

# Automating seawater measurements in the Southern Ocean

Using the Ferrybox aboard the Sail powered research and supply vessel, *Perseverance*

## DIVERSE DATA

Sea Surface Temperature (SST) and Salinity (SSS) are the basic parameters to characterise water masses from a physical point of view. Water density is directly dependent from T, S and Pressure (depth), therefore oceanic circulation (currents) is strongly correlated to those parameters. SSS/SST are the easiest parameters to measure, so there is plenty of long-term data globally, which are essential for climatological models.

A -4H-JENA-engineering FerryBox will be used in the Southern Ocean aboard the *Perseverance* as it sails to meet the Polar POD oceanographic platform drifting around 50°S in the Antarctic Circumpolar Current (ACC). *Perseverance* will cross several fronts between various water masses (subtropical, subantarctic, polar) on its regular supply journeys, and the FerryBox will record strong gradients in SSS/SST and the other parameters, including PCO<sub>2</sub> and Ph data for studying the carbonate cycle and CO<sub>2</sub> absorption (both organic and geophysical absorption cycles). Further, fluorescence and turbidity parameters will be recorded, and used mostly by biologists for plankton studies and calibration of satellites data (ocean surface color).



## SAILING & FLOATING PLATFORMS

**Polar POD:** The Polar POD is an inhabited oceanographic platform that will be towed horizontally to the research zone and tilted vertically by filling ballast tanks with seawater. The Bureau Veritas certified structure is 100m high and weighs 1,000 tons, and is designed to tackle the biggest waves in the world. It features a gondola located 15m above the surface, which is equipped to accommodate 8 people with 6 months of autonomy. Driven by the ACC like a satellite around Antarctica, Polar POD will allow the acquisition of data and long-term observations that will be transmitted to researchers, oceanographers, climatologists, and biologists; 43 scientific institutions from 12 countries are involved in the project.



**Perseverance:** Built specifically for Polar POD crew change and supply every few months, *Perseverance* is a 42m long, 11m wide sailing yacht delivered in 2023, with a -4H-JENA-engineering FerryBox on board. It will take measurements when *Perseverance* sails to meet the Polar POD as it drifts across the Southern Ocean, as well as when it traverses the Atlantic when returning home.

## HANDS-OFF MEASUREMENTS

Ocean surface parameters have been measured aboard research vessels long before the introduction of the -4H-JENA engineering Ferrybox. Initially, individual sensors were employed, necessitating the constant presence of engineers on board to manage and operate the equipment. The noteworthy advancement facilitated by the -4H-JENA-engineering FerryBox is the elimination of the continuous requirement for scientists or technicians on board once it becomes fully operational, post testing. All sensors are seamlessly integrated into a centralized system, where routine maintenance tasks such as cleaning and data management are programmed to occur automatically without human intervention. Consequently, the ship's crew is only responsible for overseeing fundamental control operations and there is no requirement for specially trained personnel on board to continue taking accurate measurements.

## COMPLIMENTARY MEASUREMENTS

Measurements collected by the A -4H-JENA-engineering FerryBox on the *Perseverance* will complement the data gathered by the scientific team aboard the Polar POD. Additionally, the information will be shared with Service National d'Observation (SNO), a French organisation responsible for overseeing data management for various vessels, including research and merchant navy ships equipped with FerryBoxes. The SNO monitors data from the FerryBox equipped French icebreaker *Commandant Charcot*, which navigates the same waters as *Perseverance* spanning the Arctic and Antarctic regions. A collaborative effort has been established to exchange field experiences and datasets managed by SNO, with the overarching goal to generate validated data series from both FerryBox installations, making them accessible to the oceanographic community through standard databases.

