



**International Research  
Ship Operators**

# **National Research Council – CNR (ITALY)**

## ***Oceanographic infrastructure an overview***

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**28<sup>th</sup> IRSO meeting**  
**Oct 20-23, 2015**  
**La Jolla, California (USA)**

# CNR IN BRIEF

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- CNR is the largest Research Organisation in Italy, besides Universities
- Acts under the Ministry of Education, Universities and Research
- **MISSION**
  - To perform **research** in its own Institutes
  - To promote **innovation and competitiveness** of the national industrial system
  - To promote the **internationalization** of the national research system
  - To provide **technologies and solutions**
  - To **advise Government and other public bodies**
  - To contribute to the **qualification of human resources**

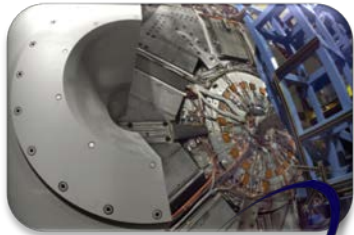
# MINISTRY FUNDING (2014)

9 more Institutes

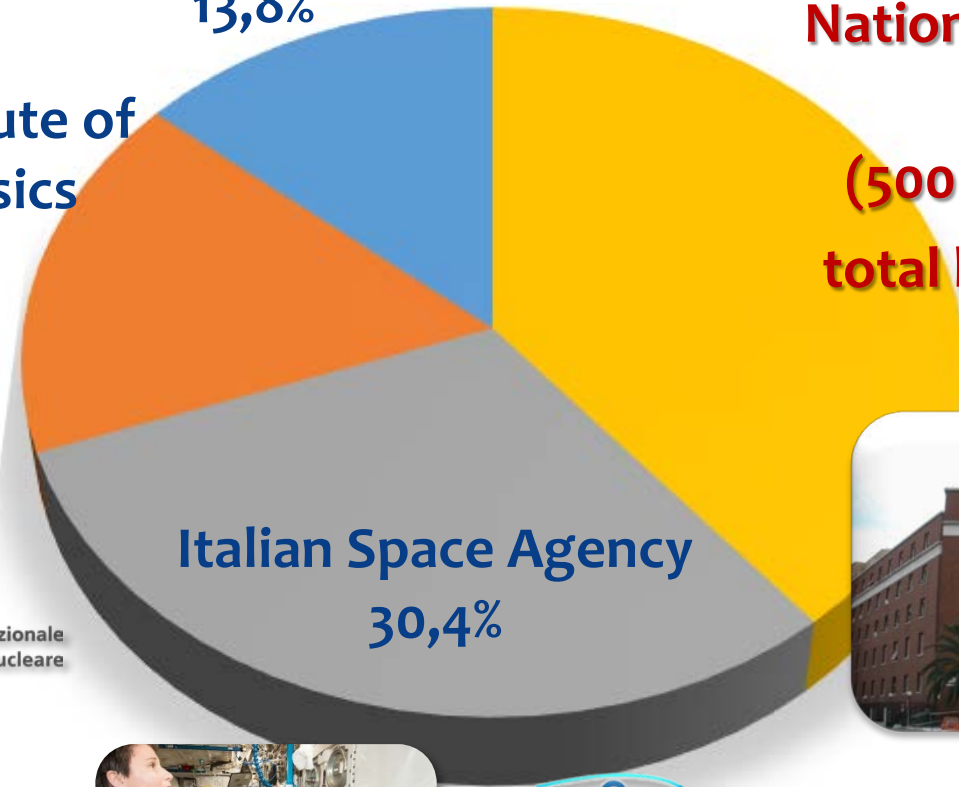
13,8%

National Institute of  
Nuclear Physics

16,8%



**INFN**  
Istituto Nazionale  
di Fisica Nucleare



**National Research Council**  
39,1%  
(500 M€ out of an own  
total budget of 800 M€ )



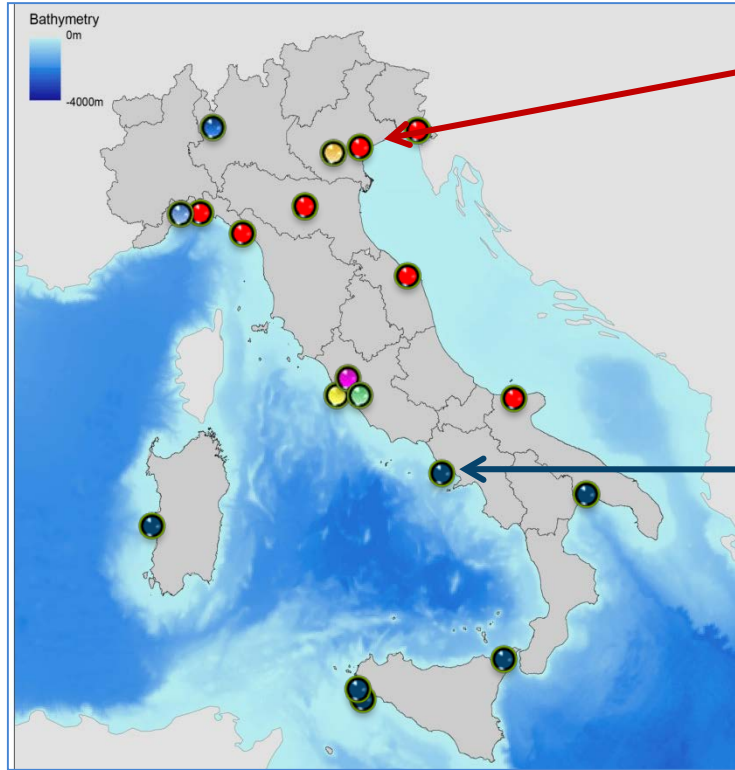
**ASI**  
agenzia spaziale  
italiana

# CNR SCIENTIFIC NETWORK

SCIENTIFIC DEPARTMENTS	INSTITUTES
Physical Sciences and Technologies of Matter	15
Agri-food and Biosciences	11
Biomedical Sciences	19
Earth System Sciences and Technologies for the Environment	12
Engineering, ICT and Technologies for Energy and Transport	20
Humanities, Social Sciences and Cultural Heritage	19
Chemical Sciences and Technologies of Material	13
<b>TOTAL</b>	<b>109</b>
<b>8.195 units of CNR personnel of which 6.822 researchers</b>	



# MARINE SCIENCE AT CNR



## VENEZIA

- TRIESTE
- GENOVA
- LA SPEZIA
- BOLOGNA
- ANCONA
- LESINA



## NAPOLI

- ORISTANO
- TARANTO
- MESSINA
- MAZZARA
- CAPO GRANITOLA



The other Institutes have teams working in: in marine engineering and naval architecture (INSEAN), remote sensing (ISAC), marine and maritime technologies (ISSIA & IREA) and geologic hazard (IGAG & IGG)

**CNR has about 400 researchers who work in the wider area of marine research**

# CNR “OFFICE FOR PLANNING”

[segreteria.uspo@cnr.it](mailto:segreteria.uspo@cnr.it)

*Central Management for Planning and Infrastructure*

*Director Dr. Massimiliano Di Bitetto*

- It manages the main CNR oceanic research infrastructure
- It is in charge of the scheduling of the oceanographic surveys proposed by CNR researchers
- It coordinates the oceanographic observation system of Platforms, Buoys and long-term mooring stations
- It coordinates national and international cooperation with other organizations



# ASSESSMENT PROCESS FOR CRUISES

**Jun/July – Aug.**

**SHIP TIME  
PROPOSALS  
APPLICATION**

- Invitation to all Institutes Directors
- On-line procedure for applications

**TO BE IMPLEMENTED:**

- *Cruise report on-line data base*
- *Shared meta-data for all cruises*

**Sept. – Oct./Nov.**

**ASSESSMENT OF  
PROPOSALS**

- Marine Commission
- Dispatch of proposals to anonymous referees for scientific assessment
- Commission gives final response considering scientific and functional evaluation

**Nov. – Dec.**

**CRUISE PLANNING**

- Cruise plan optimization
- Diffusion and adjustments

**Feb. – Dec.**

**REALIZATION OF  
PLANNED CRUISES**

# MAIN CNR RESEARCH VESSELS

## RV "G. DALLAPORTA"



### Main Technical Features

- Category: Regional
- Tonnage: 285 Tons
- Length overall: 35.3 m
- Breadth: 7.7 m
- Depth: 4.1 m
- Draft: 3.0 m
- Speed: 11,5 kn
- Drive system: 1100 CV
- Crew: 8 people
- Scientists: 12 people
- Built year: 2001

Years	N. surveys	Days at sea	Average days per survey
2013	26	274	10.5
2014	28	302	10.8
2015	25	310	12.4

## RV "MINERVA UNO"



### Main Technical Features

- Category: Regional
- Tonnage: 624 GRT
- Length overall: 47.66 m
- Breadth: 9 m
- Full load Draft: 4.6 m
- Max speed: 12.5 kn
- Average speed: 10.8 kn
- Endurance: 30 days
- Crew: 9 people
- Scientists: 13 people
- Built year: 2003  
(upgrading 2010 and 2014)

Years	N. surveys	Days at sea	Average days per survey
2013	3	49	16.3
2014	1	15	15
2015	21	294	14



# RV “MINERVA UNO” REFITTING

In 2014 RV “Minerva UNO” underwent an **extensive refitting with interventions on the naval platform and its scientific equipment**, in order to improve and enhance the operational capabilities of the ship on a functional and safety point of view.

- Electricity grid improvements
- More powerful generators to meet new electricity requirements
- Air conditioning system enhancement
- Fuel purification system improvement
- Garbage management system renovation
- New bow design to improve seakeeping
- New double seated cabin
- New refrigerators for samples storing
- DP1
- Bow thruster and stern thruster
- Fixed stabilizer fin
- New engine control system

## **SCIENTIFIC EQUIPMENT RENEWAL**

- Ship positioning system
- High resolution bathymorphologic system
- Geomorphic and bottom sampling system
- Magnetometric survey system
- Seismostratigraphic survey system
- Bottom visual inspection system

# RV “MINERVA UNO” REFITTING



RV “Minerva UNO” lifted by the crane



The new more powerful  
bow thruster



Stern thruster and fixed stabilization fin



RV “Minerva UNO” with the RV  
“Urania” new 6 meters section



New bow design of RV “Minerva UNO”

# RV “URANIA”



August 25<sup>th</sup> 2015

Livorno - Italy

Years	N. surveys	Days at sea	Average days per survey
2013	23	316	13.7
2014	24	294	12.3
2015	-	-	-

# RV “URANIA” ACCIDENT

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On August 25<sup>th</sup> 2015 while RV “Urania” was in a floating dry dock in Livorno (Italy), a severe accident happened. For reasons still under investigation by the Italian Judicial Authorities and that are to be clarified by an official inquiry, the vessel suddenly heeled portside. In the accident one member of the crew died and others were injured with different seriousness.

When the accident happened RV “Urania” was undergoing improving and strengthening work. The commissioning was expected by November 2015 and works were at full speed. Notably, the most distinguishing part of interventions, the 6 meters hull lengthening, was already completed.

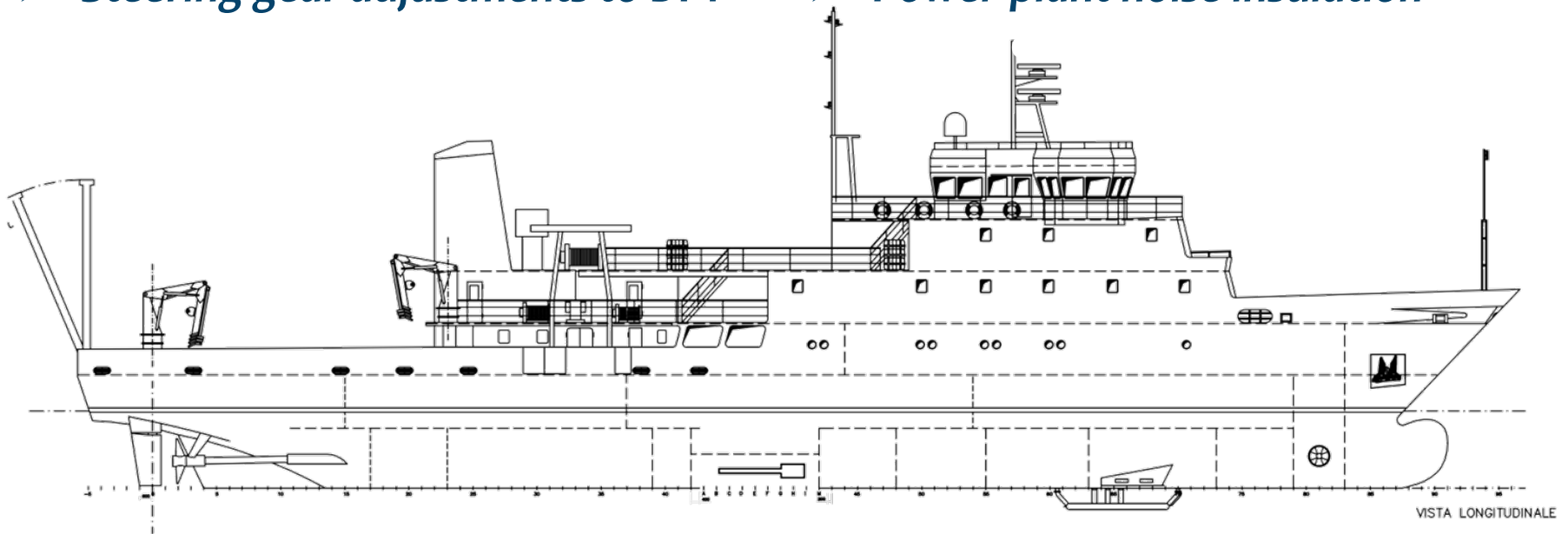
**At the moment it’s hard to assess the damages the hull and the equipment had, because the vessel cannot be accessed due to the current inquiry.**

Considering that the engine room is underwater from almost 2 months, it is likely to consider that electrical devices are irremediably damaged, just like the DP and multibeam electronic equipment. All of the scientific equipment transducers were installed in a blister below the keel and, even in this case, it’s very likely that they have been severely damaged.

# EXPECTED RV “URANIA”

This is how RV “Urania” should have looked after the end of interventions. At the time of the accident, many tasks were already fulfilled, among them:

- *Lengthening of the hull*
- *Four new cabins for scientists*
- *Scientific winches inspection*
- *New DP1 system*
- *Steering gear adjustments to DP1*
- *New more powerful bow thruster*
- *New stern thruster*
- *Three newer and more powerful generators*
- *Power-plant noise insulation*



# RV “URANIA”.....last considerations

For about 25 years RV “Urania” has been a strategically important oceanographic facility not only for CNR but also for all the Italian marine research community.

The scientific results obtained thanks to the use of this vessel are evident from the large number of scientific publications, the European projects undertaken and the numerous national and international collaborations, all of which have contributed to reinforce the image of CNR at the European and international levels.

## Main research results obtained in the past using RV “Urania”

- Complete bathymetry of Italian seas, important also for natural risk assessment (i.e. detection of active and possibly seismogenetic faults)
- Mapping of underwater habitats to assess the impact of human activities
- Discovery of still alive white coral communities, important for capturing CO<sub>2</sub>
- Study of oceanographic events like the exceptional formation of cold waters in the winter of 2012 and their subsequent transport to Ionian abyss in the following months

## Relevant planned cruises onboard RV “Urania” in 2016

- Red Sea, as an analogue of the Atlantic Ocean 100 million years ago
- Western Mediterranean, to work on stratification of deep waters and likely increase of salinity
- Study of underwater mudflows and slides, relevant for earthquakes (paleo-seismology)

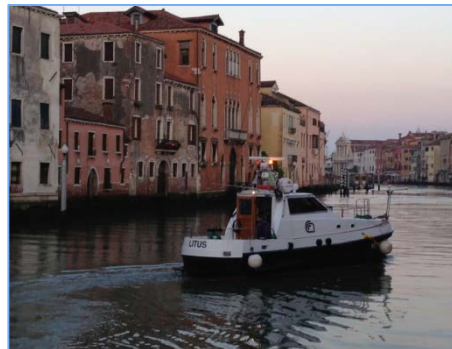
# LOCAL/COASTAL CNR RESEARCH UNITS

Name	Length	Operator	Operating area	Main activity
RV "Boreana"	10.00 m	ISMAR-CNR	Mediterranean Sea	Multiple activities
RV "Cerruti"	14.50 m	IAMC-CNR	Mediterranean Sea	Multiple activities
RV "Furetto"	10.00 m	IAMC-CNR	Mediterranean Sea	Multiple activities
RV "Litus"	10.20 m	ISMAR-CNR	Mediterranean Sea	Multiple activities
RV "Luigi Sanzo"	15.00 m	IAMC-CNR	Mediterranean Sea	Multiple activities
RV "Tecnopesca II"	16.30 m	ISMAR-CNR	Mediterranean Sea	Multiple activities

**RV "Luigi Sanzo"**



**RV "Litus"**



**RV "Tecnopesca II"**





- Multibeam System Kongsberg EM 2040D-C
- Positioning system Kongsberg Seapath 300 with DGPS correction
- Motion sensor Kongsberg Seatex MRU 5
- Valeport Mini SVS and AML Ocenographic SV Profiler







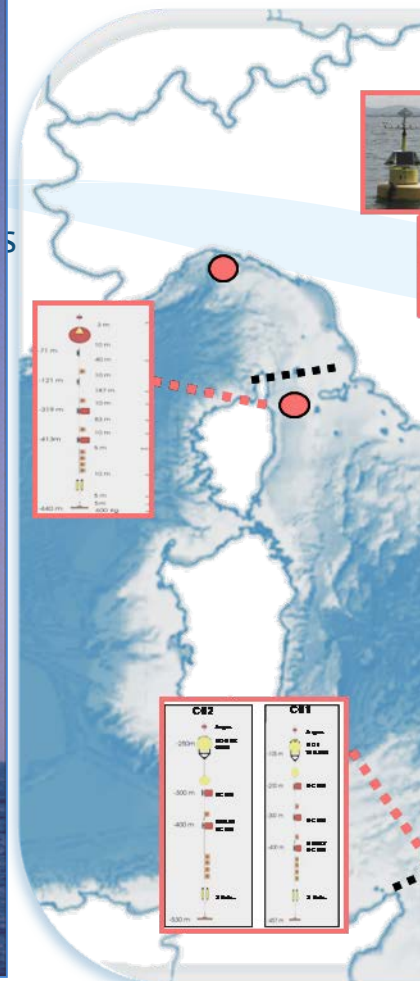
## *Litus at work on the Gran Canal*

*This new system was adopted recently for bathymetric surveys, habitat mapping, geo-archeology studies and hydrodynamic modeling of the Venice Lagoon*

# CNR MARINE OBSERVING SYSTEM

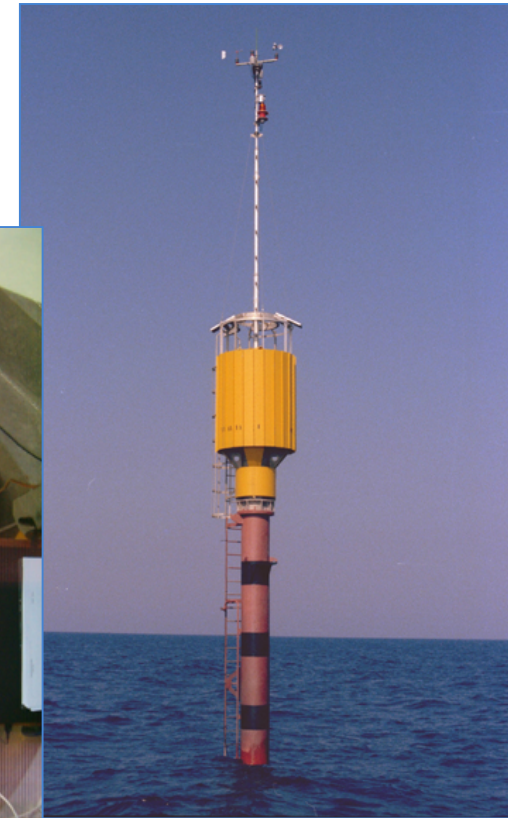


**ODAS ITALIA 1**  
Buoy



**ACQUA ALTA**  
Tower

# “ODAS ITALIA 1” SPAR BUOY

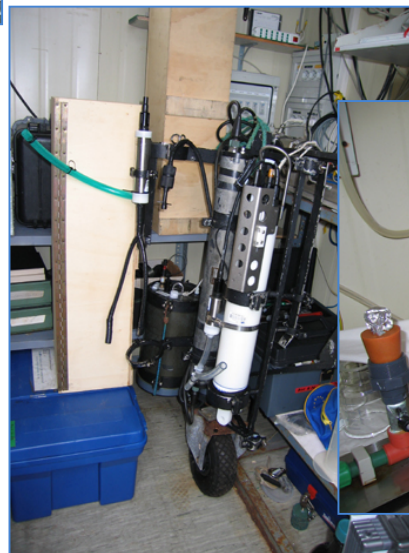


- an offshore laboratory for air-sea interaction studies
- moored in the Ligurian Sea, at 37 nm far from the coast and on a 1300 meters deep seabed
- equipped with a set of meteorological and marine sensors
- data are sent in near real time to the land by a phone link

# “ACQUA ALTA” OCEANOGRAPHIC TOWER



- located in the Northern Adriatic Sea 16 km off the coast of Venice
- equipped with a meteo-oceanographic station
- data are recorded on board and also telemetered to land
- measurements of atmosphere (wind, temperature, humidity, solar radiation and rain) and sea (waves, tide and temperature)



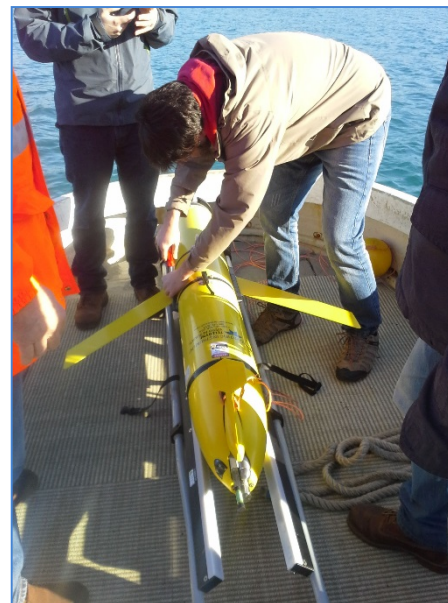
# SLOCUM DEEP GLIDER G2 “TERESA” + ROCKLAND SCIENTIFIC MICRORIDER



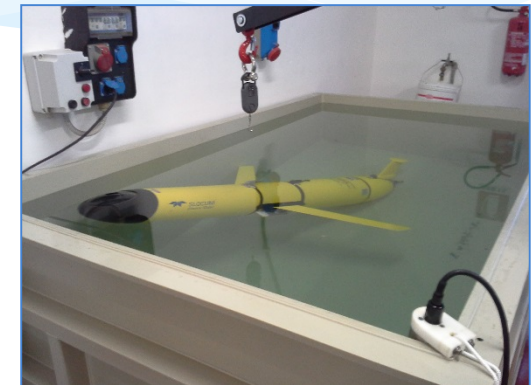
Autonomous underwater vehicle, operating along vertical sections to monitor the water column up to 1000 m depth. It provides vertical profiles of hydrological properties and turbulence through continuous cycles of immersion-emersion. The system was acquired by CNR in 2014 as part of the project EUROFLEETS.

## Measurements:

- Temperature
- Salinity
- Oxygen
- Integrated speed
- Turbulence (microprofiler interface)



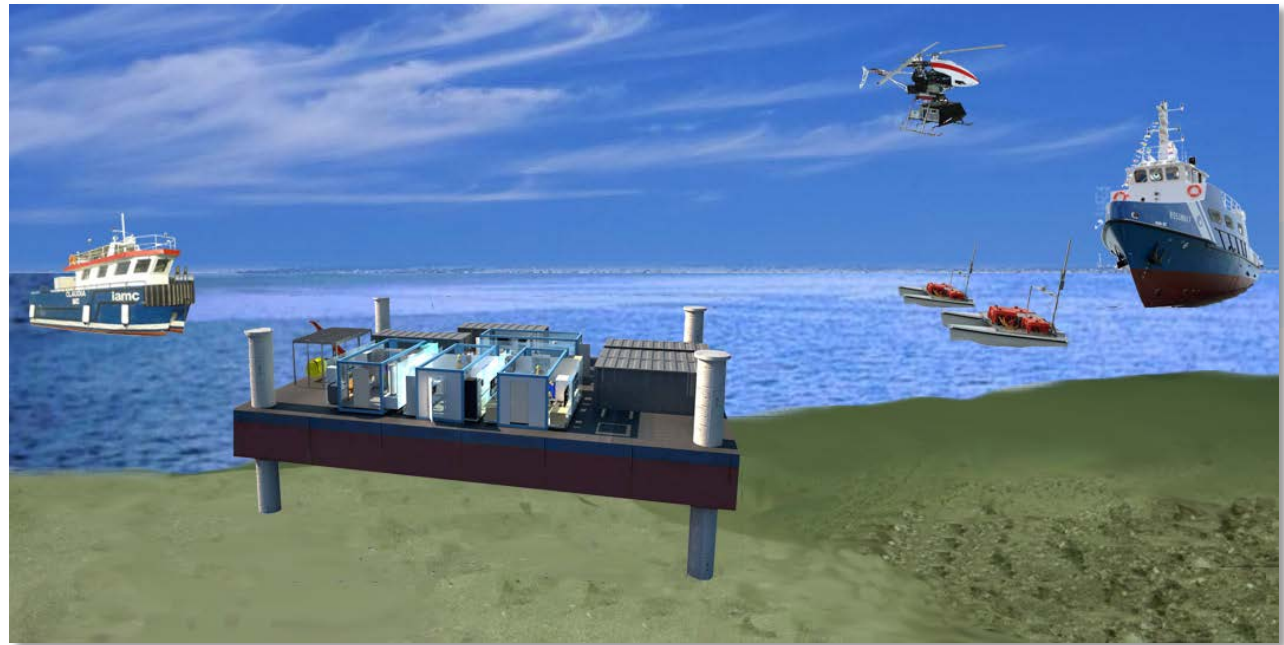
*Deployment during a test phase in the Gulf of Poets – La Spezia*



*Ballasting procedures in the CNR La Spezia Laboratory, Italy*



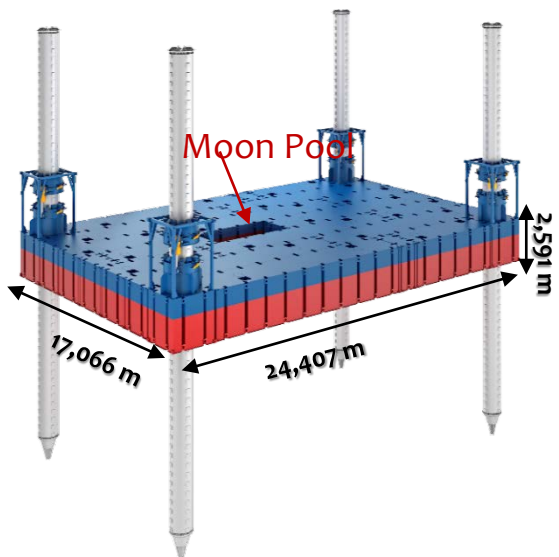
# ADVANCED TECHNOLOGICAL SYSTEMS AND INTEGRATED RESEARCH LABORATORIES FOR COASTAL AND MARINE ENVIRONMENTAL SURVEY



- Technological Jack-up Barge & tug-boat
- Fast Cargo Vessel
- Two Unmanned Surface Marine Vehicles
- Unmanned Aerial Vehicle
- Geophysical Shelter Lab
- Geochemical Shelter Lab
- Geotechnical Shelter Lab

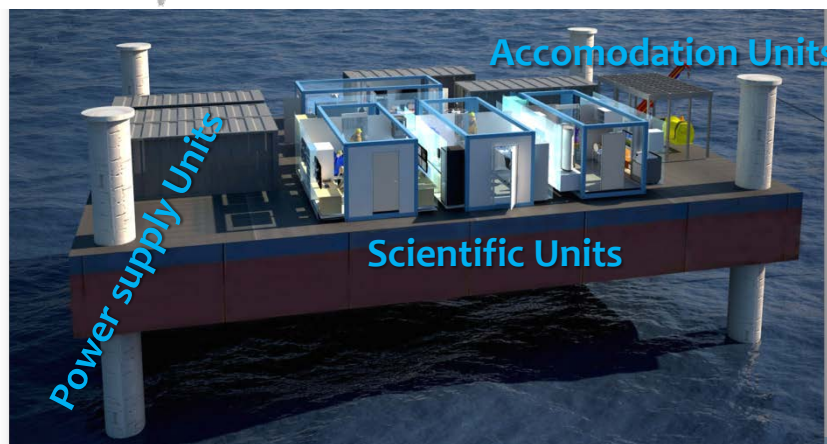
# TECHNOLOGICAL JACK-UP PLATFORM

**12-20 scientific & technical operators**  
**Endurance: 7 days**

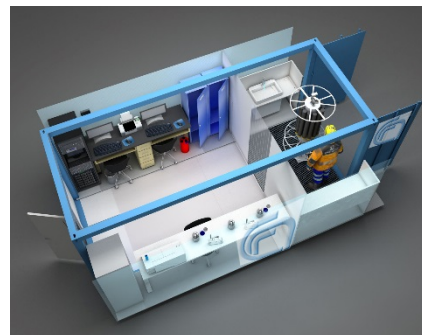


Min draft: 1,064 m abt.  
Max draft: 1,245 m abt.  
**Length overall: 36 m**  
**Max operating depth : 25 m**  
Lifting capacity: 4 x 250 mT  
**Autonomous drive**  
Power : 1000 kW abt

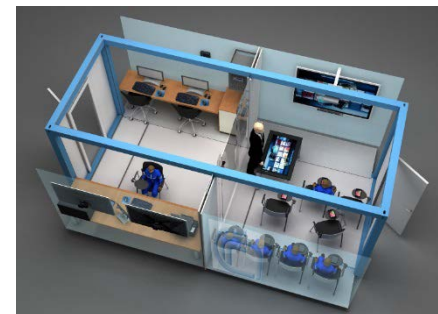
**Design parameters**  
Wind: 10 m/s  
Current Wave : 1 m/s  
Wave Height: 1,5m



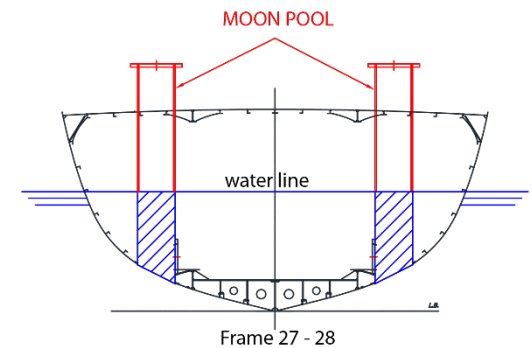
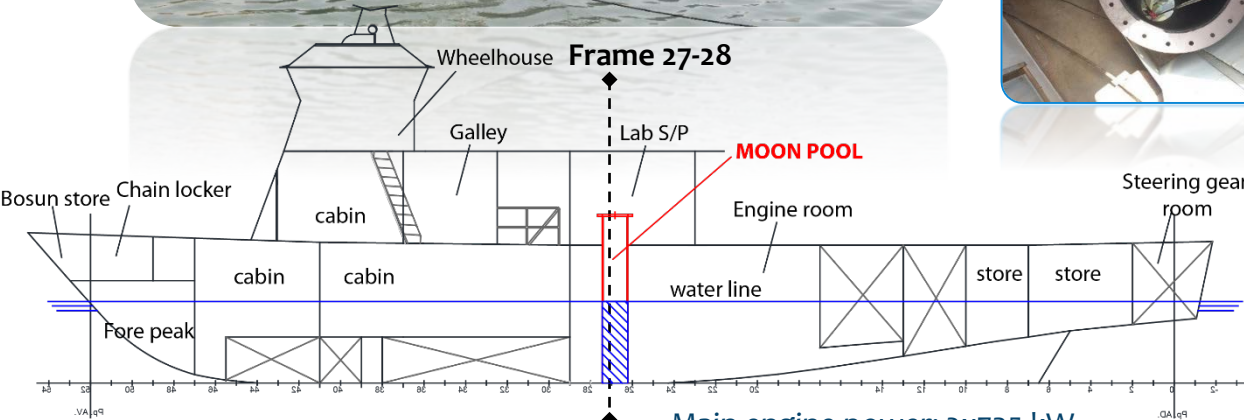
**Shelter Lab**



**Control Room**



# FAST CARGO VESSEL



**Length: 28.45m**  
**Breadth: 7.00m**  
**Height: 3.20m**  
**Draught: 1.90m**  
**Payload: 40t**

**Main engine power: 2x735 kW**  
**Auxiliary engine power: 1x200kW + 1x50kW**  
**Speed: 16 kn**  
**# technical operators: 5 people**  
**# scientific operators: 8 people**  
**A-frame: 5t SWL**



# 3 INTEGRATED RESEARCH LABORATORIES FOR MULTIDISCIPLINARY DATA ACQUISITION AT HIGH OPERATIONAL PERFORMANCES

## Geophysical Lab



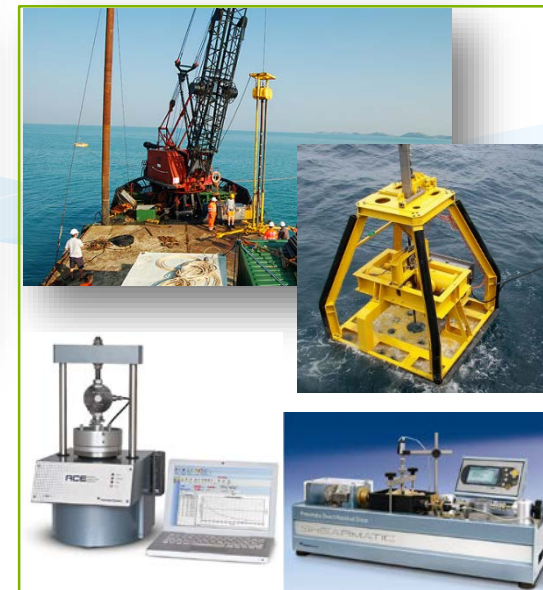
- ROV PERSEO<sup>GTV</sup>
- 3D microbathymetry
- Laser scanning survey
- Thermic-camera survey
- Seismic reflection survey
- 3D velocity current profiling
- Magnetometric survey
- Seismic Streamer
- GI.GUN Seismic source

## Geochemical Lab



- Sampling water
- Sea-bird profiling CTDs
- Photometric analysis
- Trace metal analysis
- Black-carbon analysis concentration
- Aethalometer

## Geotechnical Lab



- Sampling core (6m)
- **Sea-bed CPT profile up to 50-1500m depth**
- Mechanical characterization of soils under static and dynamic stress conditions

## Two towing tanks:

- **Tank 1** - among the largest worldwide (470 x 13.5 x 6.5 m, carriage max. speed 15 m/s)
- **Tank 2** - equipped with wave-maker for rough sea experiments (220 x 9 x 3.5 m, carriage max. speed 10 m/s)

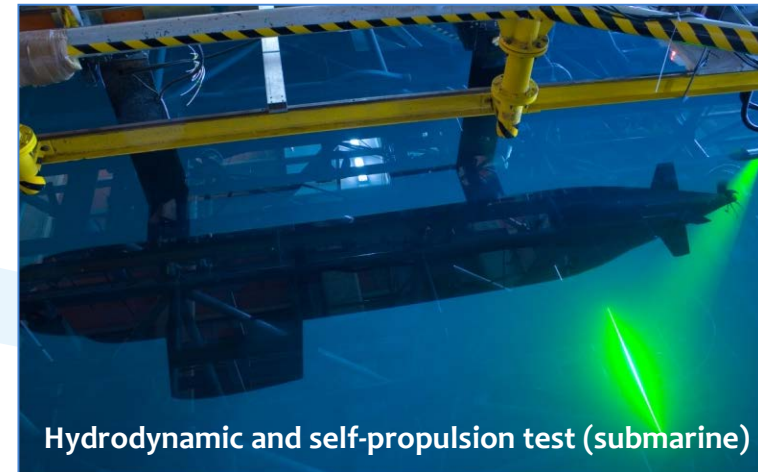
Towing tank 1

Towing tank 2



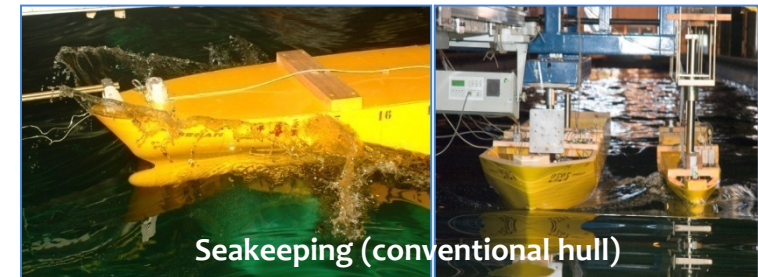
## Towing tanks activities (e.g.)

- resistance and self-propulsion tests
- seakeeping and propulsion evaluation in head and following waves
- 3D wake surveys
- open water propeller characterization

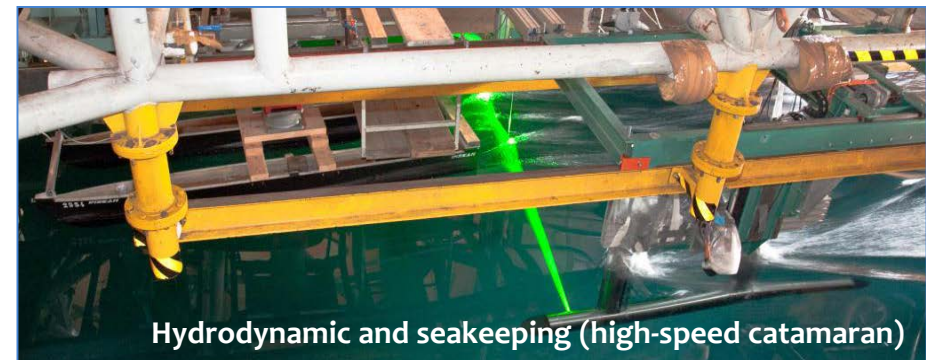


## On (e.g.)

- conventional/unconventional marine vehicles
- high-speed vehicles
- submerged bodies



Including tests on innovative technologies for the shipbuilding Industry



**Circulating water channel** (test section 10 x 3.6 x 2.2 m, maximum water speed 5 m/s and the pressure in the test section can be reduced up to a minimum of 30 mbar)

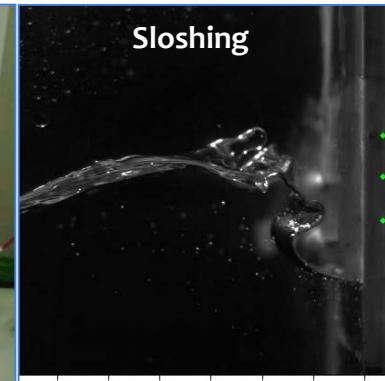
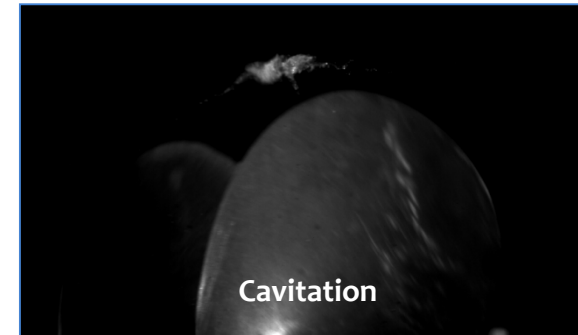
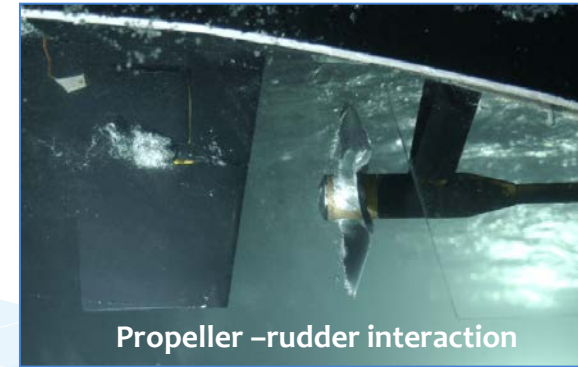
**CEIMM cavitation tunnel** (test section 2.6 x 0.6 x 0.6 m, speed range is 3-12 m/s, static pressure 300-1500 mbar)

## Circulating channels activities (e.g.)

- performance tests on propellers and propellers/rudders interaction
- cavitation tests and cavitation inception measurements
- propeller noise and radiated noise
- hull pressure fluctuation measurements

## Sloshing Lab

- sloshing flows in a LNG ship tank



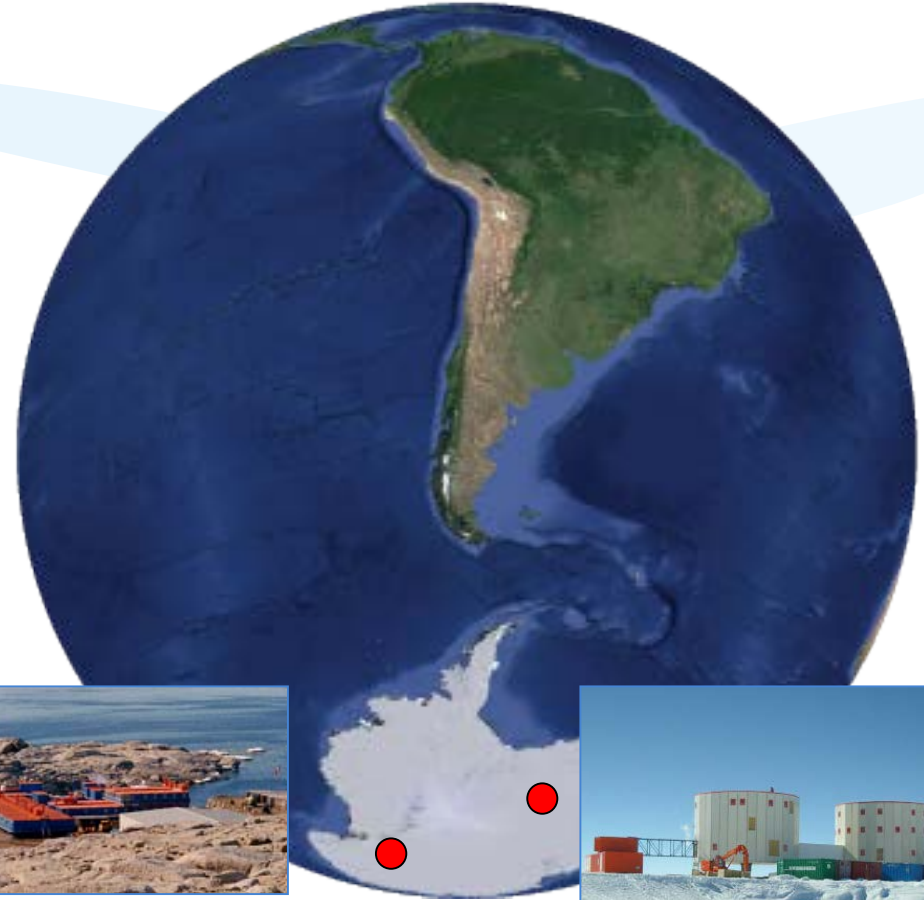
# CNR IN POLAR AREAS

## Arctic



*“Dirigibile Italia” Station*

## Antarctic



*“Mario Zucchelli” Station*



*“Concordia” Station*

# “Dirigibile Italia” ARCTIC STATION



Multidisciplinary research facility located in Ny-Ålesund in the Norwegian Archipelago of Spitzbergen (Svalbard), managed by CNR

- 330 m<sup>2</sup> infrastructure
- 170 m<sup>2</sup> used as laboratories and offices
- opened all year round
- it can accommodate up to 7 people

## Main research studies carried out in the following fields:

- *Atmospheric Chemistry and Physics*
- *Marine and Bacterial Biology*
- *Upper atmosphere physics*
- *Technology*
- *Oceanography/limnology*
- *Environmental studies*
- *Human biology and medicine*

# “Mario Zucchelli” ANTARCTIC STATION

- Large research facility located at Victoria Land, Ross Sea
- It allows operations along the Ross sea and Victoria Land coast and in the Antarctic Plateau up to Concordia station
- The whole infrastructure occupies an area of more than 7000 square m



## Multidisciplinary research carried out on a broad range of research topics:

- Cosmic ray observations
- Environmental monitoring (since 1987)
- Geodesy/mapping
- Geomagnetic observations
- Glaciology – continental
- Human biology
- Ionospheric/auroral observations
- Meteorological observations (since 1985)
- Offshore marine biology
- Onshore geology/geophysics
- Seismology
- Terrestrial biology
- Tide measurement

# “Concordia” ANTARCTIC STATION

A joint French-Italian research facility opened in 2005 on the Antarctic Plateau and managed together by PNRA (Italian National Antarctic Programme) and IPEV (Institut Polaire Français Paul Émile Victor)



- built at 3,233 m above sea level on the third highest summit of Antarctica: Dome C
- a total station area of approximately 5000 m<sup>2</sup>
- a maximum accommodation capacity of 60 persons per day

## The station is mainly used for research into the following disciplines:

- Environmental monitoring
- Geodesy/mapping
- Geomagnetic observations
- Glaciology – continental
- Human biology
- Meteorological observations
- Seismology
- Astronomy



# THANKS FOR YOUR ATTENTION!!!!



28<sup>th</sup> IRSO meeting  
Oct 20-23, 2015  
La Jolla, California (USA)