Topic	H2020 – INFRAIA-2018-2020
Short Title	EurofleetsPlus
Title	An alliance of European marine research infrastructures to meet the evolving requirements of the research and industrial communities
Project Number	824077
Delivery Date	11/10/2019
Deliverable No	D3.2
Lead Beneficiary	CSIC
Dissemination Level	Public

Specification of required improvements and additions of shipboard data management system

Document information	
Document Name	Specification of required improvements and additions of shipboard data management system
Document ID	EUROFLEETS_WP3_D3-2_20191009_V1
Revision	V1.0
Revision Date	2019-10-9
Author	Susana Diez
Security	Public

Approvals			
	Name	**Organisation**	**Date**
Coordinator	Aodhán Fitzgerald	MI	14/10/2019
Activity Coordinator	Dick M.A. Schapp	MARIS	14/10/2019
WP Leader	Arturo Castellón	CSIC	14/10/2019

History			
Revision	**Date**	**Modification**	**Author**
V0.1		First release	Susana Diez, Thomas Vandenberghe
V0.2	2019-10-03	Contribution on Acquisition system	Guillaume Clodic
V0.3	2019-10-03	Contribution on EARS Front-end and CSR	Thomas Vandenberghe
V1.0	2019-10-11	Glossary terms/List Acronyms added Ready for dissemination	Susana Diez

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1 Definitions

1.1 Terms

CDI: AngularJS: JavaScript-based open-source front-end web framework
End Point: N association between a fully-specified concrete protocol and/or a data format and a network address, often specified by a URI, that is used to communicate with an instance of a web service.
Web Service: A self-describing, self-contained, modular unit of software application logic that can be described, published, located, or invoked over the network to create products. It is a collection of open protocols and standards used for exchanging data between applications or systems.

1.2 Acronyms

CDI: Common Data Index
CSR: Cruise summary Report
EARS: Eurofleet Automatic Report System
EARS DB: Eurofleet Automatic Report System Data Base
EARS FE: Eurofleet Automatic Report System Front-End
ER-CDI: En-route Common Data Index
ER-CSR: En-route Cruise summary Report
GUI: Graphical User Interface
HTTP: Hypertext Transfer Protocol
NetCDF: Network Common Data Form
ODV: Ocean Data View
O&M: Observations and Measurements
RT/NRT: Real Time / Near Real Time
SensorML: Sensor Model Language
SOAP: Simple Object Access Protocol
SSR: Ship Summary Report
WAF: Web Accessible Folder

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2 Introduction

The Eurofleets+ fleet comprises twenty-seven research vessels operated by European and international research organizations that will provide ship time as part of the transnational access (TA) calls for deploying Eurofleets TA cruises.
In the first two years of the project, the research vessels will be equipped with the ship board system **EARS V2** (Eurofleets Automatic Reporting System), developed in predecessor Eurofleets projects.
It consists of four major components:

- EARS, developed by RBINS
- Data Acquisition System, developed by IFREMER
- En-route Ship Summary Report (SSR) system, developed by CSIC with contributions from IFREMER
- Web Services, developed by CSIC with contributions from IFREMER

These components will be upgraded by each of their original developers, also in the first two years of the project. This should result in an upgraded Eurofleets+ shipboard software suite, EARS V3, that will replace the initial EARS V2 installations. The ambition is to install and configure the upgraded system in the third and fourth years of the project on all Eurofleets+ vessels in various configurations, depending on the existing situations at these research vessels. This is required as each research vessel has a different local configuration, uses other instruments, and thus requires adaptations and flexibility from the Eurofleets+ ship board system.

The EARS V2 system and its successor Eurofleets+ shipboard software suite EARS V3 will be instrumental for gathering the full set of cruise data that is acquired during the operations of an Eurofleets+ TA cruise and transferring en-route data to the EVIOR portal. This comprises metadata and data from:

- En-route (underway) data acquisition by fixed sensors on the platform: location, meteorology, thermosalinometry, FerryBox,
- Registered events of scientific measurements made and samples taken

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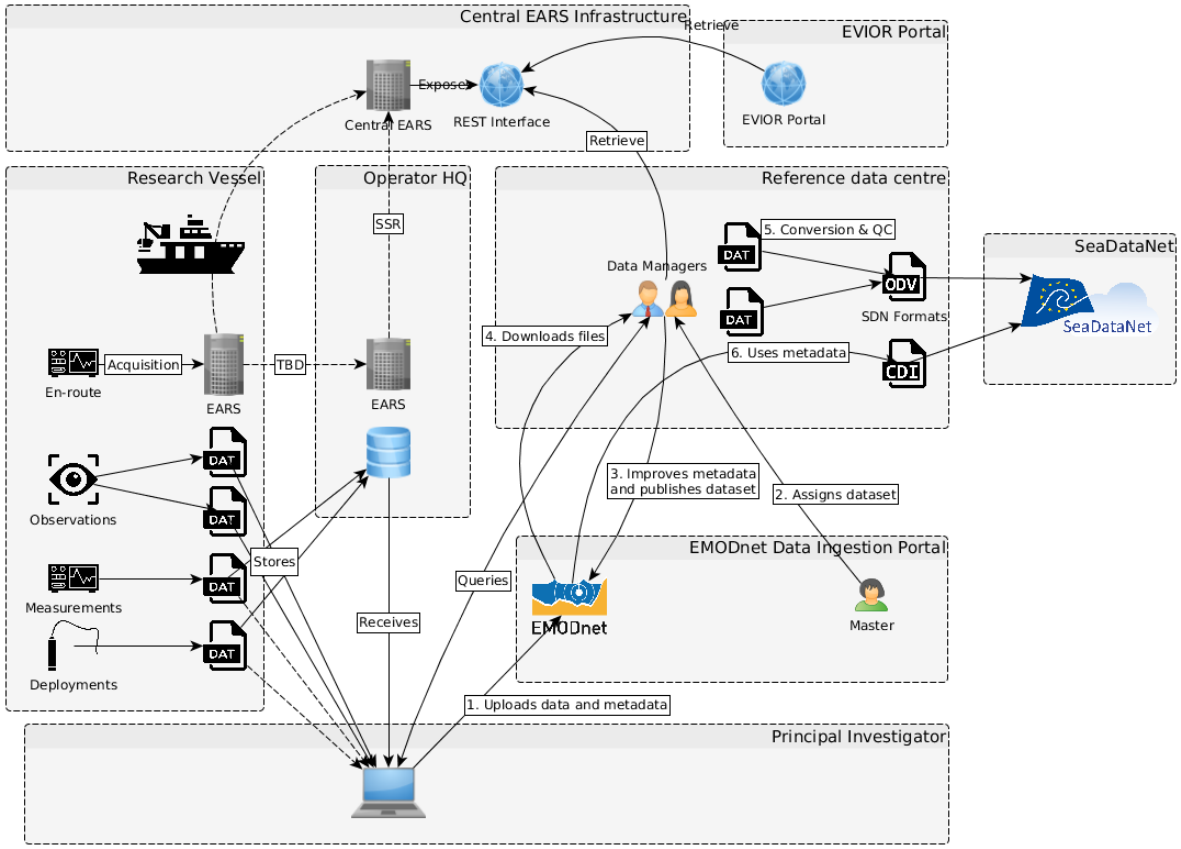

Image 1. Complete dataflow according D1.3 Eurofleets+ Data Management Plan V1.1 RBINS. Dotted lines are to be implemented

3 Main improvements and additions to be implemented

The ship board system **EARS V2** has been evaluated and reviewed, also taking in account preceding Eurofleets2 trials, in order to establish improvements and additions to upgrade the different complements. They have been classified according the priority level:

High priority:

- reporting a full Cruise Summary Report (CSR), including gml track and summary of measurements and samples, at the end of a cruise
- enabling on-shore reporting of Common Data Index (CDI) metadata including gml track, ODV or NetCDF data files for underway data,
- securing the Web Services (simple authentication)

Medium priority:

- improving the GUIs for interactions with users (crew and scientists on board)
- expand the range of Sensor ML and O&M profiles for other shipboard data acquisition equipment such as ADCPs, multi beam, seismic sensors, CTDs, and others
- improving the communication and exchange with the EVIOR portal and its services

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- analyzing different configurations, considering situation at different research vessels (each research vessel has a different local configuration, uses other instruments, and thus requires adaptations and flexibility from the EF+ ship board system)

Low priority:

- including automatic real-time data quality control
- securing the Web Services (different levels of authentication and authorization)

The below proposal integrates these main tasks with each other and gives the specifications for each component.

4 General architecture of EARS V3

All systems mainly make use of the java programming language and the Spring framework, adjoined with javascript for web applications, bash scripting for data transfer and docker container setup.
The following components are considered:

- Acquisition module (IFREMER)
- Web services (integrated into one web application)
  - ears (ears2) endpoint (CSIC)
  - navigation (ears2Nav) endpoint (CSIC)
  - SSR endpoint and scheduler (CSIC)
  - ontology endpoint (RBINS)
  - ER-CSR endpoint and scheduler (RBINS)
  - ER-CDI endpoint and scheduler (RBINS)
- EARS Front end desktop application (RBINS)

The applications considered "web services" will be compiled as one application. Each component will be modularized, will follow the single responsibility principle and will have no dependencies to other modules.
Some modules will need to address common concepts (e.g. the CSR needs to be able to operate on the same cruise trait as the ears endpoint); these shared traits will be implemented trough interfaces in a shared module that might also include common utility code.
Web application components not yet implemented in the Spring framework will be converted to it (earsNav, earsOnt, SSR Maker as a scheduled job).
The acquisition module, the web services, the vessel-to-shore data transporter and the environment (linux & tomcat) will be run as a docker container. This will simplify the install procedure considerably. The database will be kept external to properly persist the data between docker builds, to make external database access easier and to let users recover existing database solutions (for instance the one from Eurofleets2).
The applications should be written in such a way that they can run on any open-source database system, i.e. PostGREs or MySQL; this means that connection strings should be passed along at install time and the application should be capable of initializing the database itself.

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The source code of the application will be made available as open source and should be shared among the partners by using a collaborative software versioning tool.

5 Data Acquisition system

The Data Acquisition system is responsible for listening to different datagrams (position, weather, thermosalinometer), extract the useful data and logging them in:

- Raw flat files,
- NetCDF files,
- EARS database.

Data stored in the EARS database are then available through web services.
The software is based on Java and the Spring framework, a GUI developed in AngularJS is also provided. It comes with an Installation and User manual.
Further improvements for EARS V3 are:

- Updated version of the Acquisition System
- Addition of new sensors such as FerryBox (underway data).

6 Web services

The web services will be integrated and refactored and the entities will be reviewed (see annex). The REST verb endpoints will be generalized.

6.1 Authentication and authorization

A problem with the current version of EARS is that anyone who knows the endpoint verbs can modify the cruises, programs and events. Anyone with access to the EARS Front-end application can do these more easily. To mitigate this problem, we will implement a simple authentication and authorization procedure.
A first task is to implement a simple authentication layer. Two accounts will be created with a fixed set of control rights: 1) to create/modify/delete any cruise, program or event and 2) to modify the vessel ontology.
Lower on the priority list is a more complex authorization scheme that would include differential access to programs, cruises and events:
Roles:

- Create/modify/delete any cruise or program
- Create an event, and claim ownership of it
- Modify/delete any event of which one is owner
- Modify the vessel ontology

6.2 ears (ears2) endpoint

The database structure will be reviewed as it has suboptimal cardinalities (eg. a program can only belong to one cruise (so the same program is recreated every time again), a cruise can only have a single PI)

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6.3 navigation (ears2Nav) endpoint

Web application component ears2Nav not yet implemented in the Spring framework will be converted to it.

The CSR will be generated at the end of the cruise and, in order to include the track and the bounding box, new verbs will be added:

- getTrack?cruise (gml)
- getSimplifiedTrack?cruise (the CSR needs a simplified gml)
- getBoundingBox?cruise

6.4 Ontology endpoint

This component is responsible to store all changes to the vessel and program ontologies and to serve these files (as RDF) so they are synchronized among users.

It has been created in the end stages of the EF2 project and was never integrated during the workshops.

It exposes the following verbs:

- /authenticate: return whether the user can authenticate
- /ontology/vessel: return the current vessel ontology
- /ontology/vessel/date:returnthesavedateofthecurrentvesselontology
- /ontology/program?name: return the program ontology of given name
- /ontology/program/date?name: return the save date of the current program ontology of given name

It will be considered whether it is advisable if the component should email the ontology files to the responsible of the Eurofleets ontology (BMDC). No other new functionality is planned for the ontology web service, although it will be refactored along with the other endpoints in the following ways:

- It should use the same authentication framework, and a specific role should be created for it.
- It should store its RDF files in the same directories as the SSR and CSR/CDI Makers
- The code to update the base ontology and the code lists should be moved from the EARS Front-end to this module

Running a true ontology server (triplestore, SPARQL endpoint) on the EARS server is outside of the scope of the project.

In the EARS front end application, it will only be allowed to add new tools and new properties. On the level of the whole EARS infrastructure, the ontology rdf files should be collected to get the definitions of those new tools and properties users have created on top of the official ontology so that they can be fed back to vocabulary governance bodies. New tools will be forwarded to BODC and properties to BMDC. For the properties, it will be investigated if they can be replaced with already existing concepts,

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similar to the approach of the sampling descriptors in OBIS/EMODnet Biology, which are stored in P01 and Q01.

6.5 ER-CSR endpoint and scheduler

This component is responsible to create en-route CSR files. This file is continuously updated as the cruise continues, resulting in a nearly finished CSR when the cruise is ended. It remains an ER-CSR. It makes use of the standard SeaDataNet CSR profile. The ER-CSR files differs from the SeaDataNet CSR in some fields, like the CSR identifier, that must be set at National Data Centres. It also lacks the details that can only be added after review by a Data Centre. The ER-CSR identifier makes use of the local cruise identifier stored the in EARS database, and is made globally unique by prepending it with the C17 vessel identifier. If the data is reliably entered in the EARS Cruise, Project and Events table, this should result in metadata that is as complete as the CSRs normally generated by the PI by using the BSH tool. Data like bounding boxes are derived from the navigational data; in theory information like Marsden squares and the gml track can also be derived from the data. The problem with the gml track is that it is too detailed, an approach to simplify it will have to be investigated (cfr. EndAndBends). This component will make use of a separate library that can make CSRs based on simple java objects (making abstraction of the highly complex ISO 19115-2-based CSR profile). The component itself will have both an endpoint of the form getCruise/csr/current or getCruise/csr/<cruise-id> and a scheduler that stores a CSR file of the finished cruise and makes them available in a web accessible folder (WAF). At the end of the cruise, the chief scientist has to recover the correct ER-CSR file, verify it, and send this file to the Collating Data Centre, who will need to load it in MIKADO for verification and completion. For this deliverable, the output will be compared to the output of the CSR Online tool created by BSH and from output created by MIKADO.

The ER-CSR is continuously generated and sent via the SSR at the beginning of the cruise. At this moment a link to the cruise id should be coded in the SSR. The full ER-CSR will be generated at the end of the cruise including gml track and events, and is to be sent manually by the PI. The gml track is available through the EARS Web services. In a CSR, the events are the cruise start and end, sampling and measurement events and mooring deployment events, including location. They present summarised info (e.g. total counts) over tool categories and sampling profiles, for instance the number of samples, the number of species, the number of tracks, the total distance of tracks. Some are more challenging than others to retrieve from EARS.

We show in the annex excel file a mapping between the EARS entities and the CSR elements.

6.6 ER-CDI endpoint and scheduler

This component is responsible to create en-route CDI files. It will integrate the ER-CDI profile and the ER-CDI metadata generator that has been prototyped for EF2 as a Spring scheduler. The ER-CDI files will be kept available on the vessel.

The next fields are mandatory for a CDI:

Datasetid, Datasetname, bounding box, Measuring area type (point, curve or area), Start date and end date, Parameters, Instrument, Platform class, Holding centre, Originator centre, Distributor, CDI partner, Distribution Websites and services, Dataset Access Restriction, Cruise information (name, id, start date), Data format and Revision date.

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7 EARS Front-end application

The ontology and the EARS FE will be improved to have a full integration with the CSR creation and to provide a more user-friendly experience. These extensions are foreseen:

- Nested tools, mooring deployments and alternative platforms have been added in EARS FE v2 already by using the L05 and L06 lists. Storing this information in the EARS DB has been suboptimal in EARS2; this will be improved together with CSIC.
- Provide a way to predefine the characteristics and the identifiers for a tool if multiple ones are available (for instance a 5 l bucket vs a 10 l bucket).
- Record for what scientific purpose (C77) an event is performed
- Record what parameter (P02) an event investigates
- Save the EventDefinition uuid identifier along with the event in the EARS DB, so that it can be retrieved later.
- Provide globally unique identifiers for events as these can become persisted for long term.

1. Nested tools within tool categories or platforms

EARS events can be performed both on a parent tool or a nested tool. Eg. a Rosette can Profile-Start and a Bottle in that Rosette can Sample-Start independently. Nested tools are currently stored in the EARS DB by a json object. The bottle needs a reference to the Rosette so that it is known this is not an independent bottle. The EARS data model should be extended to accommodate this.

Platforms are considered Tool Categories in the EARS FE code, but as Subjects in the EARS DB code. This also needs to be improved (see below).

2. Predefined values properties

Currently, the Tools in the ontology tree lists are unique entries because they represent an abstraction of a tool, not each actual tool on board. The ontology and EARS FE will be extended to make listing actual devices possible. These will be represented as additional entities, linked to the same BODC/EF+ concept, but with a different altLabel, and additionally with a text property denoting the identifier or a defining characteristic. A rule will be added that the altLabel of a BODC/EF+ concept can only be appended or prepended, not otherwise changed (so that the ontology file remains consistent with those vocabularies). The altLabel is then a mnemonic for actual on-board use (by default it is identical to the prefLabel). The identifier is stored as a predefined property value to the event tied to that tool. The same approach will be adapted for all properties; in this way it will be possible to predefine any value for a property in the ontology (such as volume=10l or 5l). This will be achieved by a predefinedValues DatatypeProperty to Property. Properties will be mapped as much as possible to P01 and Q01. As the P01 list is huge a relevant subselection will be provided.

3. Record event purposes

Currently EARS FE saves the ToolCategory as a Subject in the event database. Showing and storing the ToolCategory serves two purposes:

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1. Provide an easy categorization of the tools to not clutter the ontology tree in EARS FE.
2. Provide the value for the L05 device category entry in the CSR (descriptiveKeywords). As a tool device L22 can belong to multiple categories, it is not possible to only store the tool in the EARS DB and derive the category from it.

Additionally, the CSR also needs the C77 entry for each sample and mooring. The concept actually saved as the Subject in the database via the web services should be the C77 SeaDataNet data categories, not the tool category. This means that the EARS DB event table needs an additional field denoting the ToolCategory.

The EARS FE will be adapted to take this into account. The ToolCategories will be kept as is, but will be redirected to the new ToolCategory database field. There are 92 entries in the C77 list so this should be presented in a simple way in EARS FE. The EARS2 ontology already contains all C77 entries as Subject individuals. It needs to made sure the EventDefinition contains an ObjectProperty for the Subject in the ontology. Subjects will be made addable to the EventDefinition in the EARS FE ontology tree visualisation. It will not be possible to modify or add subjects in EARS FE as it is otherwise meaningless to report them in the CSR. The same is already true for Tool Categories, Processes and Actions. For EARS2 some Tool Categories have been made that are not represented yet in de SeaVox lists. They will be requested to SeaVox.

The possible Subjects will be made available below the Processes; this is just visual, they are associated with the EventDefinitionRecord event purposes. Creating an event is still done by clicking on the Action.

A dropdown menu will be added on the top ribbon of the events table to preselect the currently active Subject. This list is composed from the Subjects of all the previous events already created for this cruise. Within the event row, one Subject will be choosable based on what is possible for the EventDefinition. The link to the EventDefinition will be persisted as well (see 5.) so that the Subject can be again changed later.

4. Record event parameters

On a global level the CSR needs to contain all the P02 measured parameters as keywords. There are two approaches to do this: store each P02 parameter along with the event, or store these at the level of the cruise. There are 462 entries in P02, so this needs to be organised well. We will store the P02 information at the cruise level but will investigate if it is possible to limit the options based on what Subjects have been chosen from C77 per Event. C77 links to P02 in the following way: C77-broader-P08-narrower-P03-narrower-P02.

5. Link back an Event to its original EventDefinition

Events are created and persisted in the database. When an event is created, a backreference to the EventDefinition can be easily maintained since it originates from a click on the EventDefinition itself; in the EARS2 DB however, the backreference to the EventDefinition is not kept. When the application is closed and reopened this information is lost. Keeping this information allows more fine-grained changes to the event after the cruise and improves usability. This also provides a mechanism to later protect events from subsequent tampering if the user is not authorized to edit a specific EventDefinition.

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6. **Provide globally unique identifiers for events**

EARS is a distributed system. To ensure that event identifiers are unique amongst all vessels, the event identifier will be a concatenation with the vessel identifier and the primary key of the event.

8 En-route Ship Summary Report (SSR) system

The en-route data will be gathered, stored, and transferred at a regular interval to the data centre of the vessel operator and, after local validation, also made available by web service in a standard json protocol to MARIS, as manager of the Eurofleets+ EVIOR (European Virtual Infrastructure in Ocean Research) platform. This will allow for publishing the en-route data and metadata per cruise at the EVIOR portal as part of the 'Dynamic Vessel Tracking & Events System'. The project strives for establishing this en-route data exchange not only for Eurofleets+ TA cruises, but also for all other cruises that Eurofleets+ research vessels, equipped with the shipboard system, will undertake.

ER-CSR and SSR are linked but independent:

1. SSR will be generated regularly, independently if the vessel is on cruise or not.
2. ER-CSR should only be generated and sent at the beginning of the cruise. At this moment a link to the cruise-id should be coded in the SSR.

The SSR Maker is responsible to pack a set of files (Ship Summary Reports): the last 24h information on tracks, meteorology, thermosalinometry and events; to list the last track position, last meteo and last thermosalinometry information at the time the SSR Maker was run; together with basic info like vessel identifier and cruise id.
When the EF2 SSR maker is run, it results in the following files (29AH is the C17 vessel identifier):

- 29AH.ssr
- 29AH_24h_events.sml.xml
  29AH_24h_thermosalinometer.json
- 29AH_24h_track.gml
  29AH_24h_weather.json

The SSR files are crucial for the localization of the vessel on the EVIOR vessel together with whatever data is transmitted along.

9 Vessel-to-shore data transporter

The en-route data will be transferred to shore in order to be used for presentation purposes in the EVIOR portal to show the ship's progression.
During Eurofleets2 project two different implementations were proposed in order to evaluate the strategies to follow for transmitting the en-route information from vessel to shore:

1. All the information is produced on board and distributed from vessel to shore centres
2. Vessel data is sent to vessel operator's office, where SSR is produced and distributed to other centres or users such us EVIOR portal.

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Two essays of SSR with live and real data from two CSIC Research Vessels were done, one for each implementation. The second scenario, where there is a continuous data flow from vessel to shore where SSR file are generated, optimizes better the communication links between vessels and the operator's offices, because every ship is only providing one shore centre and the use of raw navigation data can be more optimized. From the operator's office SSR files are served to the EVIOR portal using normalized protocols like HTTP or SOAP.
This approach will be implemented in EARS V3.
It can also be considered not to send the data to each operator's office but to centralize them, together with the generation of SSR files, in a Central SSR on-shore. In this way the EVIOR portal would only have to connect to one data centre (currently CSIC). This will be evaluated together with MARIS.

Regarding the connection, we expect four basic scenarios:

1. Satellite connection available, bandwidth enough for RT/NRT transmission (frequency: near-instantaneous)
2. Satellite connection available, bandwidth enough for Delayed (batch) mode transmission (frequency: more than once daily)
3. No satellite connection available; data transfer through cable or wifi-connection on the quay.
4. Data transfer by physical disks

Only vessels in category 1 and 2 make sense to transfer data to be displayed on the EVIOR portal.

Another important aspect is to have the scheduling frequency aligned with the transmission frequency so as to not create any data mismatch or inefficient runs. The scheduling frequency depends on the transmission frequency which in turn depends on the mean number of data points per time unit and the bandwidth the R/V operator has reserved for EARS operations. Operators will not like to have too many or too large data packages, so this should be balanced out.

10 Planned activities for T3.1.2

In a first stage, the individual system components of the ship board system EARS V2 will be upgraded and tested in the coming months by IFREMER, RBINS and CSIC. A test of the full integrated and upgraded system EARS V3 will be done in simulation in June and July 2020 and in field trials on *RV Sarmiento de Gamboa, RV Hesperides, RV Garcia del Cid* (operated by CSIC), *RV Thalassa* (operated by IFREMER) *and RV Belgica* (operated by RBINS) from August to October 2020. From July to December 2020 the EARS V3 will be finalized and documented in order to have it operational on all Eurofleets+ vessels by the end of the project (second stage of Task T3.1.3 Outfitting the Eurofleets+ fleet).

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Annex 1 Mapping between the EARS entities and the CSR elements

CSR element	Sub element	BODC vocabulary	Corresponding EARS2 entity	Corresponding EARS3 entity	ISO
Metadata Responsible person, detailed		EDMO	Cruise.chiefScientists	Cruise.chiefScientists	
Cruise Responsible person, detailed		EDMO	Cruise.chiefScientists	Cruise.chiefScientists	
Country code for departure		C32	*Obtained via harbour and C38, which is imported into EARS*	*Obtained via harbour and C38, which is imported into EARS*	descriptiveKeywords
Country code for arrival		C32	*Obtained via harbour and C38, which is imported into EARS*	*Obtained via harbour and C38, which is imported into EARS*	descriptiveKeywords
Port codes for departure		C38	Cruise.departureHarbourIdentifier	Cruise.departureHarbourIdentifier	descriptiveKeywords
Port codes for arrival		C38	Cruise.arrivalHarbourIdentifier	Cruise.arrivalHarbourIdentifier	descriptiveKeywords
Ship code		C17	Platform.identifier	Platform.identifier	descriptiveKeywords
Platform cat. Code		L06	Platform.platformClass	Platform.platformClass	descriptiveKeywords
Project code		EDMERP	Project.identifier	Project.identifier	descriptiveKeywords
Sea Areas		C19	SeaArea.identifier	SeaArea.identifier	descriptiveKeywords
Marsden Sq.		C37	NOT AVAILABLE	will not be included, but could be derived from the data using GIS layers.	descriptiveKeywords
Spatial bounding box			min/max(navigation.lat/lon)	min/max(navigation.lat/lon)	EX_GeographicBoundingBox
Temporal bounding box			Cruise.startdate and Cruise.enddate or if it exists Event.Cruise-Start].datetime	Cruise.startdate and Cruise.enddate or if it exists Event.Cruise-Start].datetime	EX_TemporalExtent
Temporal bounding box			Cruise.startdate and Cruise.enddate or if it exists Event.Cruise-End].datetime	Cruise.startdate and Cruise.enddate or if it exists Event.Cruise-End].datetime	gmi:operation/gmi:significantEvent
Parameter discovery code		P02	NOT AVAILABLE	Cruise.p02	descriptiveKeywords
Device categories used		L05	Event.subject	List of (Event.toolcategory)	descriptiveKeywords
Complete Cruise track			navigation.lat/lon	navigation.lat/lon	

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CSR element	Sub element	BODC vocabulary	Corresponding EARS2 entity	Corresponding EARS3 entity	ISO
Mooring information	--	--	--	--	--
	Contact details of program PI			Event.program.principalInvstigator	gmi:acquisitionInformation/gmi:objective/gmi:sensingInstrument/gmi:mountedOn/gmi:identifier, gmi:description, gmi:sponsor/gmd:CI_ResponsibleParty
	Data Categories (C77)	C77		Event.subject	gmi:acquisitionInformation/gmi:objective/gmi:sensingInstrument/gmi:identifier & gmi:type
	Quantification Units (L18)	L18			gmi:acquisitionInformation/gmi:objective/sdn:SDN_SamplingActivity
	Device descriptions	L22+circumstances			gmi:acquisitionInformation/gmi:objective/gmi:function
Sample and measurements information	--	--	--	--	--
	Contact details of program PI			Event.program.principalInvstigator	gmi:acquisitionInformation/gmi:objective/gmi:sensingInstrument/gmi:mountedOn/gmi:identifier, gmi:description, gmi:sponsor/gmd:CI_ResponsibleParty
	Data Categories (C77)	C77	NOT AVAILABLE	Event.subject	gmi:acquisitionInformation/gmi:objective/gmi:sensingInstrument/gmi:identifier & gmi:type
	Quantification Unit and quantity (L18)	L18		count over(number of sampling profiles)	gmi:acquisitionInformation/gmi:objective/sdn:SDN_SamplingActivity
	Device descriptions	L22+circumstances	Event.subject	Event.toolcategory+Event.tool	gmi:acquisitionInformation/gmi:objective/gmi:function
	Trigger (automatic, manual or preProgrammed)			always manual	gmi:acquisitionInformation/gmi:objective/gmi:objectiveOccurrence/gmi:trigger
	Context (acquisition, pass or wayPoint)			always acquisition	gmi:acquisitionInformation/gmi:objective/gmi:objectiveOccurrence/gmi:context
	Sequence (start, end or instantaneous)			always instaneous	gmi:acquisitionInformation/gmi:objective/gmi:objectiveOccurrence/gmi:sequence
Cruise information	--	--	--	--	--
	Cruise start			value=trigger=manual, context=wayPoint, sequence=start	gmi:acquisitionInformation/gmi:operation/significantEvent
	Cruise end			trigger=manual, context=wayPoint, sequence=end	gmi:acquisitionInformation/gmi:operation/significantEvent
	List of events grouped by mooring and sampling descriptor				gmi:acquisitionInformation/gmi:operation/significantEvent

This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 824077