

**“Automatic Identification System as Aids to Navigation (AIS-AtoN) implementation on Orcadas Islands and Antarctic zone”**

**Project carried out by the Argentinian Navy -  
Antarctic Naval Command - Naval Hydrography  
Service - Hidrovía S.A.**

"Automatic Identification System (AIS) as Aids to Navigation (AtoN) in Antarctic zone" project

2011 – 2017



# Goals of the Antarctic AIS-AtoN project

- Automatic Identification System set up and performance monitoring under extreme weather conditions.
- Promote the implementation of cutting edge technology in Aids to Navigation in Antártida.
- Provide a greater navigation safety by "illuminating" with AIS technology for every ship in navigation zones and landfall marks, within the influenced area.
- Generate a direct communication circuit with users in order to know with certainty the reach, visualization and the navigation safety increase accomplished by the implementation of the AIS-AtoN.

# Benefits of AIS-AtoN use in Antártica's navigation

- Reception and visualization of the real or virtual AIS-AtoN automatically represented on the electronic chart display system (ECDIS).
- Targets information can be received from locations where radars can't reach; from behind islands or riverbends, ice.
- Real time tracking and identification, with digital data registration.
- Weather information transmission from an AIS-Aton through the message 8.



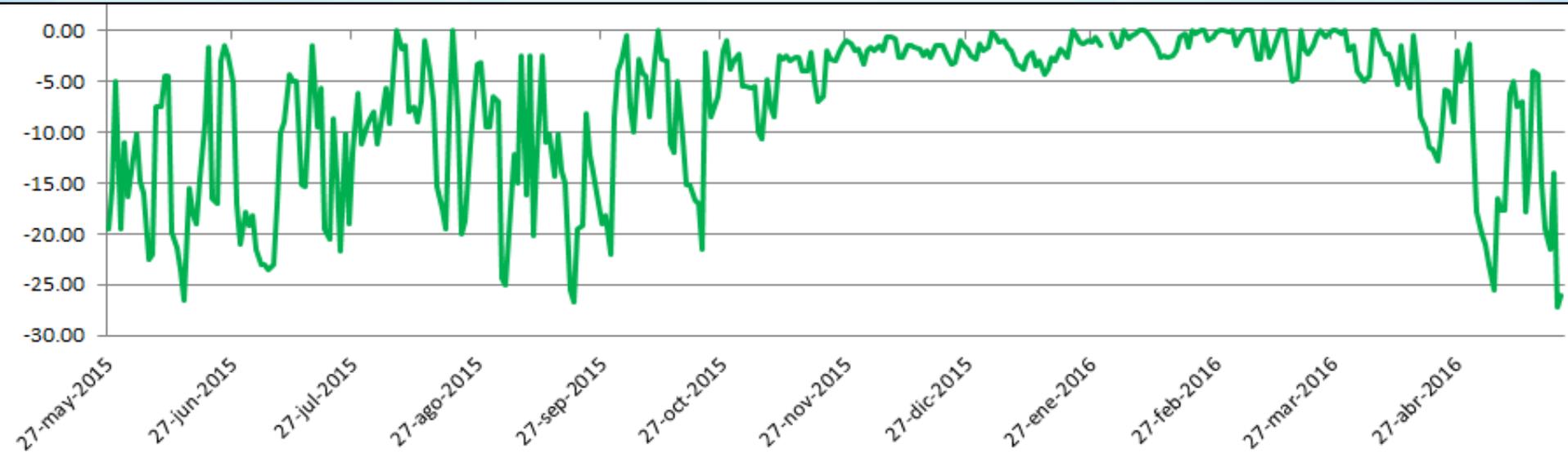


# Fase I, possible effects to study

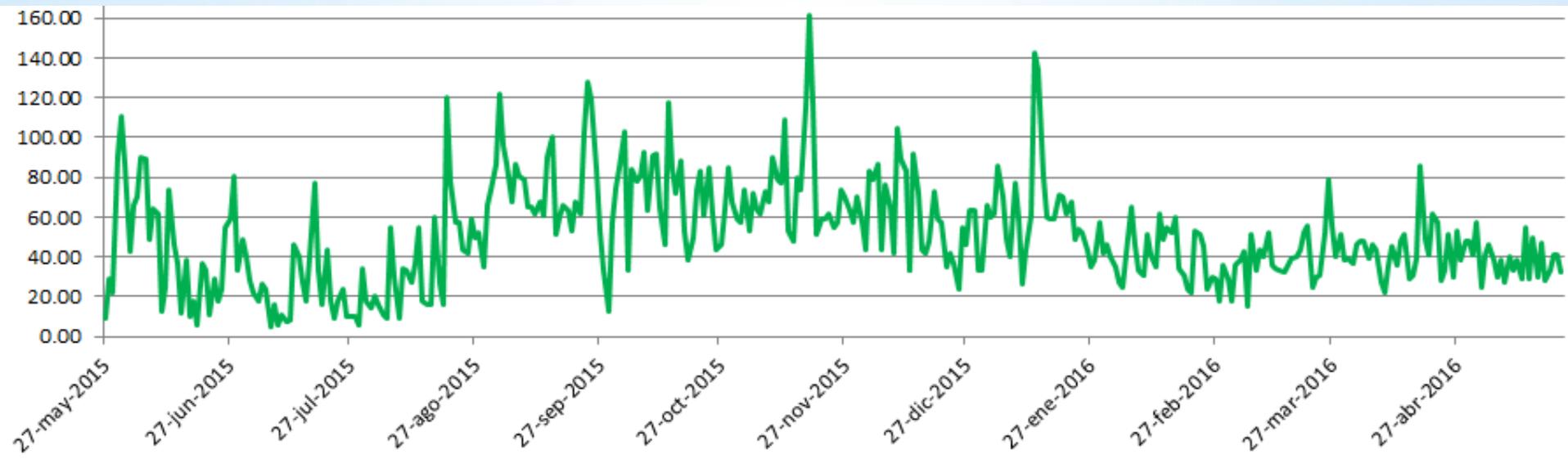


- Freezing on the connectors and VHF wire.
- Antennas' durability.
- Loss of GPS signal due to ice over the equipment.
- Condensation problems inside the equipment (sealing verification)

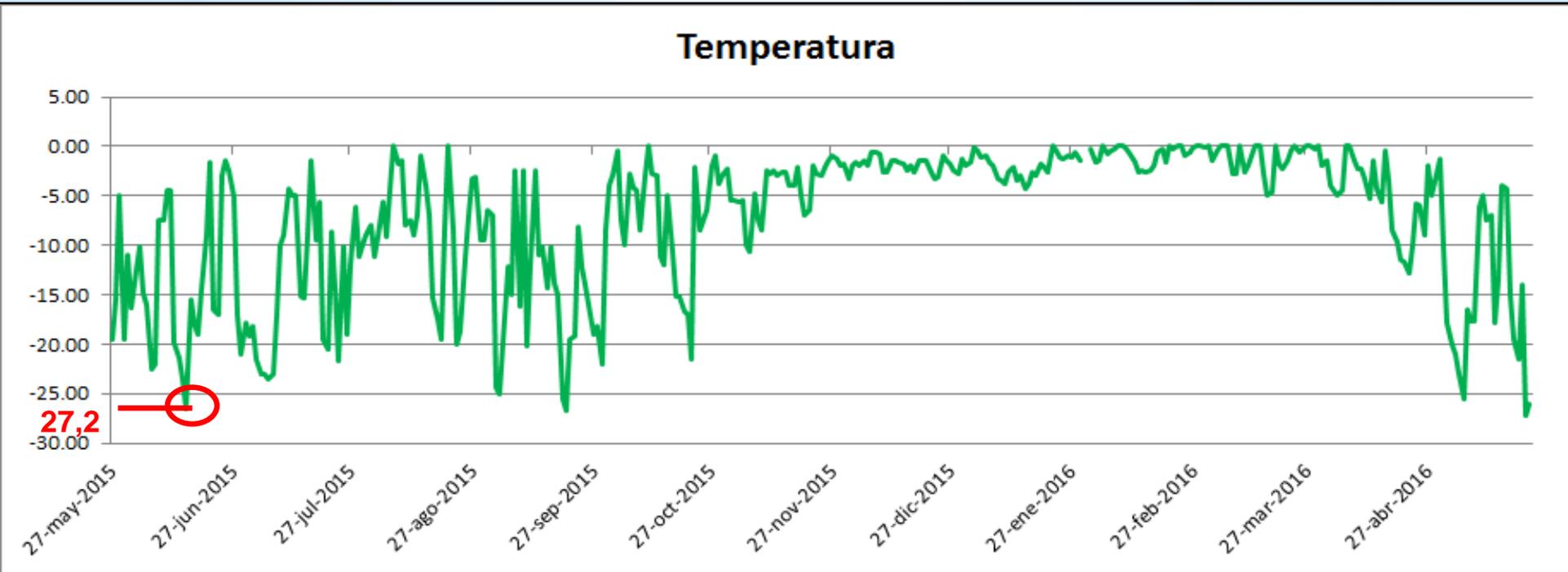
Lowest temperature that the AIS-AtoN and the VHF antenna were exposed to (-27 °C).



Strongest winds that the AIS-AtoN and the VHF antenna were exposed to (150 km/h)



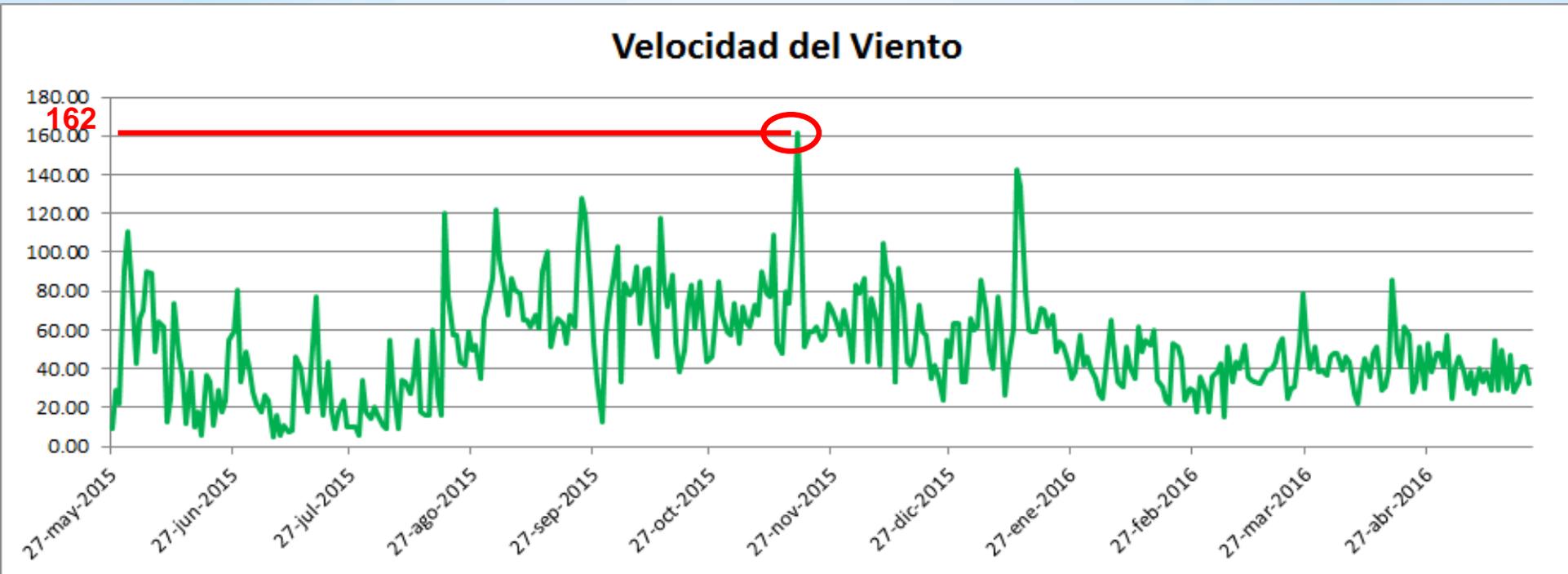
# Extreme low temperatures



Lowest temperature at which the AIS and VHF antenna were exposed

→ **-27,2 °**

# Strong winds



Maximum wind velocity at which the AIS transducer and VHF antenna were exposed



**> 150 Km/h**

# Installing an AIS aid to navigation on the Argentine Antarctic Naval Base

By Mariano L. Marpegan, Hidrovia S A;  
Captain Guillermo Palet, Argentine Navy;  
Captain Valentin Sanz Rodriguez, Argentine  
Navy and Raúl S. Escalante, Hidrovia S A

## Overview

The IALA EEP Committee has analyzed the operation of aids to navigation in Arctic regions, pondering weather conditions which may alter considerably the performance of the signals and electronic equipment installed therein. As a result, Hidrovia S.A., the Argentine company concessionary of the operation and maintenance of dredging and signalling works throughout the 1600 kilometres of the Confluencia-Santa Fé/Santa Fé-Ocean main waterway, together with the Antarctic Naval Command of the Argentine Navy, has decided to install an AIS-AtoN and an AIS receiver station in Orkneys Naval Base.

## Environment

This Antarctic base is located on Laurie Island, coordinates Lat: 60°44'S ; Long: 044°44'W, and is part of the South Orkney Island, discovered by George Powell in 1821. It has been permanently occupied by Argentine residents since its acquisition on

22<sup>nd</sup> February 1904, one year after the ramshackle premises and weather station were installed by Doctor William Bruce during the Scottish National Antarctic Expedition. For the next 40 years it remained the only permanent settlement in the Antarctic region.

Current staff is comprised of 17 members of the Argentine Army, Argentine Air Force and Antarctic National Directorate, which pursuant to the Antarctic Annual Plan perform studies of height and surface meteorology, seismology, geomagnetism, geological surveys, glaciology, sea-ice state, biology, birds and marine wildlife. They are also in charge of monitoring the ecosystem, preserving the sights and historical monuments and offering guidance, assistance and control to the tourist contingents that frequently arrive on cruise ships.

Its coastline, featuring a host of bays of different sizes, tends to freeze due to the influence of the Wendell Sea, allowing for navigation only during the summer. The lo-

west temperature recorded was -44°C, and the highest reached 15.2°C with both average temperatures standing at -8.9°C and 0.4°C respectively. Wind speed can reach 150 knots.

## Project and Objectives

This project was first introduced in October 2011, amidst EEP17. Its main objective is to compare the operation of

### Instalación de una ayuda a la navegación de AIS en la Base Naval Antártica Argentina

El Comité de EEP de IALA ha analizado la operación de las ayudas a la navegación en las regiones Árticas considerando el clima, que puede alterar considerablemente el rendimiento de las señales y de los equipos electrónicos instalados allí. Por consiguiente, Hidrovia S.A., la compañía argentina concesionaria de la operación y mantenimiento del dragado y señalización en la totalidad de los 1.600 kilómetros de la vía navegable principal Confluencia-Santa Fe/Santa Fe-Océano, junto con el Comando Naval Antártico de la Armada Argentina, ha instalado una ayuda a la navegación de AIS y una estación receptora de AIS en la Base Naval Orcadas ubicada en la Isla Laurie. Desde 1904 la base ha estado poblada permanentemente y desde 1952 ha sido el Puesto de Avanzada Naval Orcadas, que dirige el Servicio Hidrográfico Naval (SHN). El proyecto fue presentado en octubre de 2011 para comparar la operación de las ayudas a la navegación de AIS con los informes emitidos por la base naval a efectos de correlacionar los parámetros operativos y la transmisión del mensaje 21 y las variables climáticas registradas. Se consideraron varios objetivos y está planificada una fase adicional con respecto a una segunda ayuda a la navegación de AIS.

AIS-AtoN with the reports issued by the Antarctic Orkney Base, in order to correlate the operating parameters and broadcast of message 21 with the weather variables registered.

The installation and deployment of the AIS-AtoN and receiving system was conducted during the 2011-2012 Antarctic Campaign.

The objectives of this research project are based on the completion of the following tasks:

- ✓ Analyze and compare against other AIS

operating zones the special propagation registered when, under certain weather conditions, there are different refraction indexes in the troposphere, forming propagation channels for the VHF frequencies throughout extensive distances.

- ✓ Monitor the operating standards of the AIS-AtoN equipment subjected to extreme weather conditions, and comparing them with the reports performed every three hours at the Naval Base.
- ✓ Separately energize the equipment du-

ring the first phase of the project so as to not hide the power shortage within the possible flaws of the equipment.

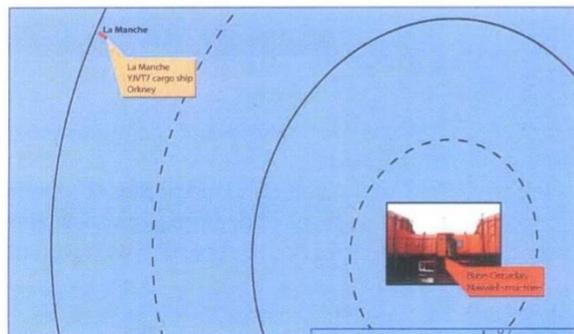
- ✓ Enhance knowledge acquired on the implementation of electronic systems subjected to harsh environmental conditions.

- ✓ Develop an AIS training protocol for technicians from the Argentine Navy, company employees and external personnel.

The final installation of the transmitting antenna as well as the AIS system itself was performed on one of the fixed antennae at base, at a height of 20 metres. The receiving antenna was placed nearby at a similar height.

The receiving system includes Rx equipment, an adapter and collector of DB9 connections, converter, power supply, UPS and an unmanaged switch which provides the link to the router of the satellite system.

Next phase of the project includes the installation of a second AIS-AtoN on a beacon, two kilometres distant from the base and powered by an independent power supply. ■



On the image above is displayed the range of the receiver equipment installed in the Base, for a ship bound under the name La Manche. This very special feature of propagation at long distances shows the benefits of having AIS-AtoN equipments installed in a place as inhospitable and inaccessible out of range of navigation routes. The distance between each circle with centre on AIS-AtoN target is 150 kilometres.



The AIS-AtoN system was configured under the name Base Antártica Orcadas MMSI number: 997011088 and call sign: LV9996. The image shows the AIS-AtoN detected and observed by means of the geo-referenced chart

This Antarctic base is located on Laurie Island, coordinates Lat: 60°44'S ; Long: 044°44'W, and is part of the South Orkney Island

### Installation d'un "AIS-aide à la navigation" à la base navale argentine de l'Antarctique

La commission EEP de l'AIMA a analysé la mise en œuvre des aides à la navigation dans les régions arctiques, prenant en compte les conditions météorologiques qui peuvent altérer de manière considérable les performances des signaux et des équipements électroniques installés en ces lieux. En conséquence, la société argentine Hidrovia S.A., concessionnaire de la gestion et de la maintenance du dragage et de la signalisation maritime sur les 1 600 kilomètres de la voie navigable principale Confluencia-Santa Fé/Santa Fé-Océan, avec le commandement naval antarctique de la Marine Nationale de l'Argentine, a installé un « AIS-Aide à la navigation » et une station de réception AIS sur la base Navale d'Orkney, située sur l'île Laurie. La base a été armée en permanence depuis 1904. Depuis 1952, c'est le cas de l'avant-poste naval Orkney, qui travaille pour le service naval hydrographique. Le projet a été lancé en octobre 2011 pour comparer le fonctionnement de l'« AIS-Aide à la navigation » avec les comptes rendus produits par la base navale de façon à corréliser les paramètres d'exploitation et l'émission du message 21 et les variables météorologiques enregistrées. Différents objectifs ont été considérés et une nouvelle phase est planifiée quant à une seconde « AIS-Aide à la navigation ». ♦

# Phase II

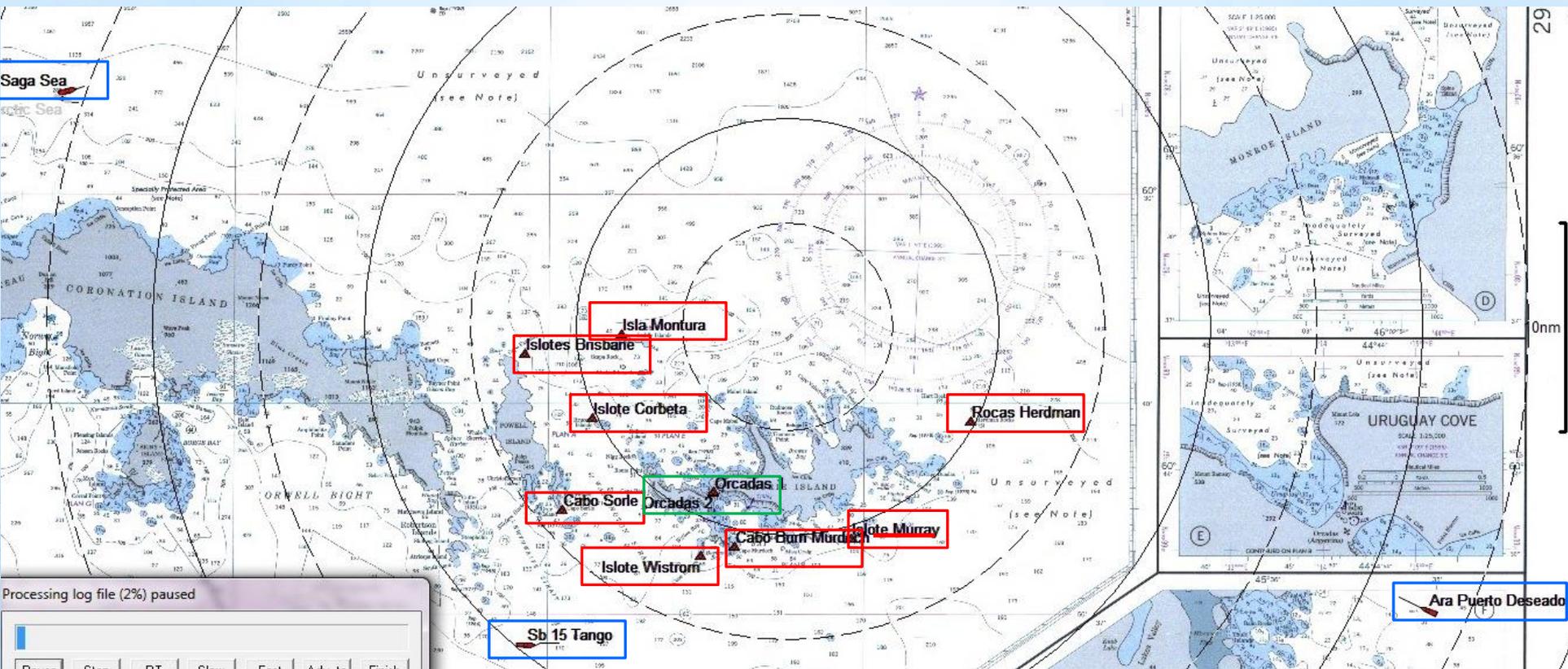
A second AIS-AtoN type 3 was installed to increase the amount of electronic Aids to Navigation.



# Phase II Visualization

The following reception patterns were verified:

- 60 NM northwest of the Base
- 25 NM south of the Base
- 40 NM east of the Base



# ORCADAS TO THE WORLD

← → ↻ 🏠 <https://www.marinetraffic.com/en/ais/details/ships/shipid:854001/mmsi:997011088/vessel:ORCADAS%201>



MarineTraffic

🌐 Live Map

🚢 Vessels ▾

📍 Ports ▾

📷 Photos

🔄 Participate ▾

⚙️ Services ▾

🔍 Vessel/Port

## ORCADAS 1

🔗 OffShore Structure

🔔 Create notifications for this Vessel

Fleet controls:

[Add to Fleet](#)

[Contribute to this page](#)

IMO: -

MMSI: **997011088**

Call Sign: -

Flag: **Argentina [AR]**

AIS Vessel Type:

**Offshore Structure**

Gross Tonnage: -

Deadweight: -

Length Overall x Breadth Extreme:

**4m x 4m**

Year Built: -

Status: **Active**

### Latest Position

Out of range



Newer position available via Satellite



Position Received:

**2016-08-24 11:45 UTC**

Vessel's Time Zone: -

Area: **Atlantic South**

Latitude / Longitude:

**-60.73807° / -44.73789°**

Status: **Aid To Navigation**



© Ar  
MarineTraffic.com

[Upload a photo](#)

[Ship Photos: 1](#)

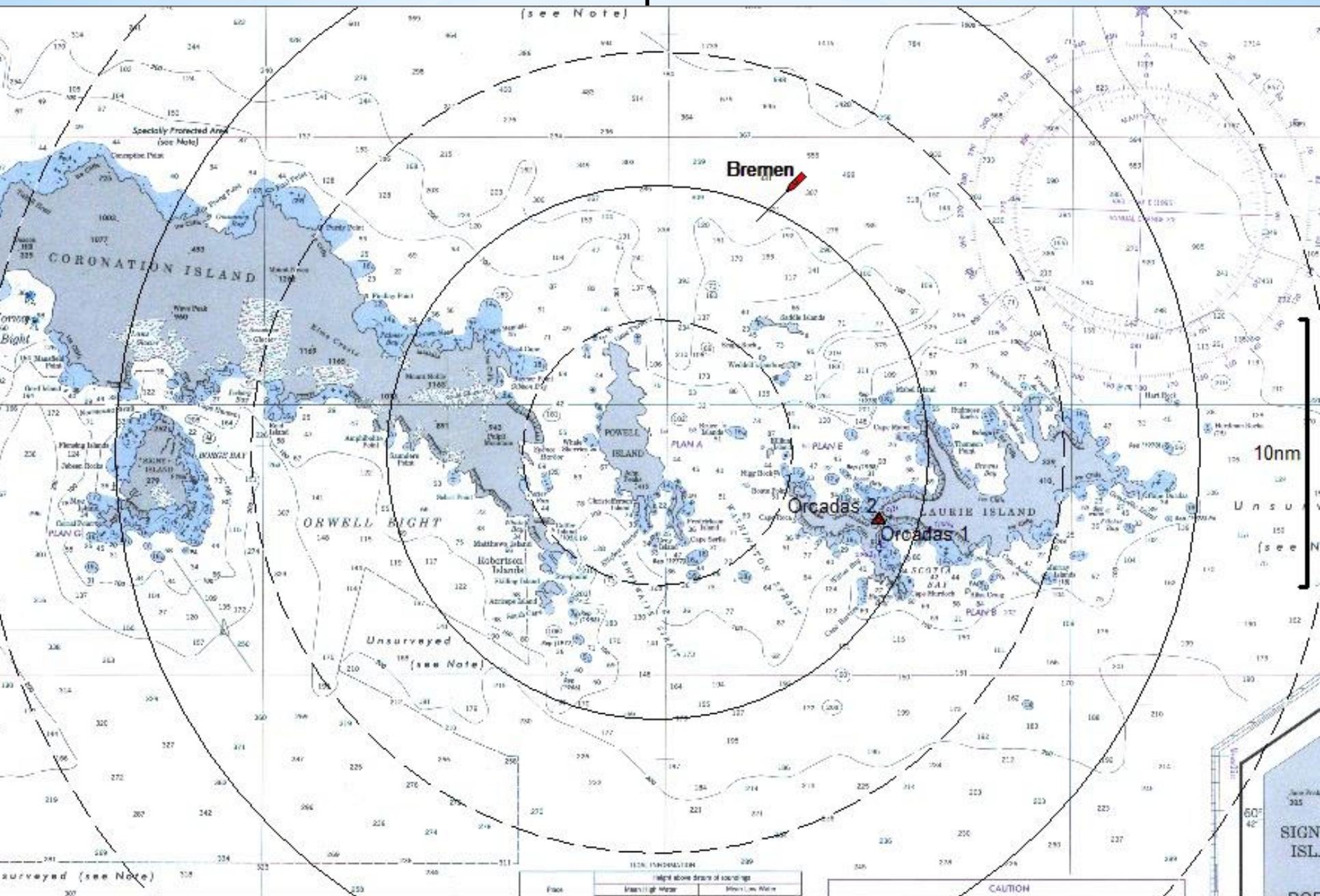
### Vessel's Wiki

[Contribute to this page](#)

General

> MMSI: **997011088**

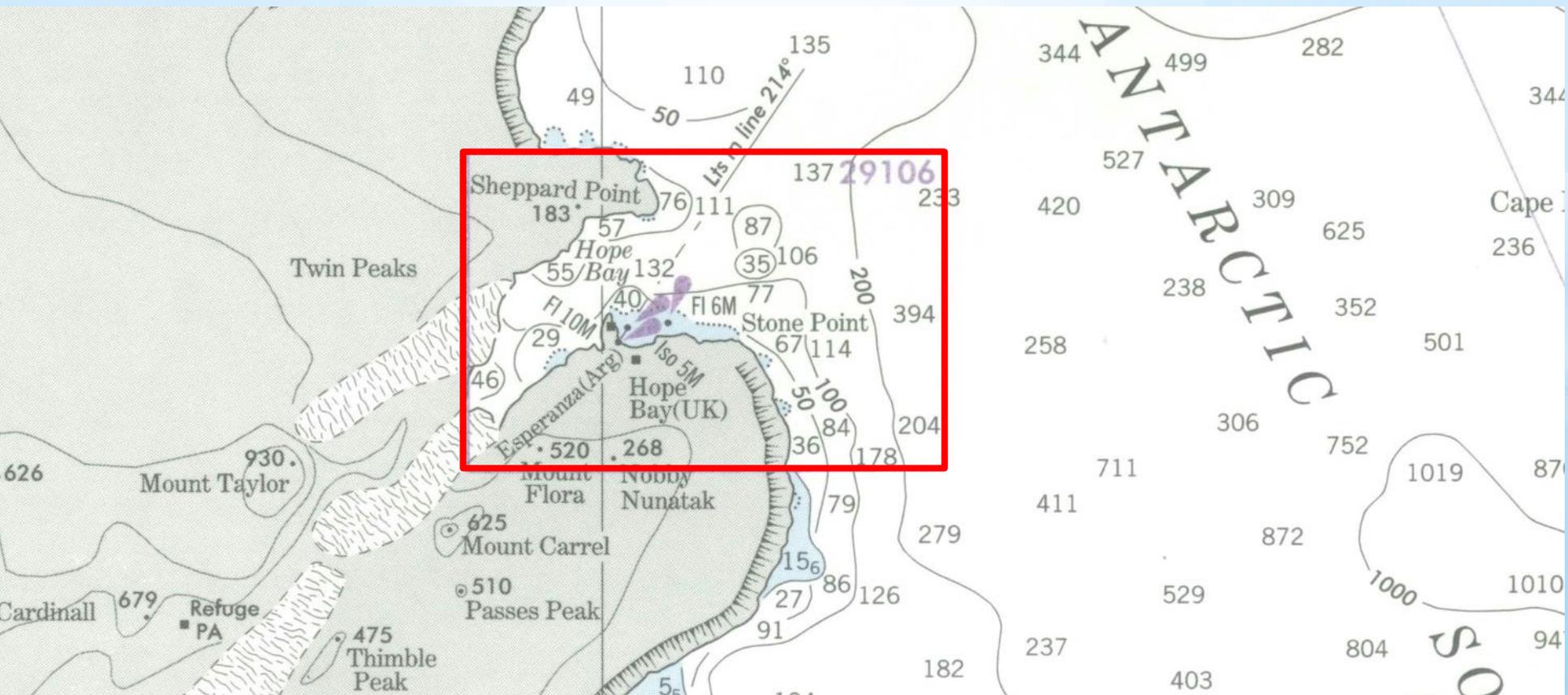
# Video - Red de AIS-AtoN implementada en Base Orcadas



# Esperanza Base

## Phase III

With the experience gathered in Phases I and II, progress was made with the set up of an AIS-AtoN and a receiving station in permanent Esperanza Base, configuring also four (4) virtual signals demarcating significant landforms.





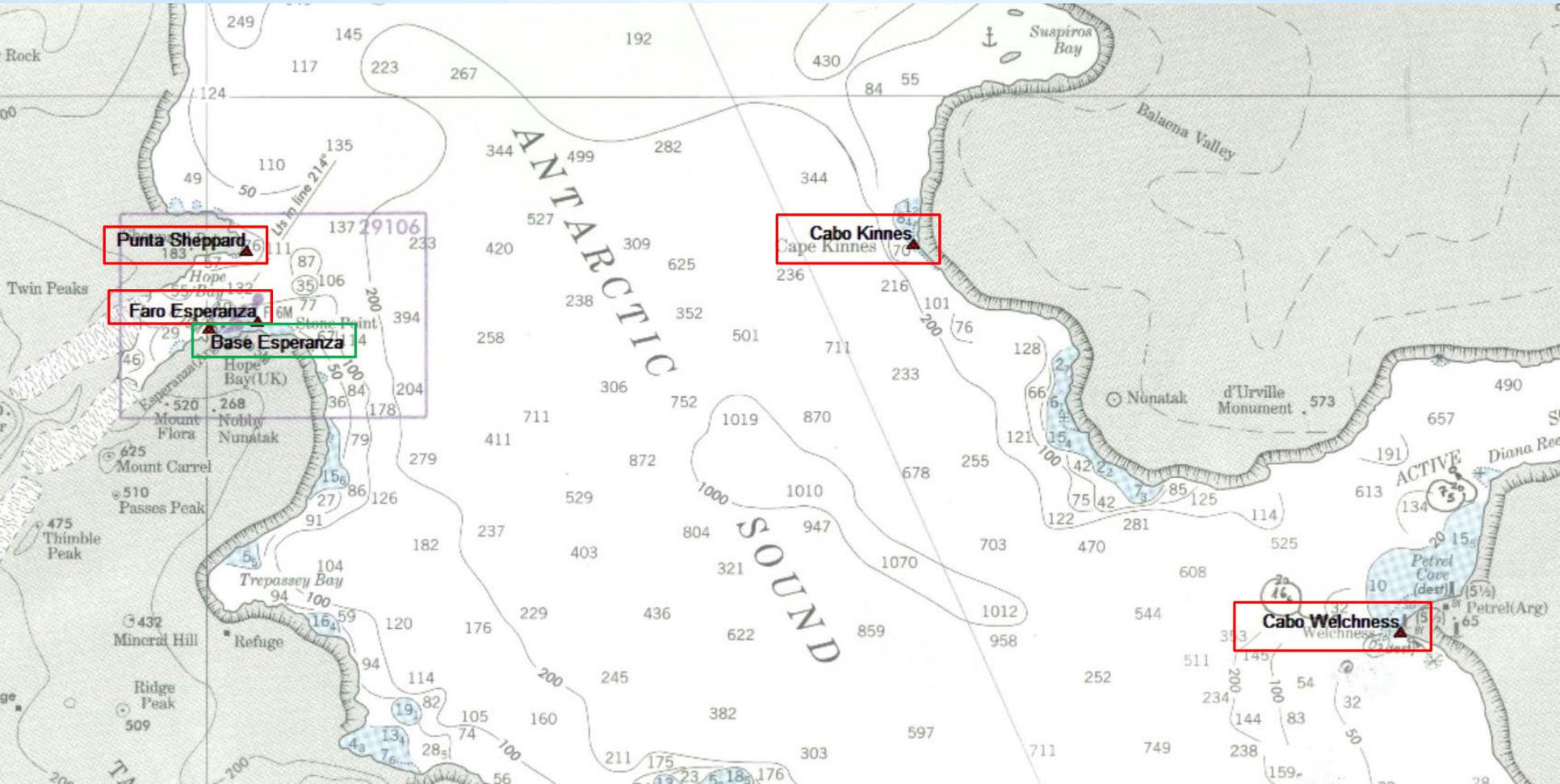
8 9:24

# Phase III Visualization

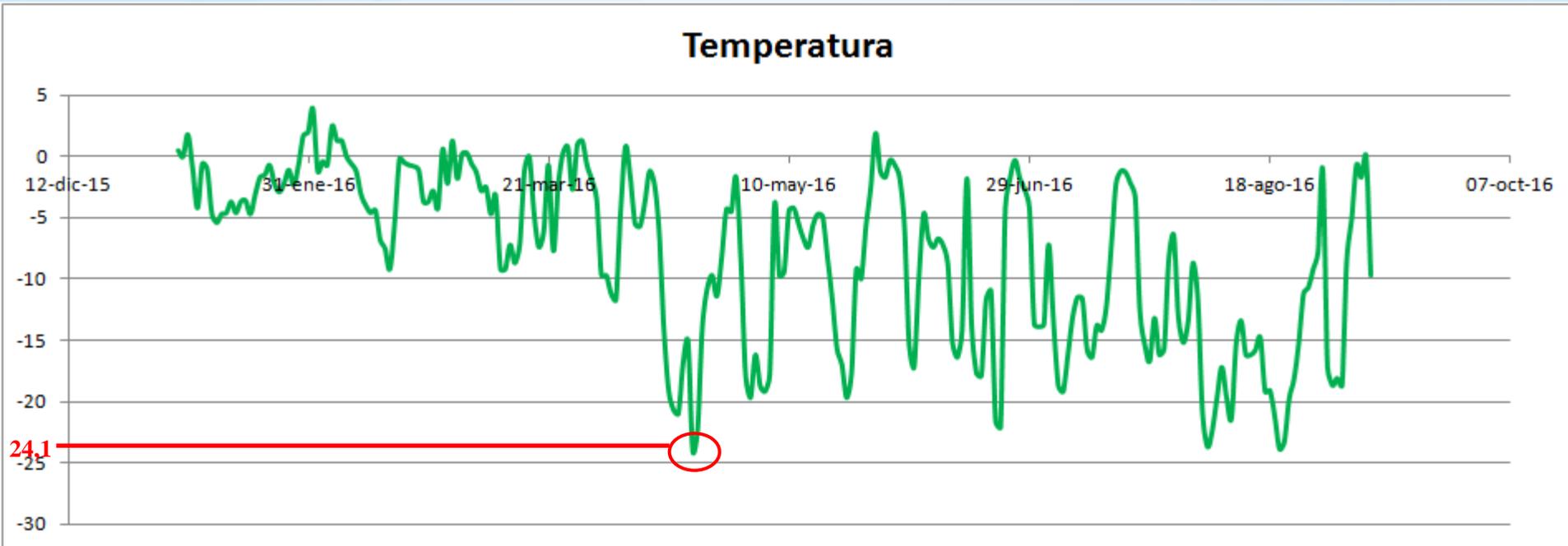


# Phase III Visualization

- 1 real AIS-AtoN – Type 3
- 4 virtual AIS-AtoN



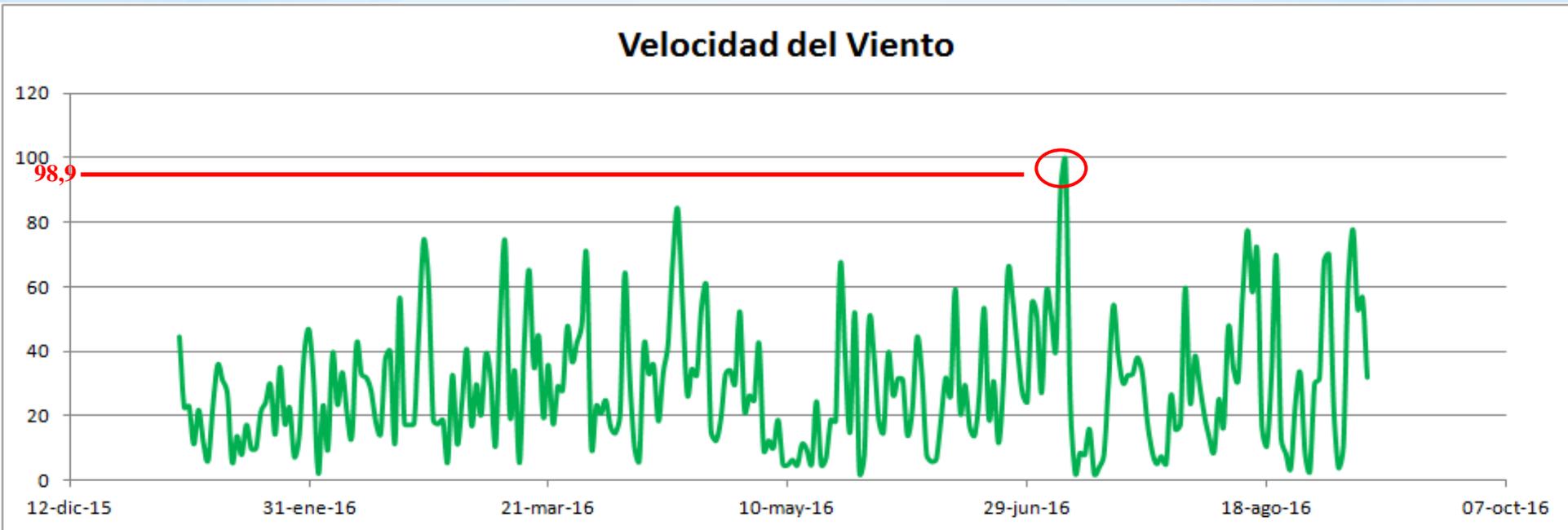
The same as in Orcadas Islands extreme weather conditions at which the system AIS – AtoN is submitted were analysed



Minimum temperature at which the AIS transducer and VHF antenna were exposed

→ **-24,1 °**

# Maximum wind speed



Maximum wind speed at which the AIS transducer and VHF antenna were exposed



**> 95 Km/h**

# ESPERANZA TO THE WORLD

S63°23'29.47  
W056°50'30.79}  
(-63.3915, -056.8419)

**PUNTA SHEPPARD**

**CABO KINNES**

**FARO ESPERANZA**

**BASE ESPERANZA**

**CABO WELCHNESS**

Jonassen Island



# ESPERANZA TO THE WORLD

← → ↻ 🔒 <https://www.marinetraffic.com/en/ais/details/ships/shipid:4079378/mmsi:997016109/vessel:PUNTA%20SHEPPARD>

Haz clic para avanzar una página o pulsa unos segundos para ver el historial



## PUNTA SHEPPARD



Navigation Aid

🔔 Create notifications for this Vessel

Fleet controls:

Add to Fleet

✎ Contribute to this

IMO: -  
MMSI: **997016109**  
Call Sign: -  
Flag: **Argentina [AR]**  
AIS Vessel Type:  
**Navigation Aid**

Gross Tonnage: -  
Deadweight: -  
Length Overall x Breadth  
Extreme:  
**4m x 4m**  
Year Built: -  
Status: **Active**



Be the first to upload a photo for this vessel

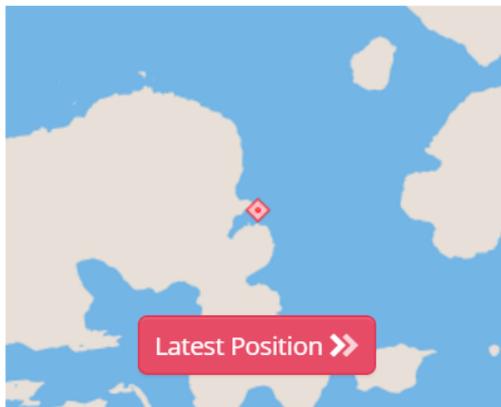
📷 Upload a photo

### Latest Position

Out of range

Position Received: -  
Vessel's Time Zone: -  
Latitude / Longitude:  
**-63.37583° / -56.9725°**  
Status: **Stopped**  
Speed/Course: **N/a**

Nearby Vessels >



### Vessel's Wiki

✎ Contribute to this

General

> MMSI: **997016109**

> IMO: 0

# ITU Link

[http://www.itu.int/online/mms/mars/aidstonavigation\\_search.sh](http://www.itu.int/online/mms/mars/aidstonavigation_search.sh)

The screenshot shows a web browser window with the URL [www.itu.int/online/mms/mars/aidstonavigation\\_search.sh](http://www.itu.int/online/mms/mars/aidstonavigation_search.sh). The page header features the ITU logo and navigation links in Arabic, Chinese, Spanish, French, and Russian. A search bar with the text "Google™ Custom Search" and a "Search" button is present. The main navigation menu includes "ITU Sectors", "Newsroom", "Events", "Publications", "Statistics", and "About ITU".

The left sidebar contains a list of ITU-R activities:

- Radiocommunication Sector (ITU-R)
- World Radiocommunication Conferences (WRC)
- Radiocommunication Assemblies (RA)
- Radio Regulations Board (RRB)
- Radiocommunication Advisory Group (RAG)
- Study Groups
- Space Services
- Terrestrial Services
- Sector Organization
- Membership
- Associates
- Activities
  - Conferences and Meetings
  - Seminars/Workshops
  - Information
  - Publications
  - Administrative Circulars and Circular Letters

The main content area displays the title "MMSI assigned to AIS Aids to Navigation (AtoN)". Below the title is a "Note (Errors and omissions):" section with the following text: "The data contained in the ITU maritime database(s) is provided only by the Telecommunications Administration having jurisdiction over the station(s) concerned. Users should therefore bring to the attention of their respective Administrations any necessary amendment of the data (errors or missing information) so that the appropriate information can be transmitted to the ITU via official channels."

Below the note is a "Conventional search method (enter either the full or partial string)" section with a form containing three input fields:

- Name of AtoN
- MMSI
- Admin. Geo. Area

At the bottom of the form are two buttons: "Submit Query" and "Clear Query".

# List of the installed AIS-AtoN in Antarctic

<b>Nº</b>	<b>Name</b>	<b>MMSI</b>	<b>AtoN type</b>		<b>AIS type</b>
1	ORCADAS ANTARCTIC BASE	997011088	Fixed structure	3	Real
2	ORCADAS ANTARCTIC BASE - 2	997011089	Fixed structure	3	Real
3	CAPE SORLE	997016101	Cardinal West	12	Virtual
4	ISLET CORBETA	997016102	Cardinal East	10	Virtual
5	ISLET BRISBANE	997016103	Cardinal West	12	Virtual
6	ISLE MONTURA	997016104	Cardinal East	10	Virtual
7	ISLET WISTROM	997016105	Cardinal South	11	Virtual
8	CAPE BURN MURDOCH	997016106	Cardinal South	11	Virtual
9	ROCK HERDMAN	997016107	Cardinal South	11	Virtual
10	ISLET MURRAY	997016108	Cardinal East	10	Virtual
11	ESPERANZA ANTARCTIC BASE	997011091	Fixed structure	3	Real
12	PEAK SHEPPARD	997016109	Cardinal South	11	Virtual
13	CAPE WELCHNESS	997016110	Cardinal West	12	Virtual
14	LIGHTHOUSE ESPERANZA	997016111	Cardinal West	12	Virtual
15	CAPE KINNES	997016112	Cardinal North	9	Virtual

## Realized 2011 - 2016

- Orcadas (permanent)
- Esperanza
- 3 Real
- 12 Virtual AIS

## Programmed

2017 - 2021

- Carlini
- Decepción (temporary)
- Cámara
- +2 to be determined
- 5 Real AIS
- 20 Virtual AIS



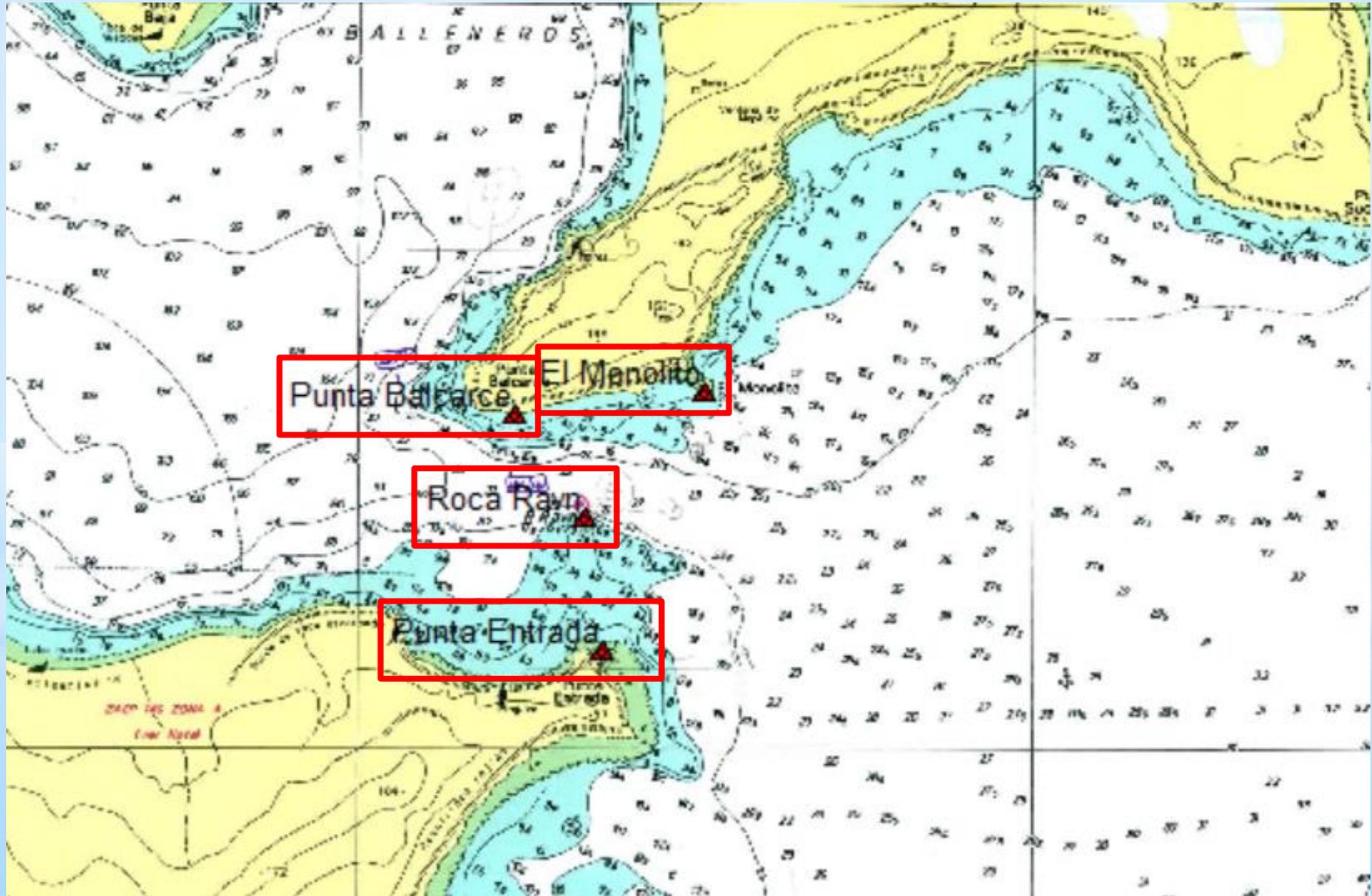


# Visualización de AIS en Base Decepción

- 1 AIS-AtoN real – Tipo 3
- 4 AIS-AtoN virtuales



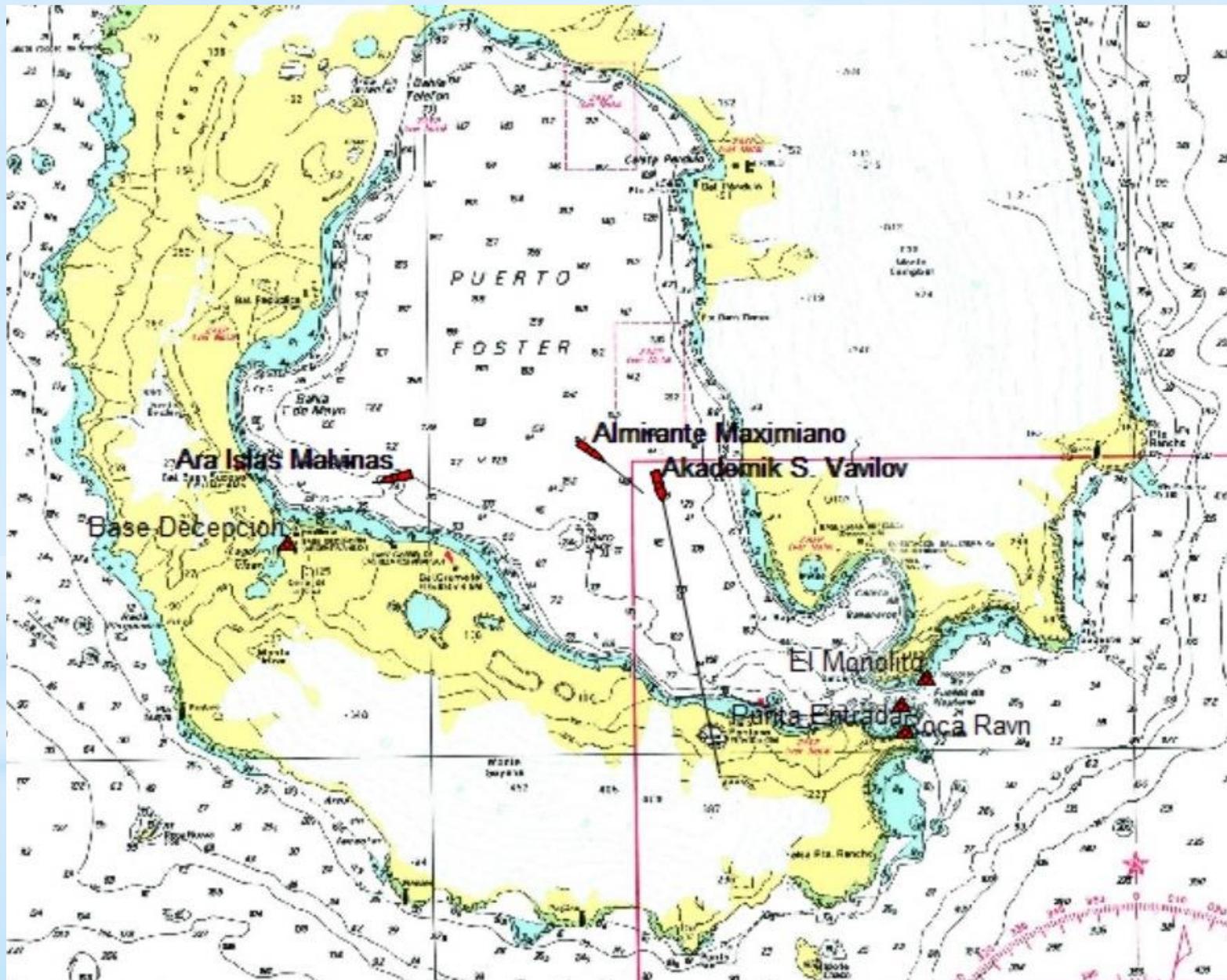
# Visualización de AIS virtuales en Base Decepción



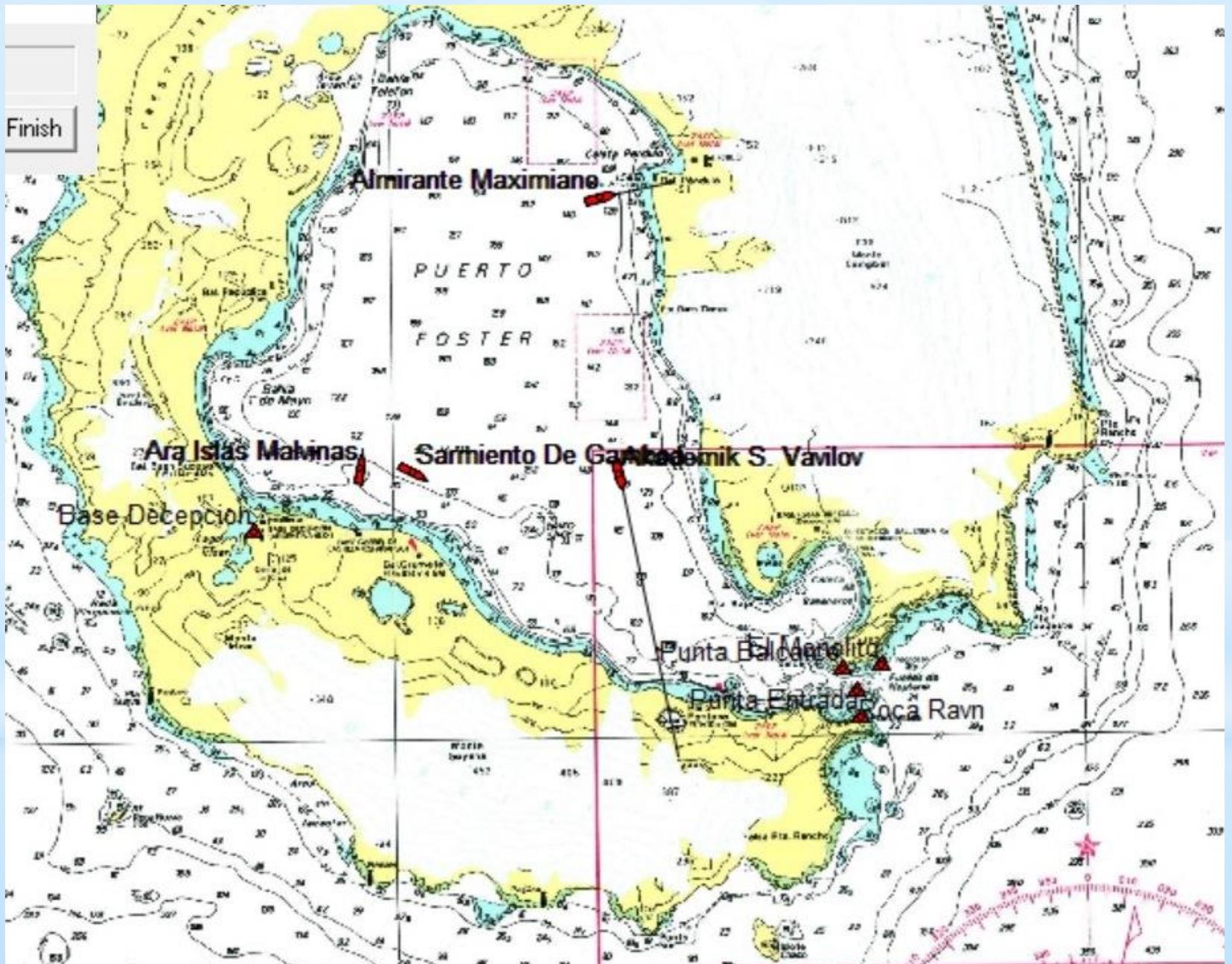
# Detalle de un AIS-AtoN virtual

The image shows a map of a coastal area with a popup window titled "Ship information". The popup window displays the following data:

Ship mmsi	997016117	Lookup
Ship name	EL MONDLITO	→ <b>MMSI - Nombre</b>
Call sign	navaid	<input type="checkbox"/> Flag
IMD number	0000000	
Registration	unknown	
Status	unknown	
Destination		
Eta at dest		
Latitude	62°59.520S	→ <b>Posición</b>
Longitude	60°32.980W	
Heading	000°	
Course	0.0°	My photo
Speed	0.0kts	Srch photo
Length	0m (forward 0m)	
Beam	0m (port 0m)	
Draught	0.0m	
Type	cardnal S [ ]	→ <b>Tipo de AtoN</b>
Range	9999.0nm (retreating)	
Bearing	0°T	
Datetime	2017-01-17 23:57:50	
Plot ship	<input type="radio"/> Never <input checked="" type="radio"/> Cond. <input type="radio"/> Always	
Label ship	<input type="radio"/> Never <input checked="" type="radio"/> Cond. <input type="radio"/> Always	
		Auto lookup
		Edit
		OK



Finish

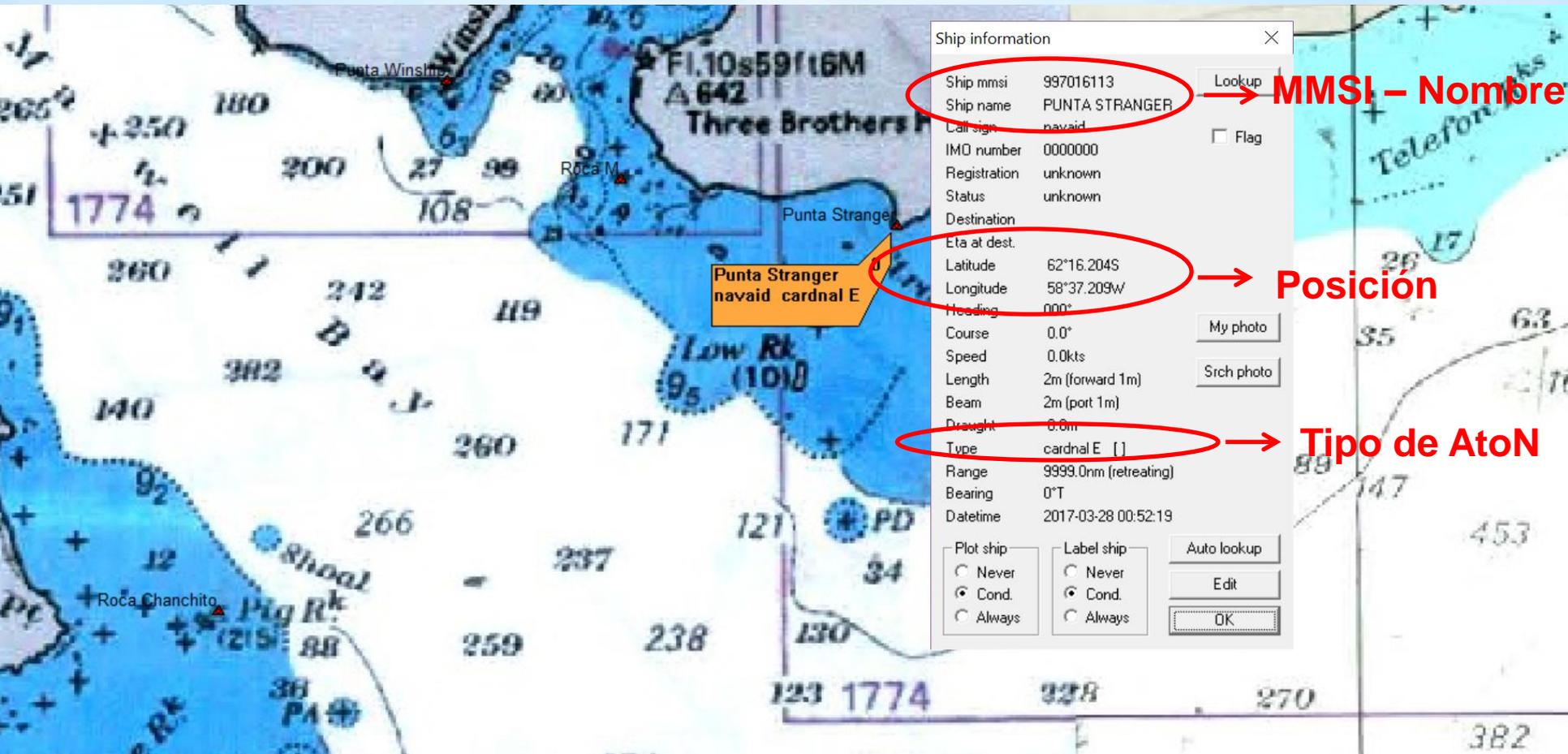








# Detalle de un AIS-AtoN virtual



# Conclusions

- Under the extreme weather conditions in Antarctic, the AIS-AtoN functioned correctly.
- The implementation of AIS-AtoN, represents a significant increase on navigation safety.
- It provided Antartida with Aids to Navigation with a known initial investment and an almost non-existent maintenance cost.
- Cooperation between public and private organizations facilitated the materialization of the project, optimizing resources.



Thank you for your attention

21 17:58

Thank you for your attention