation of the project on data integrity

INDICATORS

(1) Identification of potential issues

(2) Number of resolved issues

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement, in line with Decision C(2014)7248 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Launch of the project	Q1-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Data Integrity	Art 58 (1) (c)	2019	xxxxxx

4.1.3. ACTION 3: Access to data from Copernicus Contributing Missions

The Copernicus Space Component relies, in addition to the Sentinels, on Copernicus Contributing Missions (CCMs), ESA, EUMETSAT, international organisations and other third party mission operators.

This action is intended to ensure to the Copernicus users, and in particular to the Copernicus operational services, the seamless provision of space-borne data from Copernicus Contributing Missions (CCM). The data from the CCM should, where affordable, be made available also to Horizon2020 projects supporting the development and evolution of Copernicus Services as well as for public sector users.

4.1.3.1. ESA

During 2019, this Activity will continue to focus on the procurement of CCMs data and licences, as well as data access operations currently on-going as per the Data Warehouse version 2 requirements and associated DWH funds.

New CORE and ADDITIONAL data sets are requested through the new release of the Data Warehouse document version 2.5 and are financially covered as part of this Activity. Generation of these data sets relies on data from a wide range of satellite missions as described below.

The technical and operational data access will continue to be managed through the ESA Coordinated Data Access System (CDS).

The Access to Contributing Missions Commitment and Costs 2019 will cover in particular the following activities:

- Procurement of data from operators of Copernicus Contributing Missions: *These missions include but are not limited to, e.g.:*
    - C-Band SAR missions in-orbit or from archived data (e.g. Radarsat series, ERS 1&2, ENVISAT archives) X-band HR SAR missions in-orbit or from archived data (e.g. TerraSar- X/Tandem-X, Cosmo-Skymed)
    - Optical HR and VHR missions in-orbit or from archived data (e.g. Spot 4/5/6/7, Proba-1, ProbaV, UK-DMC missions, Deimos-DMC missions, Pleiades, Rapideye, Resourcesat, Quickbird, Worldview, GeoEye, Imagesat, archived Landsat data and new LDCM data)
    - Altimeter Data in-orbit or from archived data (e.g. ERS, ENVISAT archives, Cryosat-2)
- *Management of the Data Access Portfolio evolution and the new CCM data and licences contracts:* These activities cover the maintenance of the Data Access Portfolio, generated in response to any evolution to the Data Warehouse document. In addition, tasks also include the management of the contracts with CCMs concerning data and licences.
- *Management and operations of the Coordinated Data Access system:* These operations include, e.g.: CSC-DA Customer Interface, CSC-DA Data Dissemination, CSC-DA Reporting, CSC-DA Quality Control and CSC-DA Coordination. In addition, the procurement of the extension of the CDS service operations, maintenance and

extension will be initiated, taking into account the results of the DWH review process, the lessons learnt from CDS v3 operations, as well as the latest ground segment evolution (e.g. Copernicus DIAS).

– Integration of new Copernicus Contributing missions within the CDS (*e.g. Skysat from Planet).*

– Completion of the integration of the new Sentinels models.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Provision of CCM data and availability to the Copernicus Services and other users.

INDICATORS

(1) CCM Data Access Timeliness: number and relevant volume of datasets available to users with a prescribed timeliness and percentage available within the timeliness required;

(2) CCM Data quality: percentage of datasets provided to users which are conform to quality requirements;

(3) CCM Data Reuse: Number and percentage of datasets reused by service acquiring the original data;

(4) CCM Data Access Registration timeliness: percentage of new registered authorised users having access to data within the timeliness defined in the requirements;

(5) CCM Data Access Licenses: Number of licenses signed with CCM data providers;

(6) CCM Data Use and Volume: Number of distinct organisations using CCM Data and their respective download activity in volume.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European Space Agency (ESA), in line with Decision C(2014)7248 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Acceptance of the various lots of deliverables	Q1/2019-Q4/2019
Semestrial Implementation report	Q2/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Data Access from contributing Missions managed by ESA	Art 58 (1) (c)	2019	XXXXXXX

4.1.3.2. EUMETSAT

The following activities will be undertaken by EUMETSAT to support access to data from Copernicus Contributing Missions:

- Provide access to agreed Copernicus Contributing Mission data and products of relevance to the Copernicus services and users, based on cooperation(s) established or to be established by EUMETSAT with Partner organisations; ensure processing of such data into relevant products, when appropriate.

- Perform the dissemination of data from agreed Copernicus Contributing missions including Suomi-NPP (SNPP) products and data from other Third Party Missions to the Marine and Atmosphere Copernicus Services, as relevant, using the EUMETSAT multi-mission dissemination infrastructure and services and ensure management of the associated third-party data services with the partners.

- Support in the establishment and operational management of the Copernicus.eu domain including the interoperability with EUMETSAT´s data access infrastructure and services.

- Support the Commission in the implementation of the roadmap regarding the migration of the Copernicus Core Ground Segment towards an Integrated Ground Segment.

2019 Planned Procurements

EUMETSAT will provide data from its own satellite missions or through specific agreements with Third Parties, no data will be procured. Procurements under this activity mostly relate to the dissemination of the data and associated infrastructure.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Provision of CCM data and products, including Suomi-SNPP and other Third Party Missions, using EUMETSAT's dissemination infrastructure to the Copernicus Services and other users.

(2) Nominal distribution monitored through relevant performance indicators.

INDICATORS

(1) End-to-end availability of the Contributing Mission Data Access Service provided by EUMETSAT.

IMPLEMENTATION METHOD

Indirect management in accordance with Art 58 (1) (c) of the Financial Regulation through a Delegation Agreement with the European organisation for the Exploitation of Meteorological Satellites (EUMETSAT) in line with Decision C(2014)7248 final.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Nominal distribution monitored through relevant performance indicators	Q1/2019-Q4/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Data Access from contributing missions	Art 58 (1) (c)	2019	XXXXX

4.2. Section 2 – User uptake, digital markets and downstream services and support measures for data exploitation and use Budget Line 02 06 01

4.2.1. ACTION 1: Uptake of Copernicus by different sectors and thematic areas

4.2.1.1. Uptake of Copernicus by different sectors and thematic areas

Copernicus is a user-driven programme with an important impact on different societal areas involving diverse communities of users. In the previous years, various channels were set up in order to facilitate the exchange of information with the different user communities (either for example through the organisation of thematic workshops back-to-back with meetings of the Copernicus User Forum, or through the organisation of a series of Copernicus Information Sessions in the Copernicus Participating countries).

In order to make Copernicus relevant to different users and market segments, the Commission envisages a series of sector/ theme-specific, as well as cross-sectorial activities that will help to further raise awareness of the programme (such as, for example the oil and gas, agriculture, forestry, minerals and mining, transportation and insurance industries).

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Increased awareness of Copernicus.

INDICATORS

(1) Number of sessions organised

(2) Number of participants

(3) Number of industries/sectors directly involved

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Signature of Specific contracts	Q2/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Uptake of Copernicus by different user groups/ industry (non-EO) sectors	Specific Contracts under existing framework contract	2019	XXXXX

4.2.2. ACTION 2: The Copernicus initiative for start-ups

Since 2015 the Commission has developed the Copernicus Start-up Programme. It consists of four elements:

– The Copernicus Prizes;

– The Copernicus Hackathons;

– The Copernicus Accelerator;

– The Copernicus Incubation.

This comprehensive programme will accompany start-ups from the generation of a business idea to its full commercialisation. The Copernicus Prizes and Hackathons will support the generation of new business ideas. More mature start-ups will receive customized coaching

through the Copernicus Accelerator, to help them reach their next business target (e.g. developing a prototype, finding investors, getting a first client…). Finally, the Commission will finance the incubation of the most promising start-ups, so that they can reach commercialisation of their first product. The Copernicus Incubation will be open to all start-ups in Europe that apply jointly with a start-up support programme (Incubator, accelerator…), and not only to the start-ups that have participated in the Copernicus Accelerator.

4.2.2.1. Copernicus Incubation Programme

This activity shall finance phase 3 of the call for proposal no 260/G/GRO/COPE/17/10039 published and awarded in 2017.

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Copernicus Incubation Programme	Grant following a Call for proposals launched in 2017	2019	XXXXX

4.2.2.2. Copernicus Accelerator

The European Commission has developed the Copernicus Accelerator to support young entrepreneurs and start-ups developing business ideas based on Copernicus data and services. The first Copernicus Accelerator Contract was signed in 2016 and repeated in the years after.

Each Accelerator is a one-year programme starting after the award of the Copernicus Prizes. It includes:

- A 2-day opening bootcamp
- A 9-month mentoring programme with monthly interaction between mentors and start ups
- Monthly virtual courses
- Monthly newsletters
- A 2-day closing bootcamp

Priorities, objectives pursued and expected results:

(a) Promote innovation and the uptake of high-technologies in Europe;

(b) reward the work done by innovative companies and/or entrepreneurs in concrete prototype products and services, proving added-value and/or promoting services;

(c) Increase the uptake of Copernicus while giving proper recognition of the funding source of the activity;

(d) Generate viable projects/prototypes to maximize the likelihood of actual exploitation;

(e) Encourage SMEs and innovative companies to invest more in applications and thus support the European industry.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Signature of contract	Q1/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Copernicus Accelerator	Procurement or Specific contracts under Framework Contracts	Q1 2019	XXXXX

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) - A new Copernicus Accelerator to provide a mentoring service to start-ups

(2) - Copernicus Incubation Programme

INDICATORS

(1) Number of participants in the activities

(2) Number of new projects/prototypes

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

4.2.3. ACTION 3: Networks of Copernicus relays, Copernicus Academy and running of the Copernicus User Uptake Support Office

4.2.3.1. Networks of Copernicus relays, Copernicus Academy and running of the Copernicus User Uptake Support Office

In order to reach out to potential end-user communities, the Copernicus programme is also rapidly extending its own channels of promotion towards intermediate and end-user communities. An awareness structure has been set-up for the mid- and long-term perspective, ensuring a sustainable and homogeneous coverage of Copernicus Participating countries. Since

2016, the Commission has engaged with national, regional and local stakeholders for Copernicus user uptake through the creation of two Networks of Copernicus helpdesks/information points called the "Copernicus Relays" and the "Copernicus Academy".

The Relays provide stakeholders/general public/experienced users with technical assistance, and increase awareness activities. A bottom-up approach also exists since the structure is perceived as one of the user-feedback mechanisms to the Commission services.

The Copernicus Academy supports an uptake from universities and research centres, through providing course material and dedicated information for public research organisation. It also supports transition from research to commercial (spin-offs). The Copernicus user uptake support office has been created to provide any supports to the Relays and Academy (e.g. organisation of awareness activities, providing with background materials), to facilitate interactions and exchange of best practices among members, as well as to animate the Networks. The main objective of the Support Office is to ensure broad, coordinated and sustainable user uptake initiatives across Copernicus Participating States.

The user uptake support office also liaises and develops partnerships with the various user uptake key partners identified in the study on Engaging with Public Authorities, the private sector and civil society for Copernicus user uptake, most notably the Copernicus Relays for User Uptake, as well as the Copernicus Academy launched in 2016, but also other relevant networks and industry stakeholders.

The Copernicus user uptake support office also contributes to the promotion of any relevant user uptake activities through new channels of communication, including social media.

This tool maintains a user uptake initiatives action plan, supports the rendition in national action plans and also ensures cross-fertilisation of best practices between the partners.

The specific contract for the running of the Copernicus user uptake support office is based on the contract launched in 2016 and the activity shall be repeated on a yearly basis.

The Copernicus Relays should act as multipliers developing initiatives to reach two different types of objectives:

- To promote Copernicus as a source of free, open, and reliable information to meet the needs of local public services;
- To promote Copernicus as source of full, free, open, and reliable data for the development of environmental services with high commercial potential by local entrepreneurs.

An increased uptake can be achieved with the Relays' concrete involvement to broaden the spectrum of stakeholders to communities that have no direct connection with space.

Beyond an initial function of building awareness and stimulating local actors, the Network of Copernicus Relays and Copernicus Academy promotes the opportunities offered by the programme at a national level in order to develop an extensive network.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Running of the Copernicus User Uptake support office;

(2) Increased awareness raising of national Network of Copernicus helpdesks/information points.

INDICATORS

(1) measures/indicators to evaluate the effect (behaviour) on the target audiences;

(2) measures/indicators to evaluate the effort (what and how much was accomplished).

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Contract signature	Q2/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Relays Academy and Support office	Procurement or Specific contracts under Framework Contracts	2019	XXXXX

4.2.4. ACTION 4: Activities under the Copernicus Framework Partnership Agreement (FPA)

4.2.4.1. Activities under the Copernicus Framework Partnership Agreement (FPA)

The Commission has set-up a Framework Partnership Agreement for improved programme uptake in Member and Participating States. As a primary objective it shall seek to increase the number of users and applications derived from Copernicus.

The FPA will finance actions (through Specific Grant Agreements - SGAs) for the following Tiers:

(a) Tier 1: national user uptake, by promoting the use by national stakeholders. Examples include national or local awareness events, training sessions, online courses, support to the production and procurement of space applications (e.g. by public authorities), design and dissemination of promotional material, hackathons, etc.

(b) Tier 2: global actions, including European cross border user uptake and international user uptake.

– European cross-borders user uptake, comprises actions organised in several Member States, by increasing co-operation, joint awareness events exchange of best practices and creation of common products and applications; whereas

– International user uptake actions make use of the existing national and European infrastructure (such as the national research and education networks and the direct transatlantic high-bandwidth connection between Europe and South America) to develop, by concrete actions, the international co-operation agreements under Copernicus (e.g. the United States, Australia). Activities should support the internationalisation of European companies offering applications based on Copernicus and space data (e.g. matchmaking sessions with partners from third countries, business missions…)

(c) Tier 3: business solutions and innovative products and applications, by supporting innovation businesses and start-ups, their incubation and maturity and lifting administrative and legal barriers, and sponsoring the creation of new products and applications and their intellectual property rights (e.g., patents, licensing, etc.) Activities should focus on promoting innovation in the commercial Earth observation downstream sector, by providing such companies with training, networking and financing opportunities. The link with users will be strongly encouraged, in order to ensure the sustainability of the projects.

SGAs award criteria:

The award criteria for the SGAs will be the following: a) the relevance of the application to the objectives of the action; b) the visibility of the European institutions' involvement in the action; c) the impact on the target group and the multiplier effect of the action; d) the quality of the project; e) the budget and effectiveness.

Financing rate: up to 85%

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Involvement of public authorities in the implementation and the promotion of the Copernicus programme.

INDICATORS

(1) Number of institutions and authorities involved;

(2) Number of users reached.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER

Launch of SGAs	Q1/2019
Award of SGAs	Q3/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
SGA Activities	Specific Grant Agreements under FPA	2019	XXXXX

4.2.5. ACTION 5: Other activities to support the uptake of Copernicus

4.2.5.1. Other activities to support the uptake of Copernicus

User uptake can be fostered by raising awareness of how best to access Copernicus data, and providing typical use cases of Copernicus products. Users will have to be acquainted with state of the art working methods and good practices for integrating Copernicus data.

Such uptake activities will take the form of organisation of studies, surveys, workshops information sessions, customized consulting and training services to disseminate information on the Copernicus services, data and infrastructure, etc. The objective is to demonstrate the usefulness of the open Copernicus products to various communities at national, regional or European level, and to train Copernicus users and to support Copernicus coordination activities.

These activities will target the uptake of Copernicus by Regional, National or European authorities, commercial entities, universities and research centres. This should be closely linked and coordinated with existing thematic or regional networks or user groups.

One of the challenges to strengthen the uptake of Copernicus is to ensure the delivery of concrete solutions and applications which are able to match policy needs. Like most end-users needs, appropriate solutions may only be provided through tailor-made products and applications such as geospatial applications and Geographical Information Systems (GIS). The Commission shall be looking for technical support to identify, in a detailed, structured and systematic manner, where (specific policy areas) and how (possible solutions and technical applications) Copernicus and Earth observation data/information can be used – or better used – to respond to the policy needs of different Commission services.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Studies, surveys, workshops, information sessions, customized consulting and training services

(2) GIS developer's work to assess and encourage the use of Copernicus data and information and the usefulness of Copernicus to various communities at national, regional or European level.

INDICATORS

(1) number of workshops and information sessions organised;

(2) number of participants.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Contract signature	Q1/2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
User uptake	Procurement or Specific contracts under Framework Contracts	2019	XXXXXX

4.2.6. ACTION 6: Copernicus Pilot Programme

4.2.6.1. Copernicus Pilot Programme

This activity shall finance phase 2 of the call for proposal GRO/COPE/18/10555 published and awarded in 2018.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) GIS applications or pilot projects implementing EU policies based on remote sensing.

INDICATORS

(1) number of satisfied users as a result of the action implemented.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
New policy areas and economic sectors	Grant following a Call for proposals launched in 2018	2019	XXXXXX

4.3. Section 3 - Communication and outreach Budget line 02 06 01

4.3.1. ACTION 1: Communication activities and events, dissemination

4.3.1.1. Communication activities and events, dissemination

Communication activities and dissemination activities will be funded to raise awareness and increase the knowledge of users and public alike on the full, open and free-of-charge availability of Copernicus data and services. In 2019, communication activities will include:

– General programme-level communication, promoting Copernicus through active participation at major European events and international conferences, serving scientific and operational communities with presentations;

– The elaboration of communication material dedicated to users, maximising the use of already existing communication packages (video, press pack, …);

– The promotion of Copernicus through copernicus.eu website, social media, using multimedia (TV spots, YouTube and internet) using (animated) demonstrators.

– The dissemination of a "Copernicus Information Package" to relevant stakeholders, focusing on concrete success stories, access to funding, access to data etc.

– The organisation of communication events.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Improved visibility of the Copernicus programme, awareness by the general public, by partner organisations, by European and non-European institutions and actors, etc.

INDICATORS

(1) number of articles, interviews and any similar content in traditional media;

(2) number of participants to events, increased visibility on social media and other new means of communication;

(3) or any other aggregated indicator of these.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Contract placement	Q1/2018-Q4/2018

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
Communication activities	Specific Contracts under Framework Contracts or low value direct awards (average size 100 000 EUR)	2018	XXXXXX

4.4. Section 4 - International visibility of Copernicus

4.4.1. ACTION 1 : Increasing the international visibility of Copernicus

4.4.1.1. Increasing the international visibility of Copernicus

In line with the Copernicus Regulation (Article 9) the Commission has been charged to ensure the coordination of Copernicus with international activities. The objective of this action will be to help the outreach performed in various fora and conferences (such as GEO, CEOS, UNCOPUOS, SGAC, COP etc.) and will not create any new agreements/ties or exchanges of funds or data beyond the already existing ones. Specific contracts or low value contracts would be used in order to piggy-back sessions, workshops, seminars performed by international partners.

EXPECTED OUTPUT OF THE IMPLEMENTING MEASURE

(1) Increasing the knowledge of the programme in international fora and attracting new users. Diffusing knowledge on data, information and products.

INDICATORS

(1) Number of sessions, workshops, seminars, consultations.

IMPLEMENTATION METHOD

The Commission will implement the budget through direct management mode in accordance with Art 58 (1) (a) of the Financial Regulation.

OPERATION TIMETABLE

MILESTONE DESCRIPTION	INDICATIVE QUARTER
Award of Specific contracts or low value contracts	Q1-Q4 2019

BUDGET

ACTIVITY	INSTRUMENT	TIME FRAME	BUDGET (EUR)
International visibility	Specific Contracts under Framework Contracts or low value direct awards	2019	XXXXXX

ANNEX 1: MULTI-ANNUAL IMPLEMENTATION PLAN FOR THE COPERNICUS PROGRAMME

According to Article 12 of the Copernicus Regulation, the Commission shall adopt an annual work programme for Copernicus including a forward-looking implementation plan. This present document describes the actions needed to implement Copernicus over the period of 2014-2020 and takes into account evolving user needs and technological developments. In particular, the implementation plan defines and updates as necessary the scope, architecture, governance and technical portfolios of the Copernicus services. It should also take into consideration, where appropriate, elements of the Long-Term Scenario (LTS) which is prepared and updated by ESA in coordination with EUMETSAT and which establishes an overall framework for the Copernicus space component, including the potential tasks of ESA and EUMETSAT, and of the Union.

5. PART 1 – COPERNICUS COMPONENTS

5.1. Section 1: Services Budget Line 02 06 01

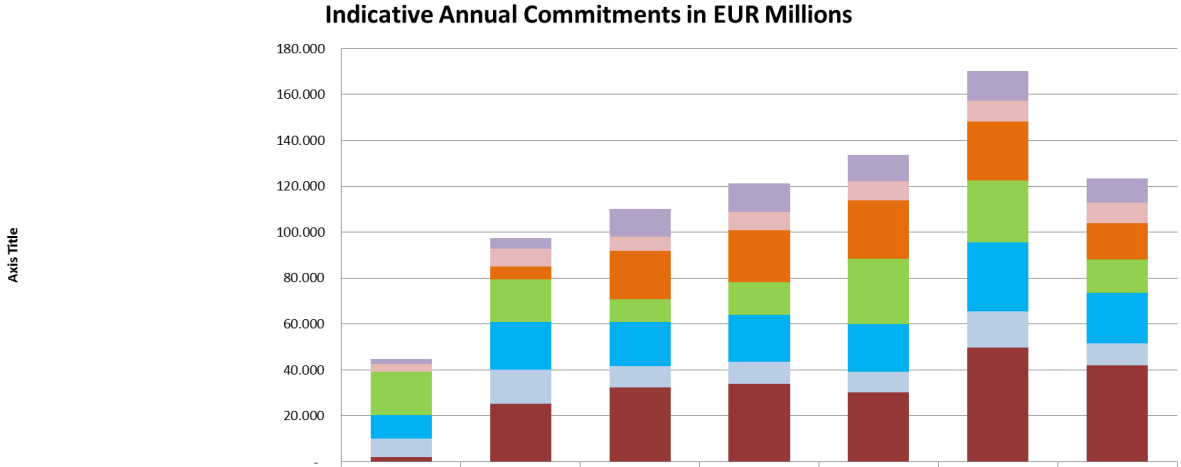
The objective of the Copernicus Service Component is to provide timely and reliable added-value information and forecasting on a wide set of geo-referenced parameters. To this end, it combines observations from satellites (largely those stemming from the Copernicus Space component) and in-situ infrastructures (such as ground, air, ship or buoy based sensors), as well as reference and ancillary data, and assimilates them into a wide set of models.

To respond to the user demands, the Copernicus Service Component is organised into six thematic services, namely the Atmosphere Monitoring Service, Marine Environment Monitoring Service, Land Monitoring Service, Climate Change Service, Emergency Management Service, and Security Service. These Copernicus services support a wide range of downstream applications in various public and commercial domains.

A set of cross-cutting activities will be carried out, such as fostering the user uptake of Copernicus data and products, the coordination of the in-situ data provision, development and deployment of advanced distribution and exploitation mechanisms for large scale data, and communication activities.

Lastly, an expert mechanism will be set-up to provide independent technical and scientific assessment of the work programmes and plans of the Copernicus programme, of the implementation measures proposed or carried out, as well as of the solutions and results provided by the programme.

The indicative budget and its evolution over the programme duration is indicated in the following table.

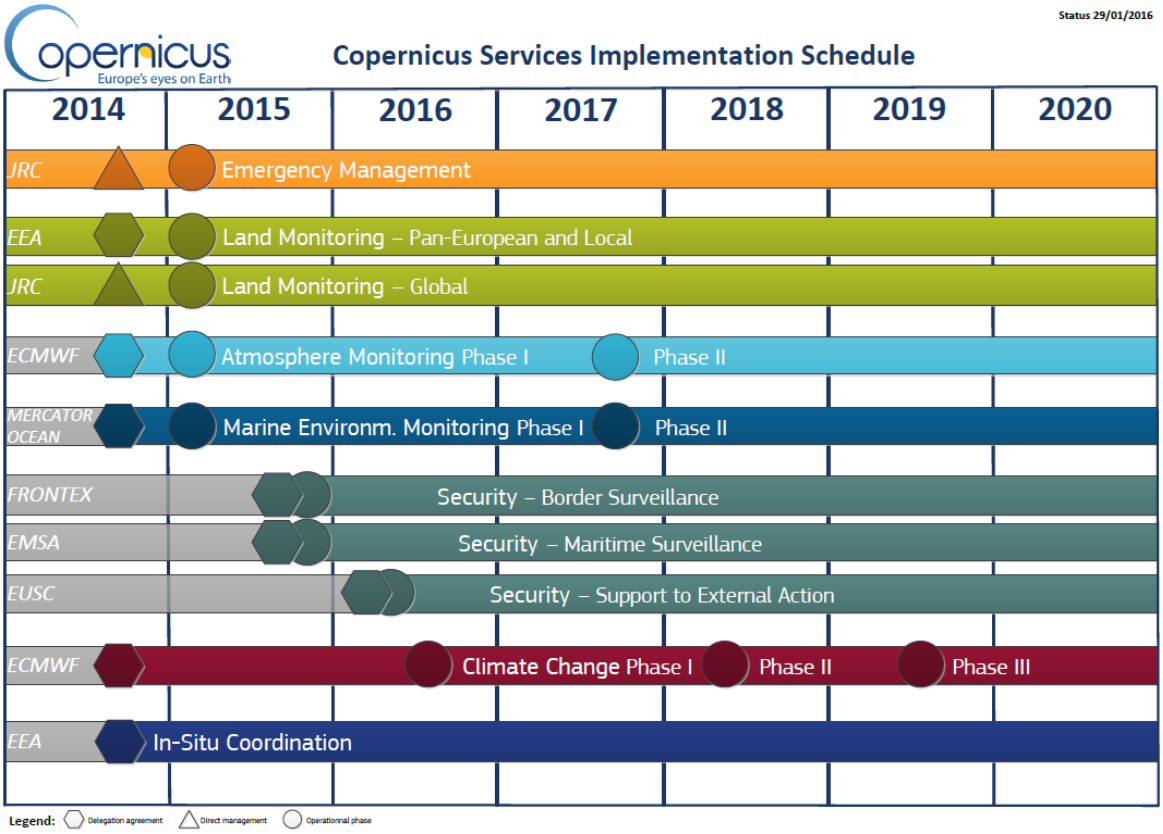


	2014	2015	2016	2017	2018	2019	2020
Others	2.195	4.727	12.147	12.411	11.561	13.000	10.500
Emergency Service (JRC)	3.480	7.606	6.046	8.000	8.500	9.000	9.000
Security Services (FRONTEX + EMSA + SATCEN)	-	5.500	21.180	22.581	25.200	25.579	15.853
Land Services and in-situ coordination (EEA + JRC)	18.886	18.563	9.768	14.300	28.500	27.080	14.383
Marine Environment Monitoring Service (Mercator)	10.100	21.000	19.445	20.385	21.000	29.840	22.230
Atmosphere Monitoring Service (ECMWF, CAMS)	8.060	14.940	9.128	9.570	9.000	15.898	9.404
Climate Change Service (ECMWF, C3S)	2.000	25.000	32.380	33.945	30.000	49.688	41.987

Services Milestones

2014	- Operational arrangements renewed for Land Monitoring Service and Emergency Management Service - Delegation Agreements (as applicable)
2015	- Atmosphere Monitoring Service ramp-up and start phase I - Marine Environment Monitoring Service ramp-up and start phase I - Security Service components (a) EUROSUR-Border Surveillance, (b) Maritime Surveillance, and (c) Support to External Actions operational
2016	- Climate Change Service entering pre-operations (stage I)
2017	- Atmosphere Monitoring Service – start phase II
2018	- Marine Monitoring Service – start phase II - Climate Change Service entering operations (stage II)
2019	- Climate Change Service entering operations (stage III) - Initial transition of the Copernicus Land Service Global Component to higher (Sentinel-2 scale) global mapped thematic products
2020	

Indicative Copernicus Service Deployment Schedule



5.1.1. ACTION 1: Land Monitoring Service

The **Land Monitoring Service** provides users in the field of environment and other terrestrial applications with high quality information based on space data combined with other sources of data. It addresses a wide range of policies such as environment, agriculture, regional, development, transport, energy as well as climate change, at EU level and also at Global level considering European commitments to International Treaties and Conventions. The Land Monitoring Service focuses on the priorities already defined by a broad consultation amongst key users: relevant Commission services within the Copernicus User Forum, the EIONET National Focal Points (NFPs), the Reference Centres (NRCs) and the International stakeholders. Four specific components (pan-European, local, global coverage and global S2 pre-processing) are proposed for the land service along the following logic: a continuation of the information time series started in the GIO phase and the start-up of new land monitoring information products.

Pan-European Land Coverage: In the Pan-European component, it is envisaged that the High Resolution Layers (HRLs) on thematic characteristics of land cover will be updated in a 3-yearly cycle; Corine Land Cover-Land Use will be updated in a 6 yearly cycle, this will allow land cover and land use change analysis. The first full series (imperviousness, forestry, permanent grasslands, wetness and small water-bodies) was deployed along the reference year 2012. The first update should thus be with the reference year 2015. These layers provide intermediate and complementary information to the CORINE Land Cover dataset that has a 6-yearly update frequency. LUCAS data will also be used during the production process for calibration and validation purposes. Product update cycle, as well as product delivery time, may be reviewed and improved based on the performance of the SENTINEL data acquisition system

and processing chains. The possibility of a continuous product update mechanism could be envisaged on the mid-term vision. Additional and complementing HRL land cover-use mapping products may also be foreseen to answer to specific policy needs, including the "Greening" Policy requirements.

Local Land: The main objective of the local land component is to provide more detailed information complementary to the Pan European component on specific areas of interest. The component should continue to cover and to focus on the mapping and change analysis of urban areas following the Urban Atlas exercises of 2006 and 2012 (3 yearly update cycle), and on the mapping and monitoring on a regular basis of high potential and endangered biodiversity areas, i.e. coastal zones, riparian areas, NATURA 2000 sites, specific areas at risk (such as alpine domain, desertification and drought prone regions).

The objective of the Global Land component is primarily to support EU policies, including development policies, at international level and the European commitments under international treaties and conventions. The Global Land component will also be a major EU contribution to the Group on Earth Observations (GEO) and to the Global Earth Observation System of Systems (GEOSS), this includes the specific support with essential variables to the GEO Societal Benefit areas, i.e. GEOGLAM (Agriculture), GFOI (Forest) and GEOBON (Biodiversity) and GEO Flagships and initiatives, including the support to SDG. The component will generate input products for the drought observation systems and for the global crop monitoring systems set up to support the implementation of the EU Common Agricultural policy and the implementation of the Food Security policy.

The first Global Land component activity produces bio-geophysical variables at worldwide level on near real time every ten days, including archive maintenance and reprocessing. This activity also includes the provision of in-situ ground observations in support of product improvement and quality monitoring.

The second Global Land component activity focuses on Hot Spot monitoring. The main objective is to provide detailed land information on specific areas of EU interest outside the European Union territory, particularly to support activities linked to the sustainable management of natural resources and biodiversity. This information will complement the bio-geophysical parameters of the first Global Land component. The activity will directly support field projects developed by EU in the framework of the EU international policies, and the set-up also of reliable reference information systems for protected areas and areas of high biodiversity value.

The Global Land component furthermore includes a specific support activity, the Global S2 pre-processing, that aims at the implementation of a service producing and delivering high pre-processing level Sentinel-2 data, as requested by a number of intermediate and final users, from public and private sectors, at European and National levels. Copernicus Sentinel-2 data are an essential source of information for most of the terrestrial applications. The provision of the data at Level 1C unfortunately does not allow an easy use and a direct exploitation of these data in to many downstream processing lines. Level 2 (atmospherically corrected) products will be provided following the ESA feasibility study. A processing chain of Sentinel-2 data at Level 3 (spatial/temporal cloud-free composites and global/continental mosaics) will allow the provision of data ready for end user applications. This is particularly critical for change detection analysis. Considering that the volume of Level 3 datasets is generally smaller than that of lower level datasets, this approach should also facilitate the dissemination of the data to a wider community. The interoperability and thus the possibility to combine Sentinel-2 data and LANDSAT mission data are also essential elements to consider in this context and can serve many applications, including applications in the forest, inland water monitoring and

agriculture sector answering to the REDD+ and Common Agriculture Policy needs. Based on the initial effort on this in 2017 and 2018 and the generation of a Sentinel-2 Global mosaic for surface refelectance, user consultation will begin so that thematic product production would start in 2019. In the context of 2019 initial global scale continuous products, the JRC together with the EEA will explore the possibility of envisaging ~20m resolution for inland water, forest and crops whilst ensuring coherence between pan-European and global products.. These efforts would represent a first step towards the next generation of user driven global products for the Copernicus Land Service.

In the development of the activities of the four components, the contributions and expertise of the Member States will be maximized in compliance with the subsidiarity principle and in a cost efficiency manner using, when possible, a decentralised implementation approach.

The evolution of the service with new activities will be based on the results of pre-operational research projects and should be defined through a transparent user consultation process, according to both EC and national user requirements. With the increased availability of SENTINEL data, potential new activities include, without being exhaustive, the development of products designed for cryosphere monitoring, in the raw material monitoring domain, for inland water monitoring (including water quality, quantity and illegal water abstraction) and to support surveillance and environmental inspection.

The action will also include the validation of the services and products provided (addressing as well methodologies as appropriate), meeting international quality insurance, certification and standard systems. External expertise may be employed to support this process. Further, outreach activities on service level will be carried out specifically to the related scientific and professional communities.

The implementation of similar products at global, pan-European and local scale level require as well essential work on the harmonisation and calibration between such products for the distinct scale levels of production, so as to ensure coherence and consistency throughout the land portfolio. This, as a minimum, requires sound coordination between EEA and JRC, and may ultimately have an impact on the distribution of tasks in order to ensure a maximum level of efficiency and coherence within the overall land monitoring portfolio.

5.1.2. ACTION 2: Marine Environment Monitoring Service

The **Marine Environment Monitoring Service** provides regular and systematic reference information on the physical state and dynamics of the ocean and marine ecosystems for the global ocean and the European regional seas. This capacity encompasses the description of the current situation (analysis), the prediction of the situation a few days ahead (forecast), and the provision of consistent retrospective data records for recent years (re-analysis).

The Copernicus Marine Monitoring Service assimilates earth observation data as well as in-situ data into 4-D models. Main parameters calculated and provided are currents, temperature, salinity, sea level, sea ice and biogeochemistry. These parameters support marine and maritime applications and related EU policies, e.g. in the field of maritime safety, marine and coastal (monitoring of coastal zone is of mutual interest for both the Land monitoring service and the Marine Environment monitoring service) environment, marine resources and weather, seasonal forecasting and climate.

The production of these Essential Ocean Variables and information products are based on distributed production centres namely:

(1) Eight Thematic Assembly Centres processing both in-situ and satellite observations in Near-real-Time and also as long time series, either to be delivered as product to the user or to be assimilated into the models.;

(2) Marine Forecasting Centres: generating model-based products on the ocean physical state and biogeochemical characteristics at global scale or for each of the European regional sea basins.

The marine service also operates a strong and effective user interface consisting of central contact points for inquiries and error reporting, sound and coordinated response activities, and training based on user demand and feedback are essential.

The Copernicus marine service acts also pro-actively to promote Copernicus in the public or private sector and towards the citizen, including also market surveys in order to expand this user base to a larger sectorial audience. If the main target is to support European and international policy related to the monitoring of the environment, the sustainable management of resources and protection of citizens and goods, the Copernicus marine service supports European goals for job creation and European competitiveness.

The Copernicus marine service multi-annual implementation plan has been structured around three phases:

- Ramp-up: to establish administrative processes corresponding to the chosen management mode as well as engineering tasks to enable production and future operations;

- Phase-I: Full fledge implementation of the service and product portfolio based on a sustainable and highly operational distributed system, and a qualification process of the products content; setting up of a continuous service improvement process gathering users'needs and scientific outcomes;

- Phase-II: Full-scale operations, service and user uptake scaling up based on the continuous service improvement process outputs.

Phase II will run from 2018 to end 2020. The main objectives will be twofold:

(1) **dramatically increase user uptake** of the Copernicus Marine Service:

- increase the number of regular users;

- foster user uptake by organizing wide training sessions in Europe to support European uptake, and offering a better service interface (renewed Web portal, new data visualisation tools);

- promote and raise awareness amongst user and stakeholders' communities, at the European and international level, and liaise with international program such as GEO, WMO/IOC JCOMM and GODAE Ocean View;

- strengthen CMEMS market penetration.

(2) keep the product and services highly attractive by:

- **delivering improved products with better performances** based on R&D advances and observation capacities, adapting service content to users' regular feedbacks, keeping a high level of quality and continuity of service;

– **proposing an improved framework for accessing and using the products with new generation tools to access data**, to reduce further technical barriers (incl. links with Copernicus DIAS platforms, big data initiatives in Europe).

CMEMS products will be improved over the period 2018-2020 by the inclusion of new input data, the integration of new algorithms (data processing, data assimilation and modelling), marginal updates of the product characteristics to meet users' request, or the extension of their time window (e.g. for multi-year simulations).

During the Phase II, a particular attention will be paid on CMEMS biogeochemical products (Chl-A, nitrates, pH, CO2 fluxes, O2) improvements in the context of the Marine Strategy Framework Directive (MSFD), ocean state/health assessment, climate and climate change studies.

The following improvements in the CMEMS product portfolio foreseen are thus (ranged by areas of benefits[4]):

Maritime transport and marine safety

– Improved models (resolution, tides), ocean/wave coupling.

– improved assimilation schemes.

– new observed surface current products.

– new ice products (thickness) and assimilation.

Biogeochemistry: ocean health monitoring and marine resource management

– Improved CMEMS biogeochemical (BGC) products (satellite, in-situ, models).

– Assimilation of ocean colour in all BGC models. Assimilation of BGC Argo.

– Carbon, CO2 fluxes and pH from in-situ observations and models.

– New micronekton products (off line).

Coastal : better meet requirements from coastal zone users

– Improving satellite products (e.g. OC), new in-situ observations (HF Radars)

– Improved models (e.g. resolution, tides) to facilitate the coupling with

– downstream coastal models.

– Strengthening interfaces with downstream coastal models.

Ocean and Climate

– Longer time series (> 30 years) for reprocessed observations and ocean reanalyses – closer to real time : Circulation, Sea Ice, Waves, Carbon (CO2) and biogeochemistry. Global/Regional.

[4] As an illustration of the expected benefit for users, although there is one single list of products available to all users in all areas

Improved assessments (expertise)

- New Ocean Monitoring Indicators and Ocean State Reports: from climate to ocean health assessment and applications (e.g. fishery and aquaculture management, marine renewable energy).

Access to the services will be improved with :

- Advanced catalogue: additional search criteria, entry in catalogue by areas of benefits, by user community (e.g. MSFD, aquaculture, ice services, ship routing).
- New & interactive visualisation of the products.
- Links of CMEMS with other Copernicus catalogues (e.g. C3S, Land, Security). Links with EMODnet catalogues.
- Support the development (User Uptake) and promote downstream services through CMEMS service/portal and inform users.
- Mobile applications developed by the downstream sector.

Production centres

The TACs production centres will benefit from new satellite and "in-situ" data from the following missions and will update their production accordingly:

- Sentinel 3B, for sea surface temperature, sea surface height, ocean color and sea waves;
- Sentinel 1, for waves;
- Sentinel 2A and 2B, for ocean colour;
- NOAA/JPSS-1 (VIIRS), for ocean colour and sea surface temperature;
- improved ocean color products for coastal zone based on S2, S3, MSG/Seviri;
- Cryosat-2 and SMOS, for sea ice thickness;
- Inclusion of HF radars, pCO2 and pH data in the situ component.

Modelling capacity evolutions will incorporate achievements from the R&D contracts through a development/validation/operations process as already experienced in the first phase with one major version released annually. Major improvements foreseen relate to:

- increasing resolution in space and time up;
- better representation of straits and estuaries;
- improving assimilation schemes, in particular for biogeochemical data;
- assimilation of new types of data (sea ice thickness products);
- developing new surface wave products;

– coupling the ocean circulation with waves to produce consistent estimates.

Two new TACS will be implemented from 2018 for waves and multi-obs products.

– **Multi Observation TAC**: Data observation service for ocean observational data, combining, via statistical methods, satellite and in-situ measurements of the oceans. This service will produce data that will be complementing products derived from CMEMS modelling and data assimilation centres

– **Wave TAC**: Data observation service for ocean waves observational data at a global scale and at the regional scales of European seas. This service will produce, from satellite data from the ground segment of the space agencies, top-level physical data in real time and in delayed time that will be integrated as part of the Copernicus Marine Environment Monitoring Service.

Modelling capacity evolutions will incorporate achievements from the R&D contracts through a development/validation/operations process as already experienced in the first phase. Major improvements foreseen relate to:

– increasing resolution in space and time up;

– better representation of straits and estuaries;

– improving assimilation schemes, in particular for biogeochemical data;

– assimilation of new types of data (sea ice thickness products);

– developing new surface wave products;

– coupling the ocean circulation with waves to produce consistent estimates.

Data assimilation techniques will evolve also to optimally exploit the considerable investment in observation infrastructure and increase of data flow, especially through the Sentinel constellation.

Ultimately, the objective to improve the overall quality of products for the whole portfolio, support a better use of marine reanalyses, develop further the use of CMEMS products in the polar regions on one hand, and of biogeochemical variables on the other, will remain central.

Framework Service Elements

This two-fold program component– "service evolution" for bringing in upstream innovation (data) and "user uptake" for downstream innovation (user) – will continue from 2018 to 2020 and be strengthened.

Contribution from science to evolution, R&D:

– The CMEMS Service Evolution Strategy: R&D priorities document designing the evolutions to be implemented by the MFC/TACs over 2018-2020 period will be updated.

– Following the second call for tenders for CMEMS Service Evolution R&D projects opened in 2017, a new batch of 2-year contracts should cover the period 2018-2019.

– These projects will mainly impact the Marine Service after 2021 and thus will set a clear programmatic constraint and provide an essential input on the definition of the long term strategy for the post 2021 period.

Contribution from users to uptake, downstream sector:

– Successive batches of calls for tenders will be further issued for user uptake small contracts.

– In 2018, 2019, the second batch of contracts will be run to address new services and new communities;

– In 2019, 2020, a third and last batch of contracts will be placed to maintain the user uptake activity at high level.

– The 3 batches of projects related to uptake will support the work to scope the priorities in terms of services for the next MFF and will provide inputs to further R&D contracts if thus required.

Communication Training and Cooperation

Actions will be widely strengthened over 2018-2020 in order to contribute to substantially increase CMEMS user base and visibility among targets and also to improve CMEMS awareness at International level, in consistency with Copernicus strategy.

– Training activities won't be managed through MFC and TAC contracts (as until April 2018 in Phase I). From 2018 onwards and in order to be more present in Member States (MS), Mercator Ocean will launch Framework Contracts in Q3 for organising Training Workshops in 6 Regional Basins (ARCTIC, BALTIC, BLACK SEA, ATLANTIC IBERIC-BISCAY-IRISH, MEDITERRANEAN SEA, ATLANTIC NORTH WEST SHELVES) for 2 populations: Public/Local and Regional Authorities (LRAs) on one side and Downstream Service suppliers mainly from the Private sector on the other side. Mercator Ocean's objective is to organise at least 1 to 2 CMEMS Training Workshops per Basin from 2018 to March 2021. To be aligned with and complete Copernicus Info sessions, Training workshops will be systematically organised in Member States having the EU Council Presidency and interests with Regional Seas (e.g.: Bulgaria in Q2 2018 BLACK SEA, Romania in Q1/2 2019 BLACK SEA; Finland in Q3/4 2019 ARCTIC; Croatia in Q1/2 2020 MED SEA; Germany Q3/4 2020 BALTIC; Portugal Q1/2 2021 IBI).

– Market analysis and surveys activities will ramp up from 2018 to populate facts and figures related to CMEMS market penetration rates and CMEMS impacts on the Blue Economy in the EU.

– Partnerships as initiated with NEREUS, CMPR, EARSC, OEE and EMODNET will be maintained and enlarged to any valuable contributor in Europe.

– At international level, the link with GEO will be strengthened and CMEMS actions included as part of the GEO work plan, as well as the participation to WMO/IOC JCOMM and GODAE Ocean view initiatives.

Preparation of the future

The work undertaken within the service evolution R&D strategy, the user uptake programme, the marketing activities together with achievements reached by the several TACS and MFCs will also form the basis to develop a long term strategy for the CMEMS service post 2020. This work will be anticipated and prepared with the Commission and partners to best fit the Commission's expectations as stipulated in the space strategy:

- supporting the EU policies, plante challenges,
- the EU business growth and innovation, and
- the international recognition of the Copernicus programme

thanks to attractive, modern, innovative and cost-efficient Copernicus services.

5.1.3. ACTION 3: Atmosphere Monitoring Service

The **Atmosphere Monitoring Service** provides the capacity to continuously monitor the composition of the Earth's atmosphere at global and regional scales. This service capacity encompasses the description of the current situation (analysis), the prediction of the situation a few days ahead (forecast), and the provision of consistent retrospective data records for recent years (re-analysis). It generates geophysical products which can be input to further technical processing, as well as high level information in various forms for further expert assessment in support of decision making.

By monitoring atmospheric composition, the Atmosphere Monitoring Service supports applications in the domains of air quality, climate forcing, ultraviolet radiation, and solar energy with special focus on the EU regions. It therefore provides products and information on the distribution and long-range transport of greenhouse gases, aerosols and reactive gases as well as regarding the input data itself in particular emissions. Products and information are provided at the global and EU regional scales. The finer EU regional scale products are complemented by a quantitative assessment of the uncertainty based on an ensemble of several regional modelling systems.

The next table briefly outlines the main following buildings blocks of the activity (besides management):

Building blocks	Brief description of main activities
In Situ observation	Technical work allowing operational feed from main in situ data sources
Development: global production	Continuous development of global assimilation and modelling system: greenhouse gases; aerosols; reactive gases.
Development: regional production	Continuous development of regional air quality assimilation and modelling systems (including ensemble processing).
Global production	• Input data acquisition • Global model maintenance and updates

	• Operations of global suites • (Bulk) global data services • NRT verification and monitoring (global) • Help desk • First-level user support (global products)
Regional production	• (Additional) Input data acquisition over European domain • Regional models maintenance and updates • Operations of regional models and ensemble suites • (Bulk) regional data service • NRT verification and monitoring (regional) • First-level of user support (regional products)
Value-added service production	• Products for policy users ("green scenarios", source apportionment and annual assessment reports…) • Solar radiation products • Greenhouse gas fluxes • Aerosol climate forcing
Validation and activities in support of production	• Anthropogenic emissions (also a product) • Fire emissions (also a product) • Ad hoc satellite data processing (retrievals) • Validation (quarterly reports)
Users' interaction, training and communication	• Second-level (specialised) user support • Dedicated data services (WCS/WMS, tailored presentation..). • Training • Communication • User interaction uptake/awareness events • User interaction management. • Use cases (short projects of downstream nature)

CAMS will be running in operational mode and system upgrades will concentrate on short term improvements (in particular regarding the spatial and temporal resolutions of the global and regional components) enabling to enhance quality, system performance and user interaction (Phase –I). Analysis and assessment will be performed regarding new user needs and corresponding arising methodologies. Phase II, in particular with a service upgrade foreseen regarding the resolution of the global component, can be considered as a quasi-continuous evolution of Phase-I.

The action will also comprise validation of the services and products provided. External expertise may be employed to support this process.

5.1.4. ACTION 4: Climate Change Service

The objective of the **Copernicus Climate Change Service** (**C3S**) is to build an EU knowledge base in support of mitigation and adaptation policies. Its scope was elaborated at the Helsinki conference (16-17 June 2011) following recommendations exposed in an expert report. This proposal was then amended by Member States during the GMES User Forum held in November 2011. The goal of the operational Climate Change service is therefore to provide reliable information about the current and past state of the climate, the forecasts on a seasonal time scale and the more likely projections in the coming decades for various scenarios of greenhouse gas emissions and other climate change contributors.

The societal benefit from the C3S lies in its capacity to provide indications about the most likely environmental changes to happen and this will greatly help taking most appropriate decisions regarding future investments in a number of industrial activities. The C3S shall capitalize on four main components: sustained networks of in-situ and satellite-based observations, re-analysis of the Earth climate, multi-model seasonal forecasts and climate projections based on a series of modelling scenarios. These components will permit us to derive a number of climate indicators (e.g., temperature increase, sea level rise, ice sheet melting, warming up of the ocean...) and climate indices (e.g., based on records of temperature, precipitation, drought event) for both the identified climate drivers and the expected climate impacts.

Climate indicators of drivers and impacts are essential for climate policy, both on mitigation and adaptation. In particular for adaptation robust information is needed on the observed and projected impacts of climate change, for various time scales and under different climate scenarios. Such information is of direct interest to the European Commission (including DG Climate Action), but also to transnational, national and local bodies in charge of policy making and implementation. Information on climate impacts, vulnerability and adaptation measures is currently disseminated via the Climate-ADAPT platform, hosted by the European Environment Agency. The C3S should contribute to further expanding the knowledge base, and thus also contributing with information to Climate-ADAPT.

The C3S shall benefit from sustained research and innovation activities, in particular in relation to the development of improved modelling capabilities at various timescales. These research and innovation activities will be mainly carried out in Horizon 2020, through actions in the "Climate action, environment, resource efficiency and sustainable supply of raw materials" and in the "Space" areas.

The architecture of the C3S has been developed and presented to the GMES Committee of December 10, 2012 and the Climate Change workshop held on June 4, 2013. This architecture has been endorsed by climate experts participating at a workshop dedicated to the Copernicus Climate Change service and convened by the European Centre Medium Weather Forecast (ECMWF) on February 17-18, 2014. This two-day workshop, attended by over 70 climate experts with a large fraction nominated by ECMWF member states, was a unique opportunity to confirm the vision of the Commission and to provide recommendations regarding the role, scope, functions and content of the C3S.

The architecture of the C3S is organized around four complementary building blocks: A consistent Climate Data Store (CDS), a Sectorial Information System (SIS) , an Evaluation and Quality Control (EQC) function and, finally, an Outreach and Dissemination (O&D) platform.

The first building block of the C3S is a consistent Climate Data Store (CDS) that contains series of geophysical climate variables and indicators, most being listed as Essential Climate Variables or Thematic Climate Data Records, needed to monitor routinely the climate drivers

and climate change impacts. The CDS will also include series of derived Climate Change Indicators. All data and products available from the CDS must be spatially and temporally consistent, traceable and with documented uncertainties.

The second building block of the Climate Change service is a Sectoral Information System (SIS) that contains information tailored to fit the needs of end users and customers of the service for various EU sectorial policies or other Societal Benefit Areas (SBAs). It will be sustained primarily by the CDS and, where appropriate, by ancillary data sets that will prove useful when addressing, for instance, climate impacts at regional, or even local, time and space resolutions in various policy sectors.

The third block concerns the Evaluation Quality Control (EQC) function in charge of the quality control and evaluation of the C3S. The EQC function comprises a component to assess the technical performance and scientific quality of the products in particular with regard to users' information needs and requirements. The EQC function will also be the natural vector for bridging the operational segments of the service with its R&D components.

The fourth block is dedicated to Outreach and Dissemination (O&D) activities to ensure the dissemination of the climate related information, both from the Climate Data Store and the Sectorial Information System, to the end users, including e.g., public authorities, businesses, researchers and the general public as appropriate.

This architecture is complemented by a Fitness-for-Purpose (F4P) function external to ECMWF to evaluate the overall performance of the service with particular attention given to satisfy the needs of EU policies. The F4P component initiates independent evaluation activities in coordination with the EQC function of the C3S and makes ample use of expert consultations.

The development of the C3S goes beyond the scientific and technical processing of data at global scale and at regional scales, in particular over Europe, to address the requirements for information at high resolutions and thus support European and national policies. The success of the implementation of the proposed service will largely rely on the quality of the information flow and the overall coordination between the various blocks. Series of precise, well-defined and operational procedures are defined and established so that the information delivered to the end-user is fully traceable, quality controlled and disseminated within the most appropriate time frame all the way from the production in the CDS to the O&D platforms. The articulation between the operating entities involved in the C3S is a critical aspect of the service and the one that has required most attention in a preliminary phase. It indeed involves different public national and international institutions as well as the private sector through the entire production chain.

The action will also comprise validation of the services and products provided and external expertise may be employed as appropriate to support this process.

Different stages have been identified to favour a proper ramping up of the service and its gradual evolution over the duration of the program. The various blocks will progressively cope with an increasing number of products and deliverables in the following four complementary stages:

The first stage (up to year 3 of this programme period) was dedicated to a proof of concept of the overall architecture envisaged so far. This preliminary step helped to consolidate the links between various contributing partners, to fine tune their perimeters of actions and to ensure a seamless flow of information.

The second stage (year 3 to year 4 of this programme period) is pre-operational. It thus constitutes the first test to generate the requested information on a quasi operational basis that

is with proven and extensive tests of the ensemble of operational procedures prevailing inside each of the building blocks and between them as well.

The third stage (year 4 to year 5 of this programme period) is associated with the start of the operational phase where products will become available to the public. This phase will include a selected set of about 20 ECVs and 7 Climate indicators pertaining to the atmosphere, the ocean and the land compartments. These quantities will provide support to 8 different Societal Benefit Areas through the production of approximately 18 indices.

The fourth stage (from year 5 up to the end of this programme period) will essentially correspond to an increase in the generated amount of information such that, by the end of the funding period, the C3S shall be in a position to document 30 plus ECVs and over 10 Climate indicators that will be of direct relevance to a dozen of the Societal Benefit Areas.

5.1.5. ACTION 5: Emergency Management Service

The **Emergency Management Service** will focus on five priority activities defined by the Emergency Response Core Service Implementation Group and guidance from the User Forum. It will be based on existing operational activities at European and national level, in particular the experience built-up in the 2011-2014 GMES Initial Operations (GIO) and Copernicus phase.

The first activity is to ensure the continuity of the operational mechanism for delivering emergency mapping products during the emergency response phase, i.e. (i) on-demand maps produced in Rapid Mapping mode to show the impact, assess the damage and follow the evolution of the disaster in the hours and days after the crisis, and (ii) geographic reference maps providing basic topographic maps on areas affected by the disaster, in particular on infrastructure and the key natural resources.

The second activity is to support the other phases of the crisis management cycle, i.e. the prevention, preparedness and recovery phases, inside or outside EU, by providing on-demand pre-disaster or post-disaster mapping products, including refugee/IDP (Internally Displaced Person) maps under a Risk & Recovery Mapping.

The third activity is the validation of the results of these two first activities and will continue in the same way as in the previous phase, including the most relevant disaster cases.

A fourth activity is to integrate in the operational set-up of Copernicus EMS mapping aerial imagery using manned (planes) and unmanned (UAV) platforms. The aerial imagery should be seen as a complementary input to space sensors in emergency situations that require very high spatial resolution or real-time follow-up of events when/where satellite images cannot provide it.A fifth activity is to build up and support an operational early warning and situation awareness capacity in Europe. Its first building block will be the European Flood Awareness System (EFAS) delivering added value information to the national hydrological services and providing a unique overview on the current and forecast flood situation to the Emergency Response Coordination Centre of DG ECHO. EFAS gives unique overview products of on-going and forecast floods in Europe more than 3 days in advance. EFAS information can also contribute to timely activation of the Rapid Mapping service for an improved flood extent monitoring. The experiences and knowledge gained within EFAS will serve as a foundation to establish also a global scale system (GloFAS) with a similar aim of supporting preparedness and response to floods with complementary, added value information to relevant stakeholders.

A second building block will be the European Forest Fire Information System (EFFIS), to support the services in charge of the protection of forests against fires in the EU and neighbour

countries, and also to provide the EC services and the European Parliament with information on forest fires in Europe.

A third building block is the Drought Observatory (DO) which was added in 2018 as the third building block of the operational early warning and situation awareness capacity. It addresses drought risk for different economic sectors and ecosystems in Europe and globally and provides complementary information to national and regional drought monitoring systems in the EU in that it provides a European and global overview of the evolution of droughts and their likely impacts. With the support and guidance of the Copernicus Committee and User Forum a drought component was developed in 2017 and integrated in 2018 as part of a multi-hazard early warning system suite under the emergency management service.

External expertise may be employed to support this process. Further, outreach activities on service level will be carried out specifically to the related scientific and professional communities.

5.1.6. ACTION 6: Security Service

The objective of the **Security Service** is to provide information in support of the security challenges of Europe improving crisis prevention, preparedness and response capacities, in particular for border and maritime surveillance, but also support for the Union's external action, through detection and monitoring of trans-regional security threats, risk assessment and early warning systems, mapping and monitoring of border areas. The Security Service consists of three main service domains:

The border surveillance service domain is designed to be interlinked with and to support the European Border Surveillance System (EUROSUR) to reinforce the control of the Schengen external border, especially the southern maritime and eastern land borders. EUROSUR became operational in December 2013 on the basis of Regulation (EU) No 1052/2013 and provides Member States with a common technical (infrastructure) and operational framework (workflow) in order to increase the situational awareness at their external borders and improve the reaction capabilities of their national authorities surveying the EU borders. One of the objectives agreed is to set up a common application of surveillance tools (satellites included), more commonly known as EUROSUR Fusion Services, having the European Border and Coast Guard Agency (FRONTEX) as coordinator. The Agency promotes, coordinates and develops European border management. For the Copernicus service domain of border surveillance, the active coordination of FRONTEX is instrumental. The need for FRONTEX to rely on Copernicus for those activities is recognised in Regulation (EU) No 1052/2013 establishing EUROSUR. The requirements for Copernicus support have been closely examined in cooperation with FRONTEX and Member States, and the draft service specifications presented in a Concept of Operations document (CONOPS) which was used as basis for the EUROSUR Regulation, the EUROSUR Handbook and the EUROSUR Fusion Services catalogue. User up-take and service validation has been carried out through two R&D projects SAGRES and LOBOS, running for the period 2013-2014.

As for the *maritime surveillance* service domain, EMSA, the European Maritime Safety Agency, is mandated for some responsibilities in maritime security and will assist the Commission in related activities. EMSA has a widely recognised expertise in the implementation of CleanSeaNet, a maritime safety operational programme relying on Earth observations, and runs SafeSeaNet, established by the Directive 2002/59/EC as amended, with data that is complementary to space observations for Maritime Domain Awareness. It is also

actively involved in several R&D activities on maritime surveillance, aligned with the Copernicus Security service requirements in the maritime domain. During 2013, a Copernicus working group on Maritime Surveillance has analysed the requirements of maritime communities identified in the Common Information Sharing Environment (CISE) concept. This will allow the detailed specifications of the services to be implemented at operational level as from 2015. As such, during 2015, it will be necessary for EMSA to start building up capabilities for operating those services.

The *Support to the External Actions* domain (SEA), through its access to Earth observation capacities and services, will comprise services to detect and monitor trans-regional security threats to enhancing risk assessment and early warning. The services will also contribute towards improving crisis prevention, preparedness and response capacities. There are also strong synergies with the Emergency Services.

After the start of the initial operations early May 2017 and the ramp-up during 2017 for reaching full operations in Q4/2017, the Service will increase its operational capacity during the following years. The budget allocated to the Service in 2018 is expected to have an increase of 40% compared to 2017. The budget allocated to the Service in 2019 is expected to remain the same compared to 2018. The budget allocated to the Service in 2020 is expected to have an increase of 33% compared to 2019.

Users activations are also expected to progressively increase due to the user uptake activities aimed at raising users' awareness and engagement. To this aim, two user workshops per year will be held from 2018 up to 2020; furthermore, brochures and other informative material on service operations will be widely disseminated to the user community.

During 2017, the SatCen awarded, via competitive calls for tenders, four contracts for the performance of the following activities (Phase 1 of the procurement within de delegation agreement).

In 2018/Q3 the preparation and signature of new ITTs will start in order to be in position to award contracts in the four activities mentioned before for the period covering January 2019 up to December 2020.

With regard to the IT Infrastructure Development it is foreseen to perform the initial operations, maintain and upgrade from 2018 up to 2020 the operational IT platform for the service including activation order, production and delivery functionalities.

In the framework of the User Uptake Support two user's workshops per year will be organised and promotion material will be updated and distributed.

The Service Evolution will enable to bring new products in the portfolio, based on the user's feedback from previous years.

From 2018 up to 2020 the Satellite Centre will provide a portfolio of products resulting of the new products emerging from the service evolution plus the Copernicus SEA Service initial portfolio composed of the following products:

- Reference Map
- Road Network Status Assessment
- Conflict Damage Assessment
- Critical Infrastructure Analysis
- Support to Evacuation Plan

– Non-EU Border Map

– Camp Analysis

– Crisis Situation Picture

– Activity Report

5.2. Section 2 – Space Component Budget Line 02 06 02

5.2.1. Introduction

The objective of the Copernicus Space Component is to fulfil the space-based observation requirements in response to EU policy priorities and Copernicus users' needs. The Copernicus Space Component Space Segment is comprised of two types of satellite missions, dedicated Sentinels and missions from other providers, called Copernicus Contributing Missions. A distributed Copernicus Space Component Ground Segment (CSC GS), through which the data are received, processed, archived and made available for the Copernicus Services and other Copernicus users, completes the Space Component.

The space segment activities described in this Implementation Plan are in accordance with the Long-Term Scenario prepared and updated by ESA in coordination with EUMETSAT. In this context, the milestones displayed in the space component part of this document are based on the dates currently officially available.

The budgetary overview for the Space component as delegated to ESA as regards the 7-year period is summarised in table 2.1 below, outlining the ESA costs and payments which need to be met by the annual Work programme Commitments, taking also into account the availability of Copernicus appropriations in the MFF (2014-2020). Table 2.2 provides the summary overview for EUMETSAT.

ESA DA - COSTS AND ADVANCES									
Total Cost and Advances (in € thousands)	2014	2015	2016	2017	2018	2019	2020	2021	Total
	Actual	Actual	Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Cat I Space Segment Development	20,905	338,362	279,059	219,314	307,953	217,131	149,582	60,089	1,592,395
Total Sentinel-1		155,780	84,152	54,922	88,177	60,853	31,227	14,789	489,900
Total Sentinel-2		59,358	86,214	54,162	68,233	39,350	16,454	6,295	330,066
Total Sentinel-3		114,169	73,402	77,444	110,038	72,441	53,655	13,885	515,034
Total Sentinel-5P	20,905	2,725	2,180	10,788					36,598
Total Sentinel-5			17,561	5,331	22,711	26,716	30,777	11,704	114,800
Total Sentinel-6		6,330	15,550	14,467	17,568	15,500	17,469	13,416	100,300
Space Segment Common Functions				2,200	1,226	2,271			5,697
Cat II System Operations		21,712	46,006	135,534	158,257	160,479	165,779	131,303	819,070
Cat III Data Dissemination		4,873	7,630	13,908	25,687	26,998	26,234	9,550	114,880
Cat IV Data Access Contributing Missions		44,739	35,978	39,963	37,493	33,750	27,883	6,849	226,655
ESA Remuneration	20,000	44,200	55,400	61,200	63,100	61,300	55,700	34,100	395,000
Total Cost & Advances	40,905	453,886	424,073	469,919	592,490	499,658	425,178	241,891	3,148,000

Table 2.1: *Costs and Advances of the Space component implemented through ESA Delegation Agreement*

Costs in EUR thousands	2014 Actuals	2015 Actuals	2016 Actuals	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast	2021 Forecast	TOTAL COST Forecast
I. DIRECT COSTS (Heading I to VI)									
Heading I Management of EUMETSAT's Copernicus Activities	317	1,508	2,031	2,800	2,420	2,650	2,738	0	14,464
Heading II Operations of the Copernicus Space Infrastructure	0	2,147	10,214	17,467	26,518	26,938	36,141	13,980	133,405
Heading III Maintenance of the Copernicus Space Infrastructure	0	1,605	6,482	8,043	9,111	9,163	9,230	0	43,634
Heading IV Evolutions of the Copernicus Space Infrastructure	0	39	389	4,143	3,166	3,376	3,471	0	14,584
Heading V Access to Data from Copernicus Contributing Missions	0	111	70	664	2,285	2,055	1,627	0	6,812
Heading VI Support to the procurement, launch & LEOP of recurrent or new missions	0	0	0	186	323	330	315	0	1,154
Subtotal DIRECT COSTS	317	5,410	19,186	33,303	43,823	44,512	53,522	13,980	214,053
II. INDIRECT COSTS	22	379	1,343	2,293	3,068	3,116	3,747	979	14,947
GRAND TOTAL	**339**	**5,789**	**20,529**	**35,596**	**46,891**	**47,628**	**57,269**	**14,959**	**229,000**

Table 2.2: *Costs of the Space component implemented through EUMETSAT Delegation Agreement*

5.2.2. Share of responsibilities

In line with the Copernicus Agreements concluded with both organizations, the Commission will over the 2014-2020 period delegate key activities to the European Space Agency (ESA), and the European Meteorological Satellite Organisation (EUMETSAT). The share of responsibility being:

ESA will perform all satellite development activities, including launches and early orbit phases, until in-orbit validation of the satellites;

The operation of the satellites will be shared between ESA and EUMETSAT as shown below. This also includes the preparation, maintenance and evolution of the relevant Ground Segment,

the maintenance and evolution of the system baseline, and the maintenance of the relevant satellites;

ESA will implement the operations of Sentinel-1, Sentinel-2, Sentinel-3 application Ground Segment for Land monitoring applications, and Sentinel-5P;

EUMETSAT will implement the operations of Sentinel-3 satellite and the application Ground Segment for Marine monitoring applications, along with the operation of Sentinel-4, Sentinel-5 and the High Precision Ocean Altimetry missions;

The overall Sentinel-3, Sentinel-4, Sentinel-5, and Sentinel-6 mission operations would be co-managed by ESA and EUMETSAT, in line with the provisions of the Joint Operations Management Plan;

EUMETSAT will support the procurement and launch of recurrent missions to the extent necessary to prepare the operations of these missions;

ESA will continue the operations of the existing Data Access System, and ensure the provision of all third party data that involve a procurement (data buy) activity;

EUMETSAT will implement the provision of third party data (no data buy), primarily in response to the needs of the Copernicus Marine and Atmosphere monitoring services, through existing agreements and mechanisms with other meteorological satellite operators. ESA and EUMETSAT will coordinate the complementary access to relevant data for Copernicus from own and third party missions (no data buy) via a joint management process.

5.2.3. ACTION 1: Space Segment Development

Description

This section includes all activities with relevance to MFF (2014-2020) funding related to the Copernicus Space Component (CSC) space segment construction and the Phase E1 activities (comprising the launch services and the In-Orbit Verification (IOV) phase). The CSC Space segment activities and tasks with relevance to the MFF (2014-2020) funding are implemented in a multi-annual perspective, in particular the procurement programme of the recurrent units.

Copernicus-funded activities from 2017 onwards include:

- Sentinel-5P: launch in 2017;
- Sentinel-3B launch in 2017/Q1 2018;
- Sentinel 1 C/D units: procurement programme from 2015 until 2021 with the Satellite Production Review (SPR) in 2017; Flight Acceptance Review (FAR) in 2020 (C unit); Pre-Storage Review in 2021 (D unit);
- Sentinel 2 C/D units: procurement programme from 2015 until 2021 with the Satellite Production Review (SPR) in 2017; Flight Acceptance Review (FAR) in 2020 (C unit); Pre-Storage Review in 2021 (D unit);
- Sentinel 3 C/D units: procurement programme from 2015 until 2021 with the Satellite Production Review (SPR) in 2017; Flight Acceptance Review (FAR) in 2020 (C unit); Pre-Storage Review in 2021 (D unit);
- Sentinel-5 B/C units: procurement programme from 2015 until 2021 with acceptance review (AR) in 2020 (B unit) and 2021 (C unit); and

– Sentinel-6 B unit: procurement programme started in 2015 until 2021 with Pre-Storage Review (PSR) in 2021 (B unit).

Space Segment Milestones and Accomplishments

The table below identifies all major CSC space segment activities and milestones from 2017 onwards, for completeness's sake also including elements not funded by the Copernicus Programme.

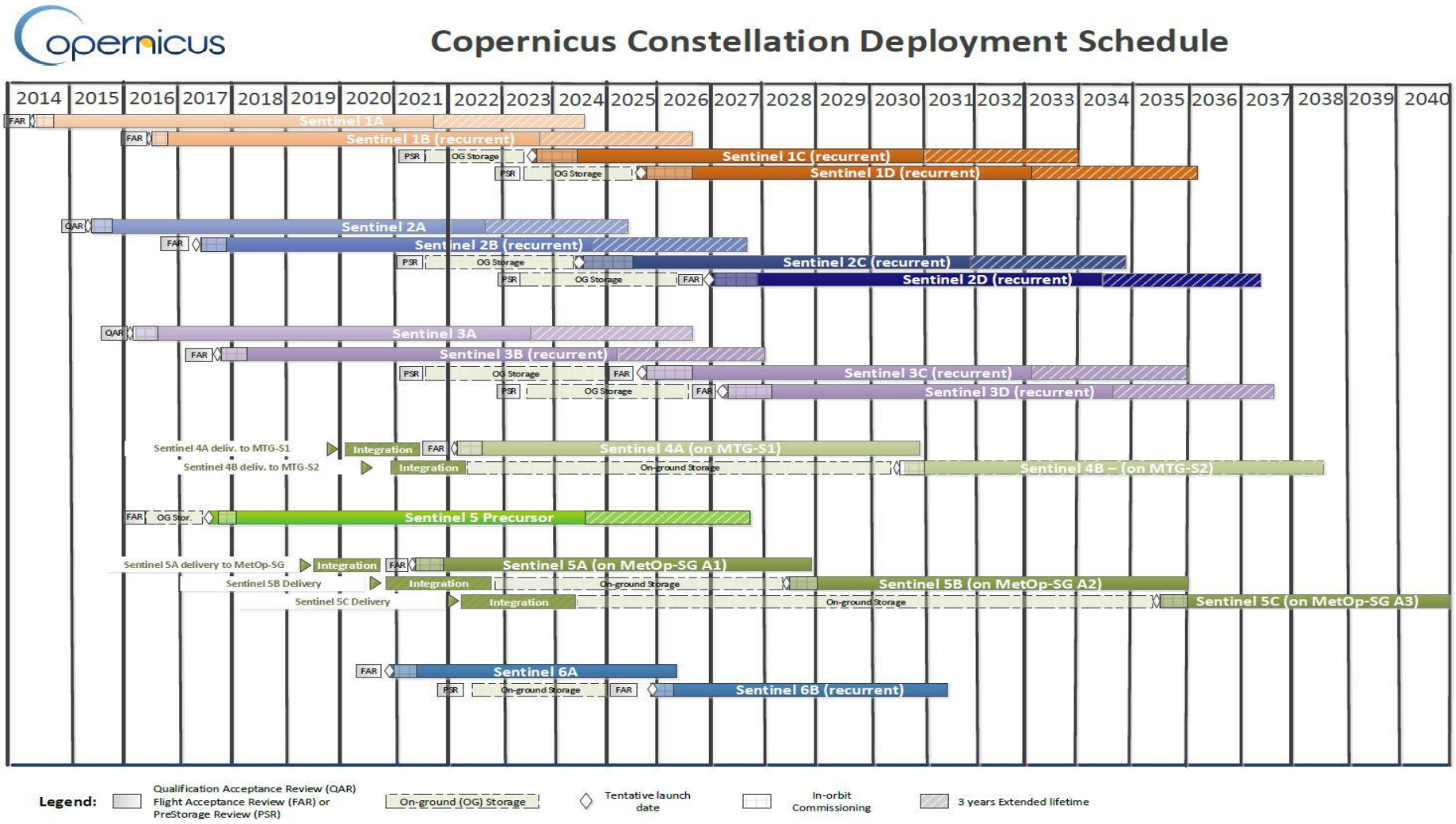
Year	**CSC programme element**	**Key activities and milestones**
2017	Sentinel-4 Development Programme	Critical Design Review; successful Board on 30 January 2017
	Sentinel-2B Launch	Launched on 7 March 2017 (CET) with VEGA from Kourou
	Sentinel-2B In-Orbit Verification	Sentinel-2B IOCR (at L+ 3months)
	Sentinel-5P Launch	Launched on 13 October 2017
	Sentinel-5P In-Orbit Verification	Sentinel-5P IOCR (pending on the launch date in 2017)
	Sentinel-3B Development Programme	Sentinel-3B Flight Acceptance Review (end 2017)
	Sentinel-3B Launch	Expected end 2017 /Q1 2018
	Sentinel-1 C/D Satellites Production Programme	Satellite Production Review start of Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-2 C/D Satellites Production Programme	Satellite Production Review start of Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-3 C/D Satellites Production Programme	Satellite Production Review; successful Board on 14 February 2017 start of Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-6 Development Programme	Critical Design Review Start of Phase D (Manufacturing, Assembly, Integration and Test)

2018	Sentinel-3B In-Orbit Verification	Sentinel-3B Phase E1 / IOCR (depending on the launch date in 2017)
	Sentinel-5P In-Orbit Verification	Sentinel-5P IOCR (pending on the launch date in 2017)
	Sentinel-1 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-2 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-3 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-4 Development Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-5 Development Programme	Critical Design Review Start of Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-6 Development Programme	Phase D (Manufacturing, Assembly, Integration and Test)
2019	Sentinel-1 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-2 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-3 C/D Satellites Production Programme	Phase D (Manufacturing, Assembly, Integration and Test)
	Sentinel-4 Development Programme	Qualification Review Sentinel-4A delivery to MTG
	Sentinel-5 Development Programme	Qualification Review Sentinel-5A Acceptance Review, delivery to MetOp-SG
	Sentinel-6 Development Programme	Phase D (Manufacturing, Assembly, Integration and Test)

2020	Sentinel-1 C/D Satellites Production Programme	Sentinel-1 C/D Flight Acceptance Review
	Sentinel-2 C/D Satellites Production Programme	Sentinel-2 C/D Flight Acceptance Review
	Sentinel-3 C/D Satellites Production Programme	Sentinel-3 C/D Flight Acceptance Review
	Sentinel-4 Development Programme	Sentinel-4B delivery to MTG
	Sentinel-5 Development Programme	Sentinel-5B Acceptance Review, delivery to MetOp-SG
	Sentinel-6 development & launch	Sentinel-6 Flight Acceptance Review Sentinel-6A launch and IOCR (tbc)
2021	Sentinel-5A Launch and In-Orbit Verification	Anticipated launch mid 2021
	Sentinel-1 C/D Satellites Production Programme	Pre-Storage Review
	Sentinel-2 C/D Satellites Production Programme	Pre-Storage Review
	Sentinel-3 C/D Satellites Production Programme	Pre-Storage Review
	Sentinel-5 Development Programme	Sentinel-5C Acceptance Review, delivery to MetOp-SG

The indicative schedule for the deployment of the Copernicus Space Component is provided on the next page.

Indicative Copernicus Constellation Deployment Schedule



5.2.4. ACTION 2: Space Segment Operations

Copernicus Space Component Operations

This section documents the Space Segment Operations activities starting from the successful conclusion of the In-Orbit Commissioning Review (IOCR). The activities included here encompass the operations of both the CSC Space Segment and the CSC Ground Segment, up to core data production. The Space Component Operations activities cover the period 2014-2021.

The Sentinel Operations will cover an end-to-end monitoring and reporting of the Sentinel Ground Segment and Operations, as well as the production of data at a processing level, in a timeliness and format as specified in the CSC GS system technical baseline documents.

ESA will manage the operations of the following satellites:

- Sentinel-1
- Sentinel-2
- Sentinel-3, *partim Land*
- Sentinel-5p

EUMETSAT will manage the operations of the following satellites:

- Jason-3
- Sentinel-3, partim Marine
- Sentinel-4
- Sentinel-5
- Sentinel-6

Sentinel-1, -2, -3 (both A and B units) and Sentinel-5p are expected to be operational in the period 2014-2021, the Sentinel-1, -2, -3 C and D units will only be launched post 2021. Sentinel-4, -5, and -6 A units are expected to be launched towards the end of the 2014-2021 period or shortly after. Jason-3 operations started in 2016.

The operations include the following activities:

- Operation of the Payload Data Ground Segment Facilities, e.g. Stations, Processing and Archiving Centres, Mission Performance Centres, Precise Orbit Determination service, European Data Relay Satellite (EDRS) services in support to the Sentinel-1 and 2 missions;
- Payload Data Management Centre activities, including e.g. Mission Planning of Sentinels;
- Flight Operations Segment;
- Mission Management;
- Ground Segment Maintenance;

– Data circulation, dissemination (which is specifically discussed in the next section) and network security;

– Payload Data Ground Segment adaptation and technical enhancements.

The Copernicus Space Component Ground Segment architecture is distributed and includes EUMETSAT and ESA receiving stations and processing centres.

Milestones and achievements

The table below identifies all major CSC operations activities and milestones from 2017 onwards.

Year	**Activity**	**Milestone**
2017	Sentinel-1 nominal operations Operations of Sentinel-2B started Start of ramp-up phase of Sentinel-2B, to be achieved two to four months after the IOCR Completion of Sentinel-2B ramp-up Completion of Sentinel-3A ramp-up	Sentinel-1: yearly routine operations review Successful Launch and early orbit phase of Sentinel-2B Successful In-Orbit Commissioning Review (IOCR) of Sentinel-2B (Launch+3 months) Sentinel-2: yearly routine operations review Sentinel-3: 1st yearly routine operations review
	Explore and showcase CSC benefits	Publish reports and examples of Sentinels-derived socio-economic benefits
2018	Sentinel-1, -2 and -3A nominal operations Operations of Sentinel-3B started Start of ramp-up phase of Sentinel-3B Operations of Sentinel-5P started Start of ramp-up phase of Sentinel-5P, to be achieved six to nine months after the IOCR	Sentinel-1, -2, -3A yearly missions routine reviews Successful In-Orbit Commissioning Review (IOCR) of Sentinel-3B (Launch+3 months) Successful In-Orbit Commissioning Review (IOCR) of Sentinel-5P
	Explore and showcase CSC benefits	Publish reports and examples of Sentinels-derived socio-economic benefits Presentation of Sentinel-based regional cases publication in a dedicated event
2019	Sentinel-1, -2, -3 and -5P nominal operations	Sentinel-1, -2, -3, -5P yearly missions routine reviews
	Explore and showcase CSC benefits	Publish reports and examples of Sentinels-derived socio-economic benefits
2020	Sentinel-1, -2, -3 and -5P nominal	Sentinels yearly missions routine reviews

Year	Activity	Milestone
	operations Operations of Sentinel-6A started Start of ramp-up phase of Sentinel-6A, to be achieved six to nine months after the IOCR	Successful In-Orbit Commissioning Review (IOCR) of Sentinel-6A Start and nominal progress of ramp-up phase of Sentinel-6A
	Explore and showcase CSC benefits	Publish reports and examples of Sentinels-derived socio-economic benefits
2021	Sentinel-1, -2, -3 and -5P nominal operations Operations of Sentinel-5A started Start of ramp-up phase of Sentinel-5A, to be achieved six to nine months after the IOCR Completion of Sentinel-6A ramp-up	Sentinel-1, -2, -3, -5P yearly missions routine reviews Successful In-Orbit Commissioning Review (IOCR) of Sentinel-5A Start and nominal progress of ramp-up phase of Sentinel-5A Sentinel-6A: yearly routine operations review

5.2.5. ACTION 4: Evolution of the Copernicus Space Component

According to the Copernicus Regulation, the European Commission is in charge of the definition of the evolution of the CSC, based on user requirements,.

The preparation of the CSC evolution and definition of new generation of Sentinel missions has produced an first version of the User and Observation Requirements in 2017 which has been provided to the Space Agencies. Based on additional interactions with stakeholders and Member States, this activity continues in order to update these requirements.

5.3. Section 3 – In-situ component Budget Line 02 06 01

5.3.1. ACTION 1: In-situ Coordination

The EEA will to focus on three primary areas of activity, i.e. overview, awareness, and access. These activates will be carried out in close collaboration with the Copernicus services and relevant in situ data providers:

- Overview. The EEA will maintain an overview of the Copernicus in situ component across and in collaboration with all six Copernicus services. The overview shall help emphasising the importance of in situ data, identifying and solving critical data gaps, and support awareness raising activities;

- Awareness. The EEA will, in close collaboration with the Copernicus services, improve stakeholders' knowledge and understanding of the Copernicus in situ component;

- Access. The EEA will improve access to critical in situ data for Copernicus services by operating dedicated data portals and creating partnership agreements with selected data providers.

The specific activities of this action will, to a very large degree, depend on the Copernicus services' needs. The EEA will work closely together with the Copernicus services to ensure that, in particular, cross-cutting present and future in situ data gaps are identified and efficiently managed to avoid duplication of effort, and to maintain an efficient division of tasks between the Copernicus service and programme level as regards in situ data. Prioritisation and scheduling of activities will be done in close collaboration with the Copernicus services, and elements of this Work Plan may thus change according to changing needs and boundary conditions. The EEA will therefore adopt a flexible planning approach, with the aim of being able to react to new or chancing requests in a timely manner.

Overview

The overview of the Copernicus in situ component is maintained and communicated by the EEA through a set of information products. The Copernicus In Situ Component Fact Sheets will be updated as necessary (one fact sheet per service component containing overall information on e.g. key in situ data requirements, data sets used, use cases, and in situ data gaps and other related challenges); and one major update of the Copernicus In Situ Component State of Play Report is scheduled for 2018 (a report summarising the current situation of the Copernicus in situ component on a service by services basis, including a description of main cross-cutting gaps, challenges and risks, and the expected evolution of the Copernicus in situ component). However, focus will be on detailed analysis of identified cross-service gaps, challenges, and risks and development of proposals for mitigating activities; including identification of needs for new research and development activities; and the provision of guidance to on-going, relevant research projects. The exact scope of these analyses and supporting thematic reports will be identified and prioritised in cooperation with the Copernicus services. If requested the EEA may provide expert support to the Copernicus services in regard to the development and specification of new products and the resulting needs for in situ data; and in relation to evaluation of tenders or similar.

The first building blocks of the Copernicus In Situ Component Information System were constructed during 2017, and the information system will be maintained and updated with detailed information about in situ data requirements, gaps, and in situ data sets in use across the six Copernicus services. The information will be traceable to the Copernicus services' product catalogues, and will thus provide a detailed picture of the Copernicus in situ component as seen from the Copernicus services' point of view. Selected elements of the Copernicus In Situ Component Information System will be made publicly available via the insitu.copernicus.eu website. New and updated information will be quality controlled by the Copernicus services before being released on a biannually basis to the public.

At least one Copernicus In Situ Data Coordination Workshop will be organised in cooperation with the Copernicus services and the European Commission. The main purpose of this workshop is to ensure the proper planning of in situ data related activities across the six Copernicus services and the EEA. Additionally, thematic workshops may be organised to allow for selected Copernicus services and data providers discussing specific in situ data related challenges and gaps. If relevant in situ data experts from the Copernicus space component may be invited to attend these workshops with a view to explore potential synergies across the service and space component.

Awareness

The EEA will continue to focus on awareness raising activities aiming at highlighting the functioning and importance of the Copernicus in situ component to all stakeholders, i.e. both users and providers of in situ data, and the significance of member states' contributions. To meet this objective the insitu.copernicus.eu website will be maintained and kept updated with information relevant to the Copernicus in situ component. In particular, the Copernicus In Situ Coordination Newsletter will be updated on a regular basis. Furthermore, the EEA will take advantage of selected opportunities, e.g. conferences, workshops and user meetings, to inform about the current status and the expected evolution of the Copernicus in situ component. These awareness raising activities will be coordinated with the entrusted entities and the European Commission.

Access to data

The Copernicus reference data access node (CORDA) will be maintained and operated by the EEA. Since October 2015 CORDA has been providing easy access to national and regional geospatial reference data, covering selected INSPIRE spatial data themes, as requested by primarily the Copernicus Emergency Management and Land Monitoring services. CORDA will be further developed in accordance with Copernicus services' needs, but focus will in particular be on increasing the number of relevant data sets that can be accessed through CORDA; and the direct support offered to the Copernicus services.

In parallel, EEA will ensure operational provision of up-to-date air quality data through the established EIONET core data flow. If access to other in situ data from EIONET core data flows is required, the EEA will cooperate with the relevant Copernicus service(s) to find an appropriate solution.

The framework service contract through which CORDA is maintained and operated ends October 2018 and accordingly a new invitation for tender would need to be launched with the intension of avoiding any gaps. This process will include an evaluation of the Copernicus services' use of CORDA to ensure that the evolution of CORDA and the next framework service contract will meet the requirements of the Copernicus services.

The EEA will cooperate with relevant European networks and organisations such as EIONET, EuroGeographics (including the European Location Framework), EuroGeoSurvey, EuroGOOS, and EUMETNET (involving the WMO) to exchange information and further develop and explore the partnership and data access agreements that have been concluded. Likewise the EEA will cooperate with other relevant coordination initiatives such as European Research Infrastructures (e.g. ENVRIplus), United Nations Initiative on Global Geospatial Information Management UN-GGIM (Europe), explore Copernicus International Agreements with the aim of improving access to relevant in situ data, and provide contributions to the GEO Foundational Task on GEOSS in situ earth observation resources.

5.4. Section 4 – Copernicus programme evaluation Budget Line 02 06 01

5.4.1. ACTION 1: Expert Support

The Commission will make use of experts to support the Copernicus Units in:

(3) The assessment of the technical and scientific feasibility of the objectives of the Copernicus programme and the proposed solutions in all the programme's components;

(4) The technical and scientific validation and review of the deliverables, solutions and results supplied by the operators of the Copernicus programme;

(5) The assessment of the implementation measures proposed or carried out by the operators of the Copernicus programme.

These experts may also be used to provide advice in other relevant areas.

5.4.2. ACTION 2: Performance Studies

The Commission may launch specific performance or support studies using external contractors to further investigate certain aspects of the Copernicus programme and its components.

6. PART 2 – COPERNICUS SPACE DATA FOR SOCIETAL CHALLENGES AND GROWTH

6.1. Section 1 – Access, exchange and dissemination of data Budget Line 02 06 02

6.1.1. ACTION 1: Ground Segment Data Circulation, Dissemination and Network Services Operations and Copernicus Data and Information Access Services (DIAS) activities

Description

The use of Sentinel data products is primarily for Copernicus Core Services and users in the Participating States, with Copernicus Core Services having the highest access priority.

The data dissemination process will ensure that the Sentinel data products are accessible on an equal footage for the Member States in EU. Further to these primary users, and in accordance with the data policy, the Sentinel data products will also be available for the wide community of users as stated in the Copernicus Regulation:

- Copernicus core users: Union institutions and bodies, European, national, regional or local authorities,
- research users: universities or any other research organisations;
- commercial and private users;
- any other third party,

Taking into account the volume of the data produced by the CSC ground segment and to be disseminated, some enhancements will be made to address the needs of the users. These actions will be conducted by the Commission together with ESA and EUMETSAT and in coordination with the Member States' initiatives when appropriate.

Milestones and achievements

Year	Activity (planned)	Milestone
2014	– Baseline dissemination server in place	– Completion of Sentinel-1A data dissemination infrastructure

Year	Activity (planned)	Milestone
	– Data dissemination enhancement specified – Sentinel-1A data used by the Copernicus services and distributed for users	deployment in support of commissioning and ramp-up phase – Sentinel data access enhancements defined and implementation plan provided to the Commission – Opening of Sentinel-1A data access to Copernicus services on 30 September and to all users on 3rd October 2014
2015	– Baseline dissemination server fully operational – Sentinel-2A data used by the Copernicus services and distributed for users – Data dissemination enhancement step-1 in progress	– Completion of Sentinel-1A data dissemination infrastructure deployment in support of routine phase – Opening of Sentinel-2A data access to Copernicus Services and users – Implementation of Sentinel data dissemination enhancement step-1 in-progress
2016	– Sentinel data used by the Copernicus services and distributed for users – Data dissemination enhancement step 1 implemented	– Opening of Sentinel-3A and Sentinel-5P data access – Implementation of Sentinel data dissemination enhancement step1 completed
2017	– Sentinel data used by the Copernicus services and distributed for users – Data dissemination enhancement step-2 in progress	– Opening of Sentinel-3B data access – Implementation of Sentinel data dissemination enhancement step-2 in-progress
2018	– Sentinel data used by the Copernicus services and distributed for users – Data dissemination enhancement step 2 implemented	– Routine access to Sentinel data – Implementation of Sentinel data dissemination enhancement step2 completed
2019	– Sentinel data used by the Copernicus services and distributed for users	– Routine access to Sentinel data – Implementation of Sentinel data

Year	Activity (planned)	Milestone
	– Data dissemination enhancement step 3 in-progress	dissemination enhancement step3 in-progress
2020	– Sentinel data used by the Copernicus services and distributed for users – Data dissemination enhancement step 3 implemented	– Routine access to Sentinel data – Implementation of Sentinel data dissemination enhancement step-3 completed
2021	– Sentinel data used by the Copernicus services and distributed for users – Data dissemination enhancement step 4 define	– Routine access to Sentinel data – Definition of Sentinel data dissemination enhancement step4

The Data and Information Access Services seek to bring users to the data applying the big data paradigm and to enable application development for all user groups and to create new markets.

Overall, DIAS will functionally consist of three types of services:

- Back office services are centred on making available Copernicus data and information in a scalable computing environment fit for their exploitation (only this will be financed under Copernicus);
- Integration services orchestrating the interactions between back office services and front office services; allowing the deployment of development environments, tools and applications capable of exploiting Copernicus data and information. The integration services consist mainly of interface layers and have a key role to play in the different interoperability requirements;
- Front office services centered on the provision of services by third parties based on the exploitation of the Copernicus data and information made available through the back office services.

The classification of functionalities according to the three types of services (back office, integration, front office) is only indicative and may evolve according to technological development. The concept of the DIAS is broader than what Copernicus is ready to (partially) finance as the objectives of the DIAS is to enable the creation of third party advanced services exploiting earth observation data and information for the benefit of end-users.

6.1.2. ACTION 3: Access to data from Copernicus Contributing Missions

Description

A number of ESA, national, EUMETSAT, international or commercial missions are operating or being developed. These missions primarily serve their respective operators' priorities but are also of high interest to Copernicus. The Copernicus Contributing Missions consist of existing and planned Earth observation satellites from European, national or commercial

organisations. They are operated by national agencies or commercial entities within ESA's or EU Member States, EUMETSAT or other third parties.

The Contributing Missions have been providing a wealth of data to Copernicus Services during the GIO programme, and will continue to fulfil Copernicus satellite data needs not covered by the Sentinels when these dedicated satellites will be in orbit. The requirements on the data from the Contributing Missions for Copernicus services and other users are captured in the 'Commission Data Warehouse Requirements' document. This activity started under GMES Regulation 911/2010 and even before under a different format. Service continuity is seen as a key aspect of this activity as Copernicus is benefiting from archived data, platform solutions and professional experience developed under the previous exercises. The Data Warehouse is evolving with the Copernicus space component and the Contributing Missions themselves.

The evolving constellation of Contributing Missions, with their own ground segment, needs to be interfaced with a dissemination system to ensure the harmonised provision to the Copernicus Services of data from the Contributing Missions as well as from the dedicated Sentinels missions.

The level of integration of the Contributing Missions data into the Copernicus data portfolio is driven by requirements stemming from Copernicus services and by parameters linked to the Contributing Mission data licensing conditions and delivery scenarios.

The Commission Data Warehouse requirements document, which is regularly updated, defines two main types of data from Contributing Missions covering the different needs of Copernicus Services:

A fixed part called 'CORE datasets' which are typically well defined large datasets; and

A flexible part called 'ADDITIONAL datasets', which typically are of an on-demand or ad hoc nature.

This dual approach is expected to be flexible enough to accommodate additional or specific requirements, which are not covered by the CORE datasets and are not known in advance. Modifications to the Data Warehouse document to better suit user needs may bring additional types of data beyond CORE and ADDITIONAL datasets.

The Technical and operational data access will continue to be managed through the ESA Coordinated Data Access System (CDS).

Milestones and achievements

Year	Activity	Milestone
2014	Ensuring the continuity of provisions under the Data Warehousev1.9 requirements exercise until November 2014. Implementation of the DWH v2.0 requirements, in particular through a Call for Tender organized by ESA for the access to commercial missions.	Continuity of Copernicus Contributing Missions (CCM) data access provision in the frame of DWH phase 1 ensured until end March 2015 Release of Call for Tender for DWH version 2 data access achieved. Contract award proposal approved by Copernicus Procurement Board in December 2014.

Year	Activity	Milestone
2015	Provision of core and additional data sets to Copernicus services under Data Warehouse v2.0. Reference year (N 0) for the acquisition campaign for the land service (pan-European and local) using the new contributing mission contracts implementing the Data Warehouse requirements v2.0. Progressive deployment of the new modules for the CSC-DA	Release of reference year (N) core datasets and additional datasets. Deployment of CDS version 3 releases
2016	Provision of core and additional data sets to Copernicus services under Data Warehouse v2.0. Reference year (N+1) for the acquisition campaign for the land service (pan-European and local) Progressive deployment of the new modules for the CSC-DA.	Release of reference year (N) core datasets and additional datasets. Deployment of CDS version 3 releases
2017	Provision of core and additional data sets to Copernicus services under Data Warehouse v2.0. Reference year (N-1) for the acquisition campaign for the land service: pan-European, Corine Land Cover, local, urban atlas. Deployment of the new modules for the CSC-DA.	Release of reference year (N-1) core datasets and additional datasets. Deployment of CDS version 3 releases
2018	Provision of core and additional data sets to Copernicus services under Data Warehouse v2.0. Reference year (N) for the acquisition campaign for the land service: pan-European, Corine Land Cover, local, urban atlas Release of Call for tender for implementation of CSC-DA v4	Release of reference year (N-1) core datasets and additional datasets. Release call for tender CDS v4
2019	Provision of core and additional data sets to Copernicus services under Data Warehouse v2.0. Reference year (N+1): for the acquisition campaign for the land service (pan and local). Deployment of the new modules for the	Release of reference year (N+1) core datasets and additional datasets Deployment of CDS version 4 releases

Year	Activity	Milestone
	CSC-DA.	
2020	Implementation of the Data Warehouse requirements v3.0. N-1 Reference year (N-1) for the acquisition campaign for the land service (pan-European and local). Deployment of the new modules for the CSC-DA.	Release of reference year (N-1) core datasets and additional datasets. Deployment of CDS version 4 releases

6.2. Section 2 – User uptake, digital market and downstream services Budget Line 02 06 01

The *user uptake* activities aim at improving the links of the Copernicus programme into the various user communities and to further increase the awareness for Copernicus data, products and services. Specific activities for relevant user segments will be developed to achieve the optimum involvement of the lead players and to address any specific barriers they may face in introducing Copernicus into their workflow. This activity will as well aim at stimulating the networking between national and regional user organisations where applicable.

6.3. Section 3 – Communication and outreach Budget line 02 06 01

The *communication activity* will support programme level communication and be complementary to the domain specific outreach activities done under the responsibility of the thematic services.

6.4. Section 4 – International visibility of Copernicus Budget Line 02 06 01

In line with the Copernicus Regulation (Article 9) the Commission has been charged to ensure the coordination of Copernicus with international activities. Further activities will be defined in forthcoming Work programmes following discussions in the User Forum and Copernicus Committee.

ANNEX 2: COPERNICUS BUDGET PROFILE 2014-2020 (MILLION EURO)

The budget profile for the Copernicus Programme is given in the following table:[5]

Copernicus MFF (version DB 2018[6])	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
	actual	actual	actual	forecast	forecast	forecast	forecast	forecast
Services (02.0601)	44.721	97.336	110.094	118.306	130.664	187.755	131.356	820.233
Infrastructure (02.0602)	316.000	483.342	489.404	486.526	507.297	686.315	511.591	3,480.475
TOTAL Operational lines	360.721	580.678	599.498	604.832	637.961	874.070	642.947	4,300.708

[5] Following DG BUDG scheme, 'actual' figures (2014-2016) include the EFTA contribution and 'forecast' figures (2017-2020) do not yet include the EFTA contribution. When adding the 2.33% of EFTA contribution to 2018 figures, the budget amounts to EUR 652,825,491 which is consistent with all other tables in this document.

[6] Source: DG BUDG - Statement of estimates of the European Commission for the financial year 2018 – SEC(2017)250 - May 2017.
Amounts for 2019 (EUR 10M deduction) and 2020 (EUR 5M deduction) under the 02.0601 budget line have been modified in order to reflect the decrease of EUR 15 Million in favour of the European Defence Industrial Development Programme aiming at supporting the competitiveness and innovative capacity of the EU defence industry (COM(2017)294 FINAL).

ANNEX 3 : LIST OF ACRONYMS AND ABBREVIATIONS

ACTRIS – Aerosols, Clouds, and Trace gases Research Infrastructure Network

AERONET-OC – Ocean Colour component of the Aerosol Robotic Network

AIS – Automatic Identification System

AIT – Assembly, Integration and Test

AMR-C – Advanced Microwave Radiometer for Climate

AOCS – Altitude and Orbit Control Subsystem

AOD – Aerosol Optical Depth

AoI – Area of Interest

AR – Acceptance Review

ARCOM – Coastal Ocean Models

ARD – Analysis Ready Data

AWP – Annual Work Programme

C3S – Copernicus Climate Change Service

CA – Coastal Altimetry

CAL/VAL – Calibration/Validation

CAMS – Copernicus Atmosphere Monitoring Service

CAP – Common Agricultural Policy

CCI – Climate Change Initiative

CCM – Copernicus Contributing Missions

CCN – Contract Change Notice

CDR – Critical Design Review

CDS – Coordinated Data Access System

CEMS – Copernicus Emergency Management Service

CEOS – Committee on Earth Observation Satellites

CET – Central European Time

CFO – Call for Offers

CIS – Central Information System

CISE – Common Information Sharing Environment

CLC – CORINE Land Cover

Climate-ADAPT – European Climate Adaptation Platform

CMEMS – Copernicus Marine Environment Monitoring Service

CMES – Copernicus Marine Monitoring Service

CMPR – Conference of Peripheral Maritime Regions

CNES – Centre National d'Etudes Spatiales (French Space Agency)

CODA – Copernicus Online Data Access

CONOPS – Concept of Operations

COP – Conference of the Parties

CORDA – Copernicus Reference Data Access

CORINE – Coordination of Information on the Environment

COST – Committee on Science and Technology

COTS S/W or H/W – Commercial Off-The-Shelf Software or Hardware

CPMR – Conference of Peripheral Maritime Regions

CSC – Copernicus Space Component

CSC GS – Copernicus Space Component Ground Segment

CSC-DA – Copernicus Space Component Data Access

CSS-MS – Copernicus Security Services for Maritime Surveillance

CSS-MS – Copernicus Security Services for Maritime Surveillance

CUF – Copernicus User Forum

DA – Delegation Agreement

DAP – Data Access Portfolio

DEM – Digital Elevation Model

DG AGRI – Directorate-General for Agriculture and Rural Development

DG CLIMA – Directorate-General for Climate action

DG DEVCO – Directorate-General for Development and Cooperation

DG ECHO – Directorate-General for European Civil Protection and Humanitarian Aid Operations

DG ENV – Directorate-General for Environment

DG ESTAT – Directorate-General for European Statistics (Eurostat)

DG GROW – Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

DHuS– Data Hub Software

DIAS – Data Information Access Services

DMC – Disaster Monitoring Constellation

DMCSEE – Drought Management Centre for South Eastern Europe

DORIS – Doppler Orbitography and Radiopositioning Integrated by Satellite

DWH – Data Warehouse

EAGLE – EIONET Action Group on Land monitoring in Europe

EAN – European Aeroallergen Network

ECMWF – European Centre for Medium-Range Weather Forecasts

ECV – Essential Climate Variables

EDO – European Drought Observatory

EDRS – European Data Relay System

EEA – European Environment Agency

EEA39 – 33 member countries and six cooperating countries of European Environment Agency

EFAS – European Flood Awareness System

EFCA – European Fisheries Control Agency

EFFIS – European Forest Fire Information System

EFM – Electrical Function Model

EFS – EUROSUR Fusion Services

EFTA – European Free Trade Association

EGNOS – European Geostationary Navigation Overlay Service

EIONET – European Environment Information and Observation Network

EMODnet – European Marine Observation and Data network

EMS – Emergency Management Service

EMSA – European Maritime Safety Agency

ENP – European Neighbourhood Policy

ENVISAT – Environmental Satellite

EO – Earth Observation

EQC – Evaluation and Quality Control

ERA5 – Fifth generation of ECMWF Atmospheric Reanalyses of the Global Climate

ERCC – Emergency Response Coordination Centre

ERS – European Remote-Sensing Satellite

ESA – European Space Agency

ESGF – Earth System Grid Federation

ESOF – EuroScience Open Forum

ETC/ULS – European Topic Centre on Urban, Land and Soil Ecosystems

EUCP – Climate Projections for Europe

EU-DEM – Digital Elevation Model over Europe

EU-Hydro – Pan-European Hydrographic and Drainage Dataset

EUMETCast – EUMETSAT's primary dissemination mechanism for the near real-time delivery of satellite data and products

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

Euratom – European Atomic Energy Community

Eurostat – Statistical Office of the European Union (DG ESTAT)

EUROSUR – European Border Surveillance System

EUSC – European Union Satellite Centre

F4P – Fitness-for-Purpose

FAO – Food and Agriculture Organization of the United Nations

FAR – Flight Acceptance Review

FDF – Flight Dynamics Facility

FOC – Full Operational Capacity

FOS – Flight Operations Segment

FP7 – Seventh Framework Programme for Research and Technological Development

FPA – Framework Partnership Agreement

FRONTEX – European Agency for the Management of Operational Cooperation at the External Borders of the EU

FRP – Fire Radiative Power

FUA – Functional Urban Areas

FWI – Fire Weather Index

GADRI – Global Alliance of Disaster Research Institutes

GAW – Global Atmosphere Watch

GDIS – Global Drought Information System

GDO – Global Drought Observation

GEO – Group on Earth Observations

GEOBON – Group on Earth Observations Biodiversity Observation Network

GEOGLAM – Group on Earth Observations Global Agricultural Monitoring

GEOSS – Global Earth Observation System of Systems

GFCS – Global Framework for Climate Services

GFOI – Global Forest Observations Initiative

GHRSST – Group for High Resolution Sea Surface Temperature

GIO – GMES Initial Operations

GIS – Geographic Information System

GISC – GMES In-Situ Coordination

GloFAS – Global Flood Awareness Systems

GMES – Global Monitoring for Environment and Security

GMSDE – Ground Motion Spatial Database of Europe

GNSS – Global Navigation Satellite System

GNSS-POD – GNSS Precise Orbit Determination

GO – General Objectives

GODAE – Global Ocean Data Assimilation Experiment

GOOS – Global Ocean Observing System

GPCC – Global Precipitation Climatology Centre

GPS – Global Positioning System

GRACE – Gravity Recovery and Climate Experiment (NASA)

GSC – GMES Space Component

G-SEXTANT – Service Provision of Geospatial Intelligence in EU External Actions Support

GWIS – Global Wildfire Information System

H2020 – Horizon 2020 (EU Framework Programme for Research and Innovation)

HELM – Harmonized European Land Monitoring

HR – High Resolution

HRL – High Resolution Layer

IAGOS – In-service Aircraft for a Global Observing System

ICOS – Integrated Carbon Observation System

ICT – Information and Communication Technology

IDP – Internally Displaced Person

INSPIRE – Infrastructure for Spatial Information in Europe

IOC – Intergovernmental Oceanographic Commission

IOCCG – International Ocean-Colour Coordinating Group

IOCR – In-Orbit Commissioning Review

IOSTST – International Ocean Surface Topography Science Team

IOV – In-Orbit Verification

IPF – Instrument Processing Facility

IPSAS – International Public Sector Accounting Standards

IT – Information Technology

ITT – Invitation to Tender

IWG-SEM – International Working Group on Satellite Emergency Mapping

JCOMM – Joint Technical Commission for Oceanography and Marine Meteorology

JDP – Joint Deployment Plan

JOMP – Joint Operations Management Plan

JPSS – Joint Polar Satellite System

JRC –Joint Research Centre

KPI – Key Performance Indicator

L – Level

L2P/L3 – Marine Altimetry data products

LC/LU – Land Cover and Land Use

LCCS – Land Cover Classification System

LCML – Land Cover Meta Language

LDCM – Landsat Data Continuity Mission

LOBOS – Low-time critical Border Surveillance

LRA – Laser Retroreflector Array

LRIT – Long Range Identification And Tracking

LTS – Long-Term Scenario

LUCAS – Land Use and Cover Area frame Survey

LULUCF – Land use, Land Use Change and Forestry

MACC – Monitoring Atmospheric Composition and Climate

MAIT – Manufacturing, Assembly, Integration and Test

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

MCS – Mission Control System

MFC – Monitoring Forecasting Centre

MFF – Multiannual Financial Framework

MMU - Minimum Mapping Unit

MODIS – Moderate Resolution Imaging Spectroradiometer

MOOC – Massive Open Online Courses

MPF – Mission Planning Facility

MS – Member States

MSFD – Marine Strategy Framework Directive

MSG – Meteosat Second Generation

MSI – Multi Spectral Instruments

MTG – Meteosat Third Generation

MWR – Microwave Radiometer

NASA – National Aeronautics and Space Administration

NATURA – Network for the Detection of Atmospheric Composition Change

NCC – National Coordination Centres

NDACC – Network for the Detection of Atmospheric Composition Change

NDVI – Normalized Difference Vegetation Index

NEREUS – Network of European Regions Using Space Technologies

NFP – National Focal Point

NGO – Non-Governmental Organisation

NIR-2 – Near-InfraRed Band 2

NOAA – National Oceanic and Atmospheric Administration

NPP – National Polar-orbiting Partnership

NRC – National Reference Centre

NRC-LC – National Reference Centres Land Cover

NRT – Near-real-time

NWP – Numerical Weather Prediction

NWS – North West Shelf Seas

O&D – Outreach and Dissemination

OC– Ocean Colour

OCP – Optical Communication Payloads

ODA – Online Data Access

OGC – Open Geospatial Consortium

OLCI – Ocean and Land Colour Instrument

OpsPrep – Operations Preparation

OSINT – Open Source Intelligence

OSR – Ocean State Report

OSTST – Ocean Surface Topography Science Team

PAC – Partner Advisory Committee

PDAP – Payload Data Acquisition & Processing

PDGS – Payload Data Ground Segment

PDMC – Payload Data Management Centre

PFM – Proto-Flight Model

POD – Precise Orbit Determination

PSR – Pre-Storage Review

R&D – Research and Development

RAD – Requirement Analysis Document

RAM – Random Access Memory

RDA – Reference Data Access

REDD+ – Reducing Emissions from Deforestation and Degradation in developing countries

REVEX – Exploitation Review

RFQ – Request for Quotation

RO – Radio Occultation

RORR – Routine Operations Readiness Review

RZ – Riparian Zones

S – Sentinel

SAF – Satellite Applications Facility

SAGRES – Service Activations for Growing EUROSUR's Success

SAR – Synthetic Aperture Radar

SatCen – Satellite Centre

SBA – Societal Benefit Area

SCII – Sectoral Climate Impact Indicators

SCOPE-CM – Sustained Co-ordinated Processing of Environmental Satellite Data for Climate Monitoring

SDG – Sustainable Development Goal

SEA – Support to the External Actions

SEIS – Shared Environmental Information System

SES – Service Evolution Strategy

SG – Second Generation

SGA – Specific Grant Agreement

SGAC – Space Generation Advisory Council

SIM – Simulator

SIS – Sectoral Information System

SL – Sea Level

SLSTR – Sea and Land Surface Temperature Radiometer

SME – Small and Medium Enterprises

SMOS – Soil Moisture and Ocean Salinity

SNP countries – Southern Neighbourhood countries (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia)

SNPP – Suomi National Polar-orbiting Partnership

SOS – Sensor Observation Service

SPP – Service Product Portfolio

SPR – Satellite Production Review

SRAL – SAR Radar Altimeter

SST – Sea Surface Temperature

SST – Space Surveillance and Tracking

STM – Structure and Thermal Model

SWF – Small Woody Features

TAC – Thematic Assembly Centre

TT&C – Telemetry, Tracking and Command

UN-GGIM – United Nations Initiative on Global Geospatial Information Management

UN-SPIDER – United Nations Platform for Disaster Management and Emergency Response

URAD – User Requirements Analysis Document

URDB – User Requirements Data Base

VDS – Vessel Detection Service

VHR – Very High Resolution

VIIRS – Visible Infrared Imaging Radiometer Suite

VMS – Vessel Monitoring system

WBS – Work Breakdown Structure

WCS – Web Coverage Service

WFS – Web Feature Service

WG – Working Group

WIS – WMO Information System

WMO – World Meteorological Organisation

WMS – Web Mapping Service

WMS-T – Web Map Service Time

WP – Work Programme