



# IV ROSS SEA CONFERENCE 2023

Università degli Studi di Napoli "Parthenope"

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**Topic:** Ocean-ice-atmosphere interactions

## Gabriele Bruzzone

**ABSTRACT Subject :**

Robotic-based invESTigation and mOnitoring of Ross sEa with PROTEUS  
- The RESTORE project

**Abstract** 26/01/2023 11:49:55

In the framework of the PNRA RESTORE (Robotic-based invESTigation and mOnitoring Ross sEa) project, during the XXXVIII Italian Expedition in Antarctica (2022-2023), the PROTEUS unmanned marine vehicle (UMV) was used for carrying out multi-disciplinary scientific surveys in the Ross Sea. PROTEUS (Portable RObotic TEchnology for Underwater Surveys) is an innovative UMV, developed by the Marine Robotics research group of CNR-INM, which is particularly suitable, thanks to its reduced size and weight, modularity, reconfigurability, and open hardware and software architectures, to operate in extreme environments as the polar ones. One of the most important peculiarities of PROTEUS is its capability of easily changing shape in order to operate underwater (as an ROV – Remotely Operated Vehicle) semi-submersed (as a USSV – Unmanned Semi-Submersible Vehicle) and in surface (as a USV – Unmanned Surface Vehicle) and thus to adapt to the specific needs of the different surveys it is called to carry out. In the first part of the Antarctic scientific expedition PROTEUS was used underwater, in ROV configuration, for performing a multi-sensor 3D mapping of Tethys Bay (Ross Sea; East Antarctica). For carrying out this survey seven holes were drilled in the ice pack from which it was possible to deploy the robot in the seawater. In a second phase PROTEUS was transformed in a USSV for operating semi-submersed and thus permitting marine scientists to collect data in the proximity of the Campbell Glacier tongue. In particular, for this survey the robotic vehicle was equipped with an additional remotely-operated winch for releasing a multi-parametric sensor probe along the water column down to a depth of 100 m. Moreover, an automatic water sampler (8 independent sterile bottles with 0.5 l capacity) was also mounted on PROTEUS. Successively PROTEUS was transported in helicopter to test the limnological versatility and used, always in USSV configuration, to perform a multi-parametric data survey and a complete bathymetry of a lake at Tarn Flat. Finally, PROTEUS was further transformed in a USV vehicle for operating on the sea surface. More precisely, PROTEUS took the shape of a catamaran, so guaranteeing a better naval stability and the possibility to mount on its bow a Harvey cylinder aimed at collecting the superficial micro-layer of the sea water. Furthermore, on the robotic vehicle was also installed an automated hydraulic plant comprehending water containers, remotely controlled electro-pumps and electro-valves that allowed to also collect water just under the sea surface. Thanks to the versatility and the open architectures of PROTEUS, during the activities performed at field it was possible to install manifold sensors and acquire a comprehensive collection of bio-geo-chemical and physical parameters of the water column (acoustic,



conductivity/salinity, temperature, depth, dissolved oxygen, turbidity and chlorophyll), acoustic and video data of the ice and