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Report on simulation and field trials of fully integrated system and recommendations



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1 Introduction

During Transnational Access cruises, scientific teams will have to keep an index of data and sample acquisition, for which it is recommended that use is made of the Eurofleets+ EARS system. EARS stands for Eurofleets Automatic Reporting System and needs to be installed and configured on the Research Vessels in advance of the Eurofleets+ funded cruises. Once installed on the Research Vessel, the EARS system is instrumental for automatically gathering underway data, gathering metadata about the events concerning the human deployments of instruments and taking of samples, and for real-time data transfer to shore and European Virtual Infrastructure in Ocean Research (EVIOR) portal.

EARS has been upgraded from version 2 to version 3 and simulations on-shore and field trials on research vessels have been carried out in order to test the system and get inputs from testers.

Due to the COVID-19 crisis, access to vessels has been more restricted than usual and cruises schedules have been modified and therefore EARS 3 has not been tested on all ships which was planned. However, it has been possible to do tests on-shore and on 3 different vessels and the information provided by the testers has been very valuable.

2 EARS

EARS is composed of two main components: **EARS Server** and **EARS Client**.

The Data Acquisition System, included on the server, logs en-route data in a database in order to make them available through the available Web Services. In addition, it has a web application to monitor the data in real-time.

The EARS 3 Client is a desktop application and a web application (for PC, tablets and smartphones) used by researchers to register/log manual events of marine scientific cruises onboard research vessels.

When logging an event, the event and its details (time, coupling with acquisition info) are stored in a database, which can be disseminated for later data management. When leaving the vessel, the researcher can export events, automatically georeferenced, as an excel file including underway data.

A Cruise Summary Report (CSR) can be generated including the cruise bounding box and the GML track of the navigation.

3 Simulation and field trials

EARS3 has been tested on-shore at RBINS and CSIC headquarters. In addition, it has been tested on field trials on RV Sarmiento de Gamboa (CSIC), RV SOCIB (SOCIB) and RV Laura Bassi (OGS). SOCIB and OGS have volunteered to perform some trials, as has also CNR who however has not been able to carry out the tests yet.

RBINS and CSIC have provided information and technical support when needed. The testers have been asked to check, test and give some inputs on:

1. Installation:

Server: <https://github.com/naturalsciences/ears3-server>

Client: <https://github.com/naturalsciences/ears/releases/tag/3.0.1beta>

2. Creation of EARS datagrams

3. Server:

- **Acquisition system:** http://{your_host}:8080/ The Dashboard is configured with a predefined configuration but it can be customizable with an own view.

4. Client:

- Settings
- Creating a vessel tree (instrumentation on board)
- Creating a program and a cruise
- Editing cruises and programs
- Creating events, edit
- Web application: building common scenarios (buttons)
- Exporting events

5. Web services:

- [http://localhost/ears3Nav/nav/getLast/\[xml, datagram, json\]](http://localhost/ears3Nav/nav/getLast/[xml, datagram, json])
- [http://localhost/ears3Nav/met/getLast/\[xml, datagram, json\]](http://localhost/ears3Nav/met/getLast/[xml, datagram, json])
- [http://localhost/ears3Nav/tss/getLast/\[xml, datagram, json\]](http://localhost/ears3Nav/tss/getLast/[xml, datagram, json])
- [http://localhost/ears3/events.\[xml, .json, .csv\]](http://localhost/ears3/events.[xml, .json, .csv]),
- [http://localhost/ears3/cruises.\[xml, .json\]](http://localhost/ears3/cruises.[xml, .json])
- [http://localhost/ears3/programs.\[xml, .json\]](http://localhost/ears3/programs.[xml, .json]).
- **CSR:** http://localhost/ears3/cruise/csr?identifier=cruise_identifier

3.1 RV Sarmiento de Gamboa (CSIC)

Tests carried out from May 2 to 31, 2021

During the Client installation technicians have encountered some problems due to the Java version. The EARS datagrams were already created. The Acquisition system worked properly. On EARS Client Settings have been modified and vessel tree, program, cruise and events created and edited:

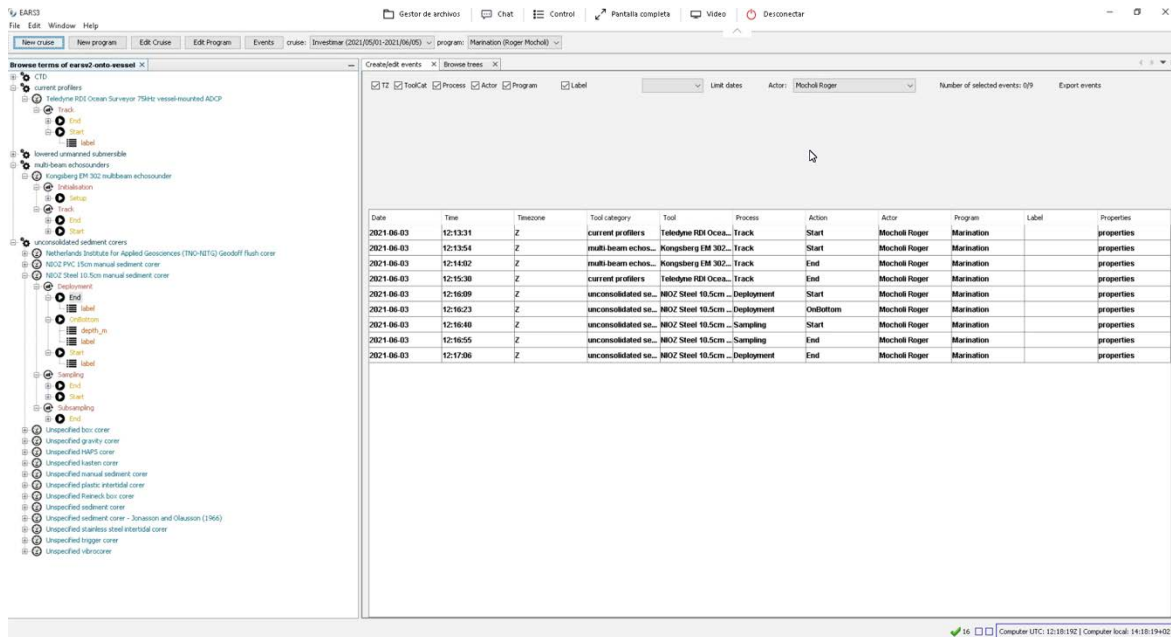
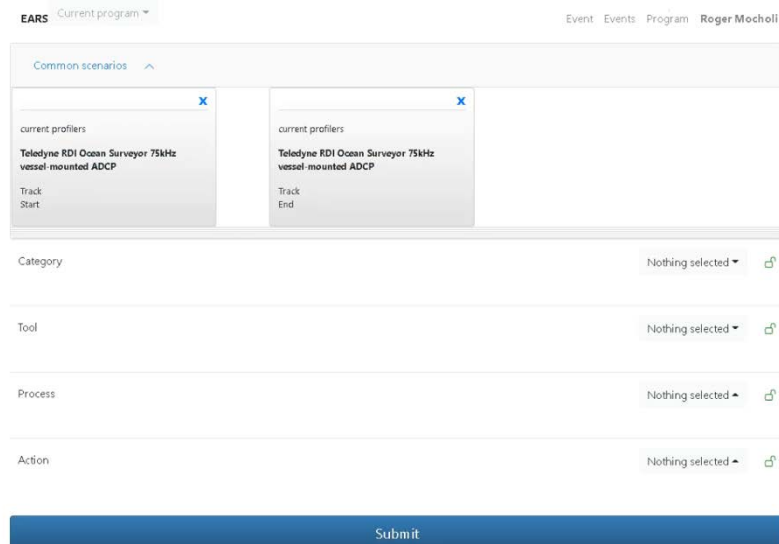


Figure 1: EARS Client desktop application with the vessel tree view and a list of events

The Web application was used to build common scenarios (buttons) and create events:



EARS Current program ▾ Event Events Program Roger Mocholi

Show entries Search:

timeStamp	toolCategory	tool	process	action
2021-06-03T13:16:25Z	current profilers	Teledyne RDI Ocean Surveyor 75kHz vessel-mounted ADCP	Track	Start
2021-06-03T13:16:33Z	current profilers	Teledyne RDI Ocean Surveyor 75kHz vessel-mounted ADCP	Track	End

Showing 1 to 2 of 2 entries Previous Next

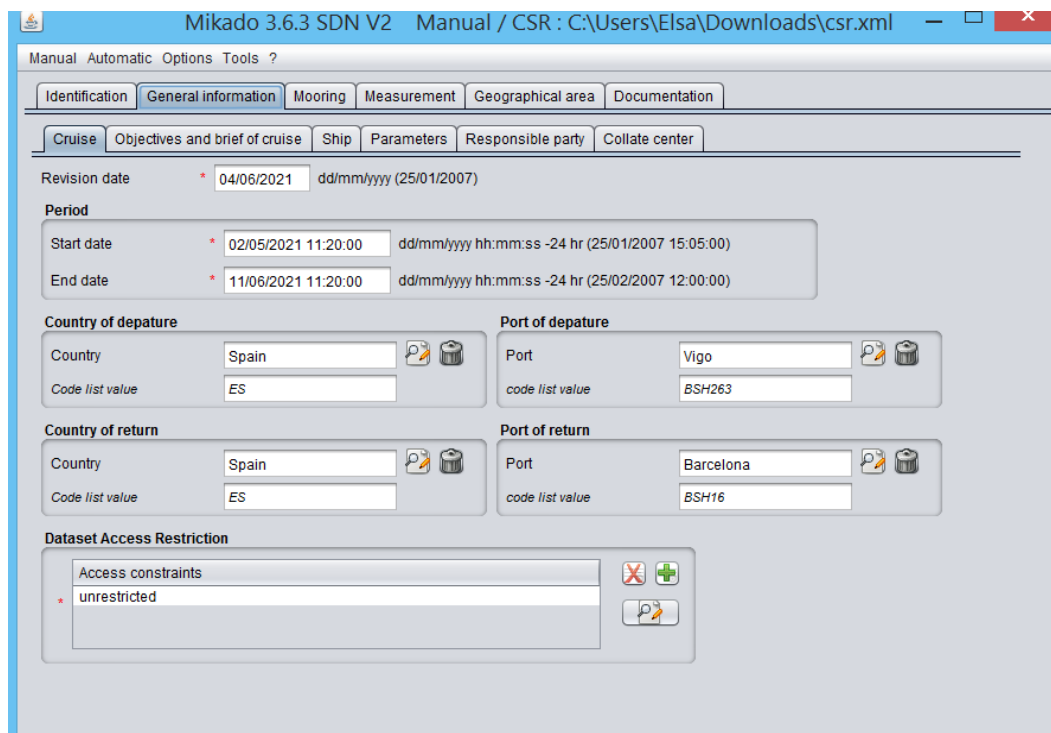
Figure 2: EARS Client web application

Events have been successfully exported with underway information (navigation, meteo and thermosalinograph data) retrieved from the database:

```
time_stamp,actor,"Program","Principal Investigator","Tool category","Tool category code","Tool","Tool code","Process","Action","Acquisition Timestamp","Latitude","Longitude","Depth","Surface water temperature","Heading","Course over Ground","Speed over Ground","depth_m","Label","Salinity"
2021-06-04T12:00:20.243Z,"Roger Mocholi","Marination","Roger Mocholi","lowered unmanned submersible","SDN:L06:26","N0 QZ Video frame","Deployment","Start","2021-06-04T12:00:20.243Z","42.2427017","-8.7269167","5198.3","22.5824","232.8","182.2","0.0","","34.6759","50.157745","23.808631","5
2021-06-04T12:00:28.253Z,"Roger Mocholi","Marination","Roger Mocholi","lowered unmanned submersible","SDN:L06:26","N0 QZ Video frame","Deployment","OnBottom","2021-06-04T12:00:28.253Z","42.2427017","-8.7269183","5148.3","22.583","232.8","194.7","0.0","","34.6751","50.157745","23.808632
2021-06-04T12:00:38.289Z,"Roger Mocholi","Marination","Roger Mocholi","lowered unmanned submersible","SDN:L06:26","N0 QZ Video frame","Deployment","End","2021-06-04T12:00:38.289Z","42.2427017","-8.7269183","5058.8","22.583","232.7","207.0","0.0","","34.6758","50.158764","23.808631","5.49
```

Figure 3: CSV file, events exportation result

Web services have been tested and the output for the CSR web service was a CSR xml file with the cruise metadata information including the GML track that could be opened with MIKADO¹ software:



¹ <https://www.seadatanet.org/Software/MIKADO>

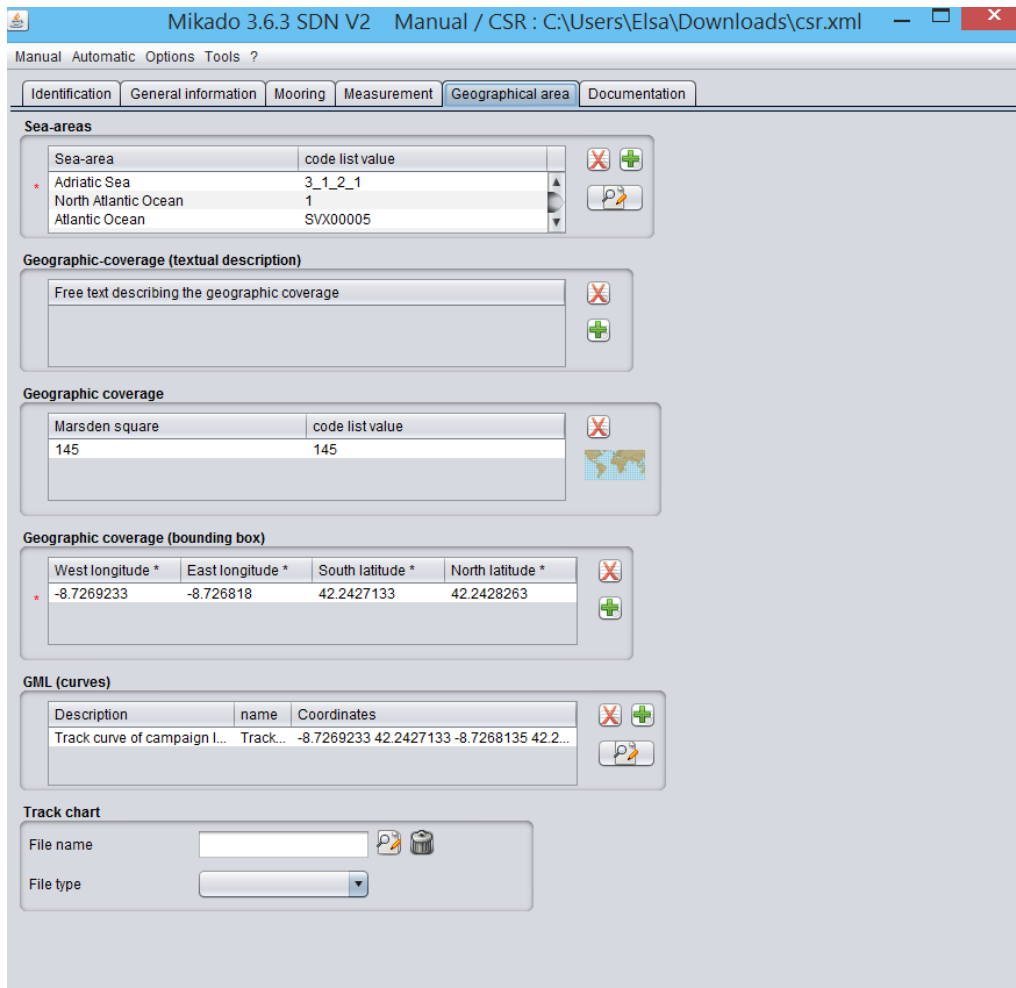


Figure 4: CSR metadata file

Data is sent to the UTM-CSIC datahub on-shore and can be retrieve on Eurofleets Dashboard: <http://eurofleets.utm.csic.es>

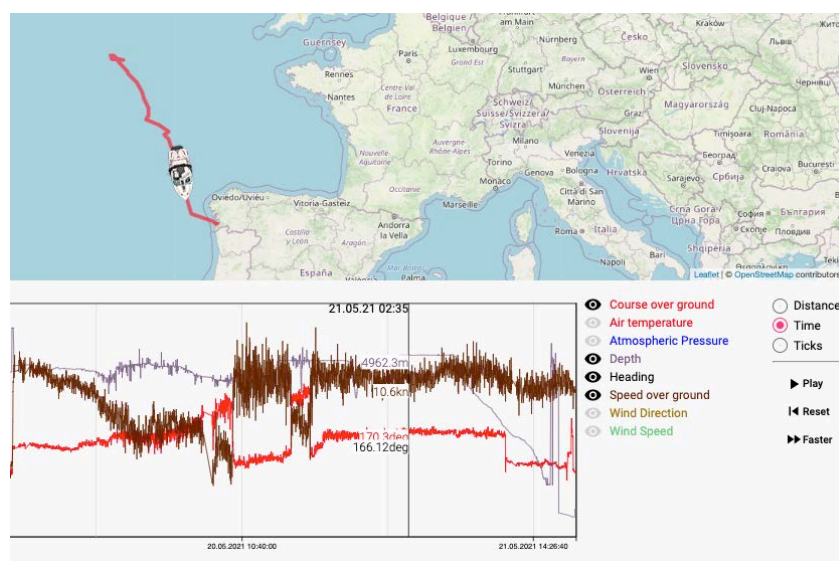


Figure 5: RV Sarmiento de Gamboa data on EF dashboard

3.2 RV SOCIB (SOCIB)

Tests carried out from May 17 to 21, 2021

During the Client installation technicians have encountered some problems due to the Java version. The conversion of the datagrams was not possible due to lack of time, so it was not possible to check if the acquisition system was working correctly nor could the web services be tested. On EARS Client, settings have been modified and vessel tree, program, cruise and events created and edited. The Web application was used to build common scenarios (buttons) and create events. Events have been successfully exported but without underway information since the EARS server was not receiving EARS datagrams.

3.3 RV Laura Bassi (OGS)

Tests carried out from May 3 to 7, 2021

The conversion of the position datagram was done by a script provided by CSIC that had to be slightly modified by the technician in charge of the tests.

The acquisition module showed the monitoring of the devices and the dashboard with the possibility of customizing the view:

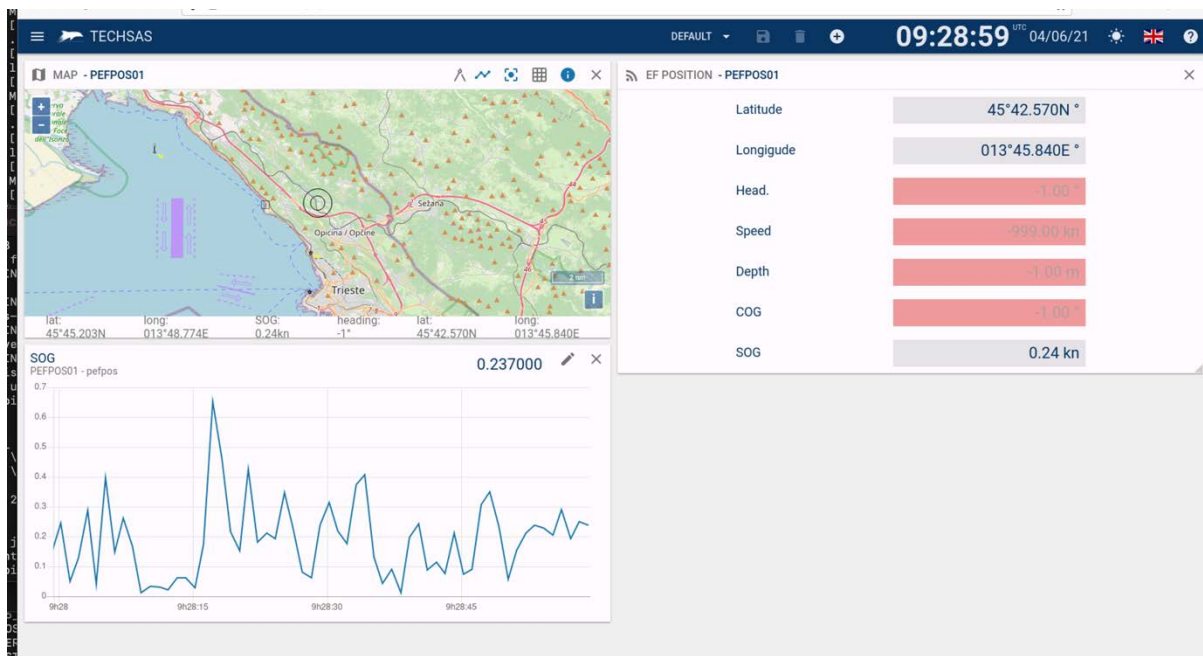


Figure 6: Acquisition system dashboard customized with a navigation map

On EARS Client, settings have been modified and vessel tree, program, cruise and events created and edited. The Web application was used to build common scenarios (buttons) and create events. Events have been successfully exported with navigation data retrieved from the EARS database.

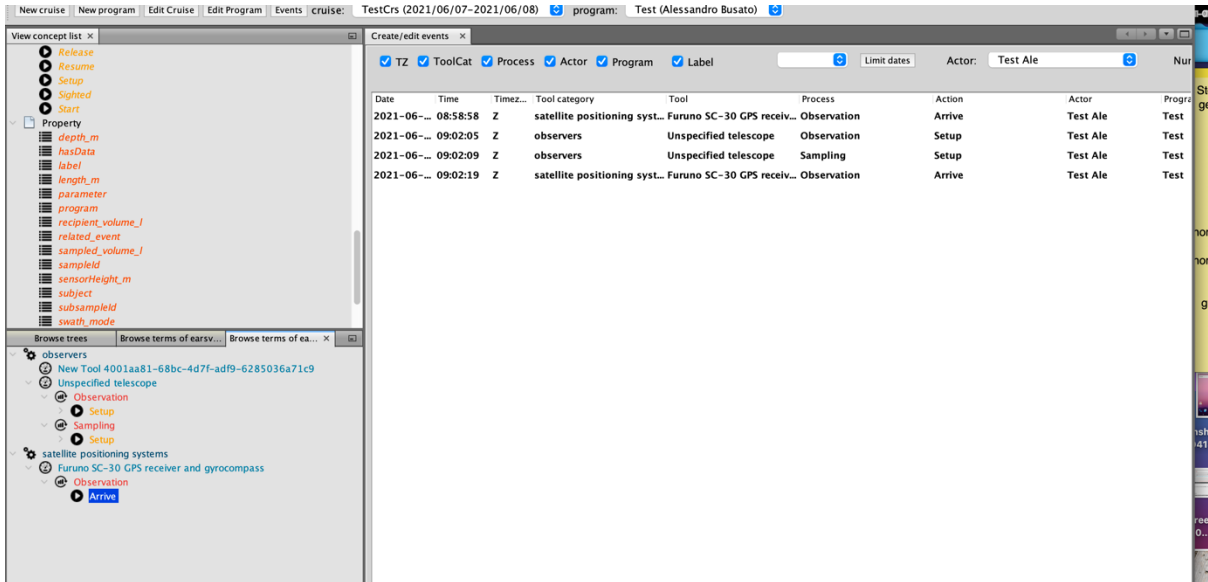
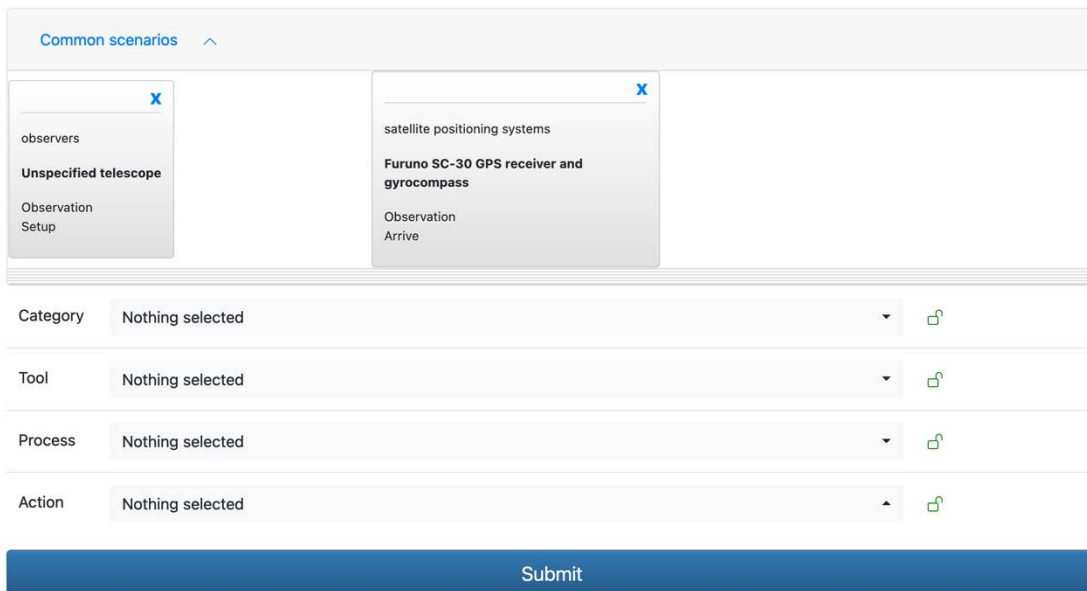


Figure 7: EARS Client desktop application with the vessel tree view and a list of events



EARS Test (Alessandro Busato) ▾ Event Events alessandro busato

Show 10 ▾ entries Search:

timeStamp	toolCategory	tool	process	action
2021-06-07T09:20:57Z	observers	Unspecified telescope	Observation	Setup
2021-06-07T09:21:09Z	observers	Unspecified telescope	Observation	Setup
2021-06-07T09:21:10Z	observers	Unspecified telescope	Observation	Setup
2021-06-07T09:21:16Z	observers	Unspecified telescope	Observation	Setup
2021-06-07T09:21:36Z	satellite positioning systems	Furuno SC-30 GPS receiver and gyrocompass	Observation	Arrive
2021-06-07T09:21:40Z	satellite positioning systems	Furuno SC-30 GPS receiver and gyrocompass	Observation	Arrive
2021-06-07T09:22:27Z	observers	Unspecified telescope	Observation	Setup
2021-06-07T09:22:28Z	satellite positioning systems	Furuno SC-30 GPS receiver and gyrocompass	Observation	Arrive
2021-06-07T09:22:33Z	observers	Unspecified telescope	Observation	Setup

Showing 1 to 9 of 9 entries Previous Next

Figure 7: EARS Client web application

The web services worked properly but the CSR could not be generated with the navigation information (mandatory bounding box and optional GML vessel track) since the vessel was docked. The code has been improved to take this edge case into account.

4 Recommendations

The tests revealed some bugs that were reported and fixed on the fly. The difficulties encountered by the testers during the installation or configuration of the system led to the expansion of the instruction manual in some points.

The testers installed the server from scratch, but the EARS 3 distribution will be carried out through a Virtual Machine (VM) image provided by CSIC, an approach already taken in version 2 deployments, so that the installation is easier and does not require the download of large files on the vessel. A script for the conversion of the position datagram (from NMEA RMC output to EARS format) will be included in this VM with input and output ports configured for each RV, so that although the technicians on board cannot program the conversion themselves, the events will be able to include the information from the position.

It is recommended to include in the VM, whenever the operator allows it, a VPN connection in order to have remote access to the server in case support is needed during the cruise.

It is also recommended to include in the VM the sending of the UDP datagrams to the UTM-CSIC datahub on-shore so data can be viewed in real time on the EF dashboard (1 datagram per minute). It will also be possible to have a more distributed implementation, whereby each RV operator will have its own hub. The dashboard on the EVIOR Portal will then be fed by different sources: UTM-CSIC datahub plus different RVS, different datahubs, etc. The interest of RV operators will be explored, once there is a considerable base of RVs equipped with EARS.

Using the web application is a practical and easy way to create events (once the desktop application has been configured) that represents a substantial improvement compared to version 2, since it can be done from any device connected to the Wi-Fi network of the vessel in a friendly manner.

It is recommended to edit the generated CSR with Mikado, since it is necessary to expand part of the metadata to obtain a final CSR. For instance, the Sea areas are only suggestions based on their bounding boxes and the ship track; because of this large water bodies such as oceans are nearly always included. Automatic inclusion from the bounding box and GML track has proven to be very useful.

Some recommendations made by the testers for improvement of the system will be taken into account for future releases of the software.