ISME
Integrated Systems for Marine Environment

Sessione
«La conservazione dei mari italiani: stato delle ricerche e soluzioni tecnologiche innovative»

Gianluca Antonelli
DIEI
Università di Cassino

Giovanni Indiveri
DIBRIS
Università di Genova

22 ottobre 2025

ISME

Integrated Systems for Marine Environment

GENOVA PISA FIRENZE ANCONA CASSINO LECCE BOLOGNA ROMA 1 COSENZA

NATIONAL INTER-UNIVERSITY CENTER TO SUPPORT RESEARCH ACTIVITIES IN THE FIELDS OF MARINE TECHNOLOGIES AND OCEANIC ENGINEERING

The University of Padova and of Bolzano are in process of joining the center

UNIVERSITÀ DEGLI STUDI DI PADOVA

Brief Presentation - 1

- Main background

Systems and Control Engineering

Applied Mechanics

Computer Science

Competences and applications include

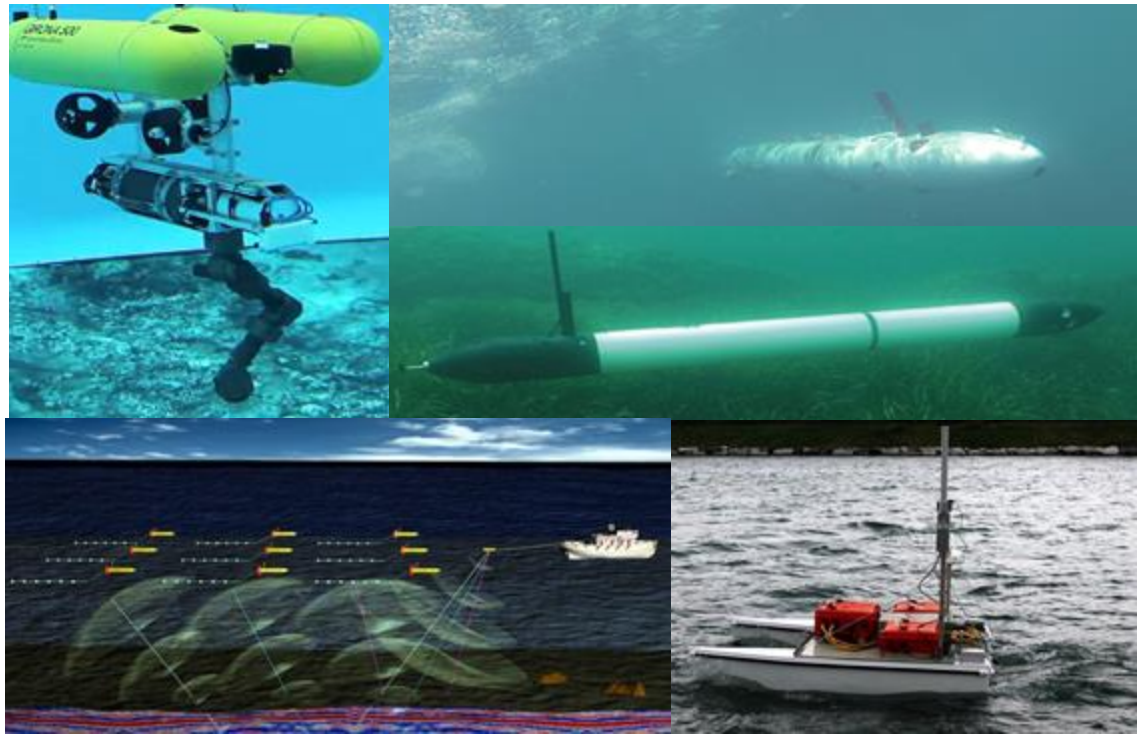
- Navigation, Guidance and Control for autonomous marine robots
- Underwater Manipulation and Intervention robotics
- Communication systems
- Marine Acoustics for communication and perception including active and passive sonars
- Acoustic Imaging
- Underwater systems mechanical design
- Networking and underwater IoT for underwater environment monitoring and surveillance
- AI and Machine Learning methods
- System identification methods for marine systems
- Proprioceptive and exteroceptive perception
- Mission planning and execution + Human-Machine Interface
- Cooperative Robotics

ISME
Integrated Systems for Marine Environment

Brief Presentation - 1

Established in 1999

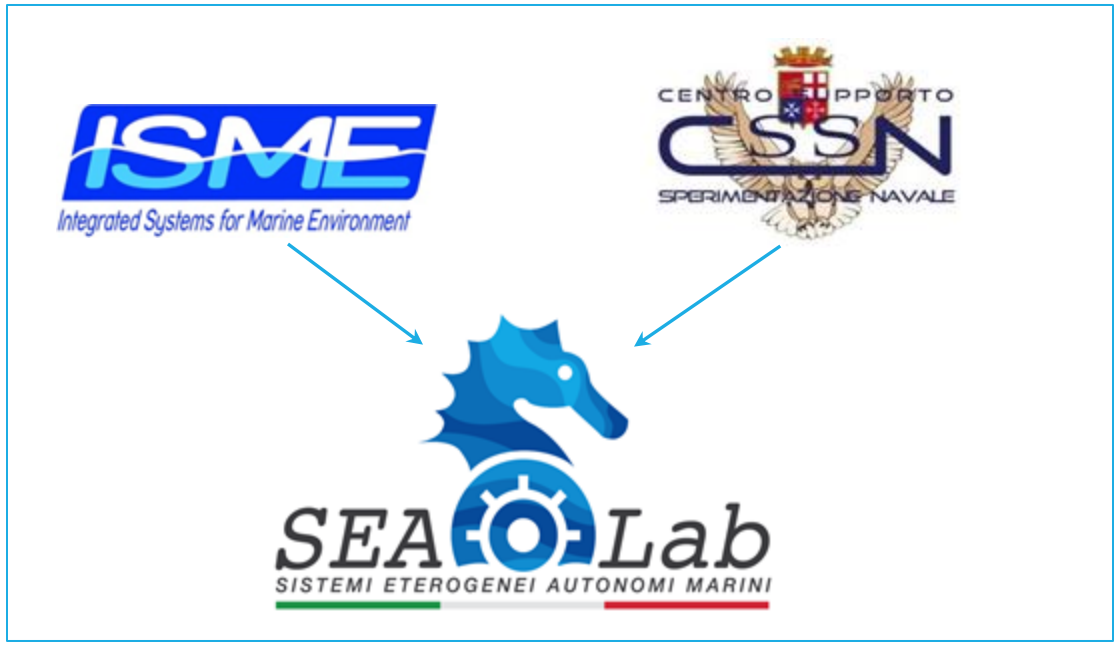
- 9 Italian University members
- 70+ Researchers;
- Shared Infrastructures, labs, equipments
- Funding from EU, National , Industrial res. projects
- 1MEuro/year (approximate average of last 5 years)
- CSSN-ISME Joint Lab (SEALab)



SEA Lab
SISTEMI ETEROGENEI AUTONOMI MARINI

A national academic collaborative network of wide-spectrum synergic competences, devoted to research and development on marine unmanned system.

Brief Presentation - 2



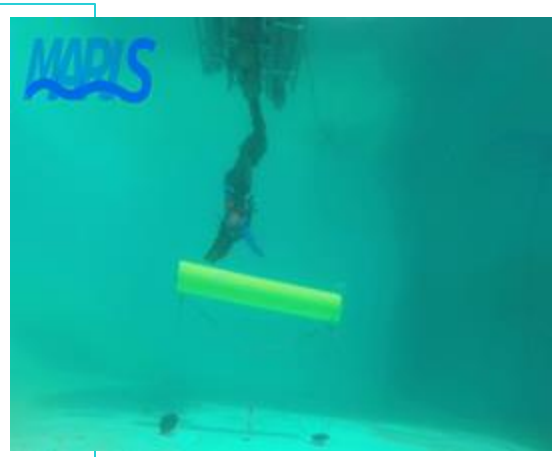
SEALab: Joint CSSN-ISME Laboratory on “Sistemi Eterogenei Autononomi”
(started in 2015)

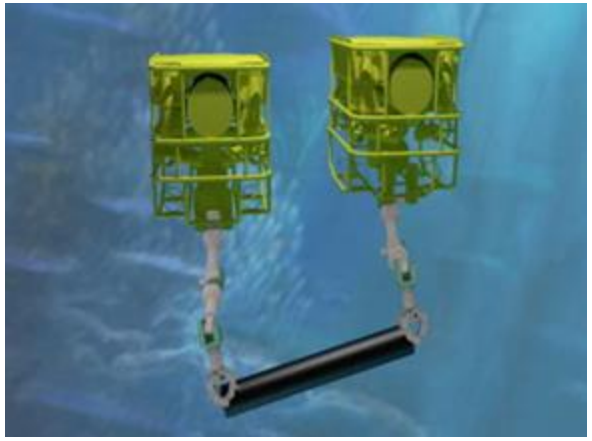
ISME
Integrated Systems for Marine Environment

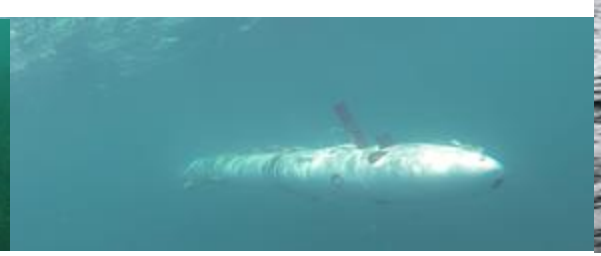
Brief Presentation - 3

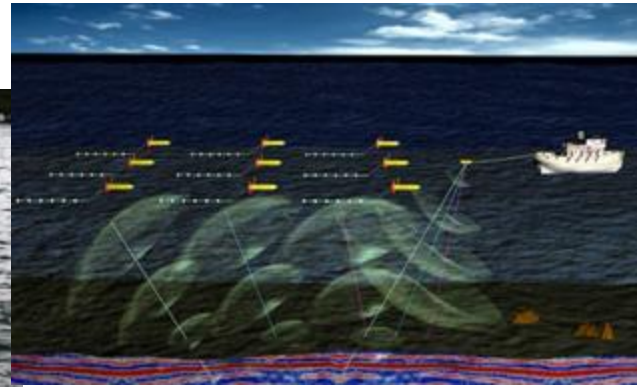
An integrated modular approach is adopted, developing throughout the following

- Components, sensors, devices, agent-subsystems
- Sensor Integration & data fusion/interpretation
- Individual Agent Autonomy
- Underwater Communication infrastructures and methods
- Multi-agent Cooperative Autonomy
- Multi-agent Mission Planning and Supervision









Polo Nazionale Subacquea

ISME
Integrated Systems for Marine Environment

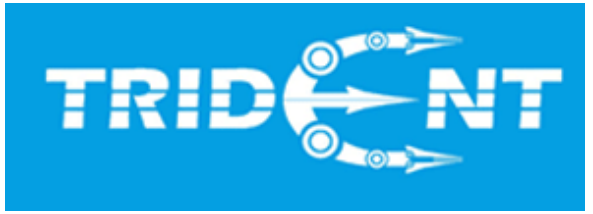
CENTRO SUPPORTO CSSN SPERIMENTAZIONE NAVALE

SEA Lab
SISTEMI ETEROGENEI AUTONOMI MARINI

This site of Marina Militare Italiana is chosen to host the new "Polo Nazionale della Subacquea" from 2023

ISME
Integrated Systems for Marine Environment

Projects matter



ARCHEOSUB.EU

DexROV

OPTIMUS
POLO NAZIONALE DELLA
DIMENSIONE SUBACQUEA

ISME
Integrated Systems for Marine Environment

Project funded by the Italian Navy

- MEDUSA – Monitoring maritimE areas by a cooperative Distributed Unmanned System made of heterogeneous Assets

Ongoing – Involved ISME nodes: UNIPI, UNIROMA

- BiSS – Non-cooperative Bistatic Sonar System

Ongoing – Involved ISME nodes: UNIPI

- DAMPS – Distributed Autonomous Mobile Passive Sonar system

Ongoing – Involved ISME nodes: UNICAS, UNIFI, UNIGE, UNIPI, UNIROMA, UNISAL

- RECON-UV – Reconfigurable Autonomous Underwater Vehicle

Ongoing – Involved ISME nodes: UNIFI, UNIGE

- HYDRONE-D – Defence: Modular Multi-mission Underwater Drone

Starting – Involved ISME nodes: UNIGE, UNIPI

- PACMAN – Proficient Artificial intelligence Counter Mine AutoNomous vehicles

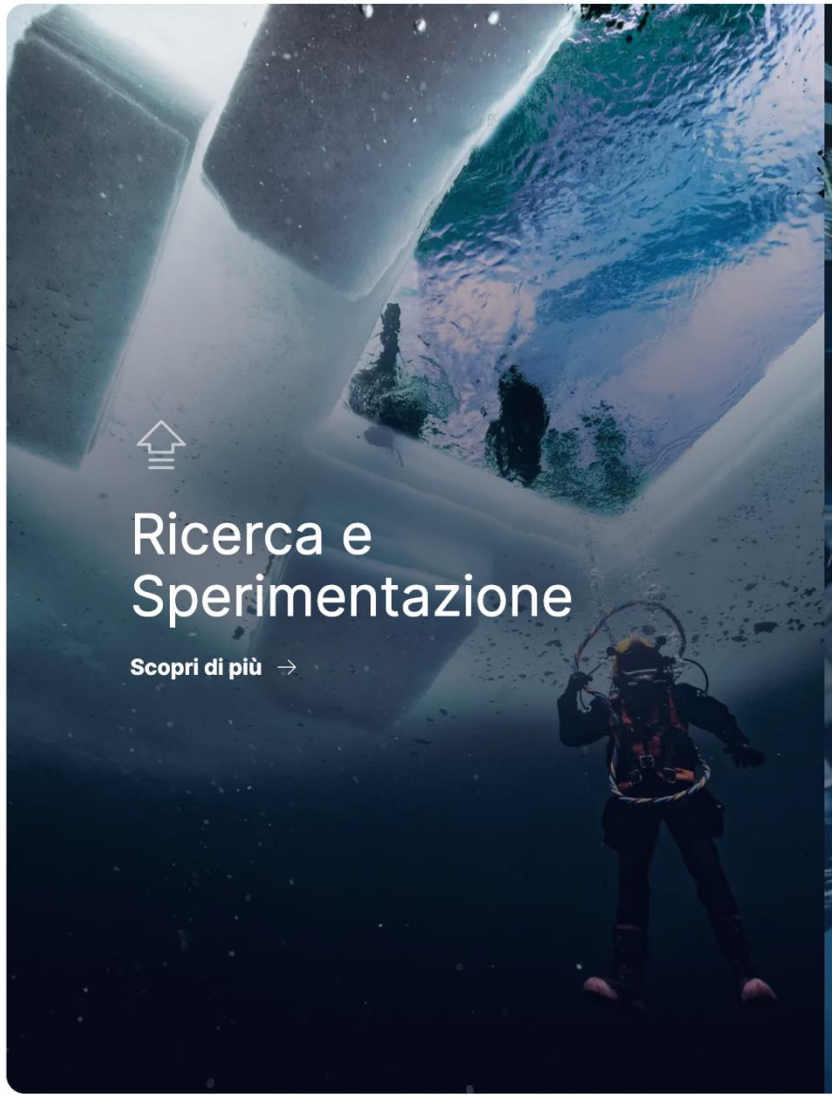
Negotiation – Involved ISME nodes: UNIFI, UNIPI

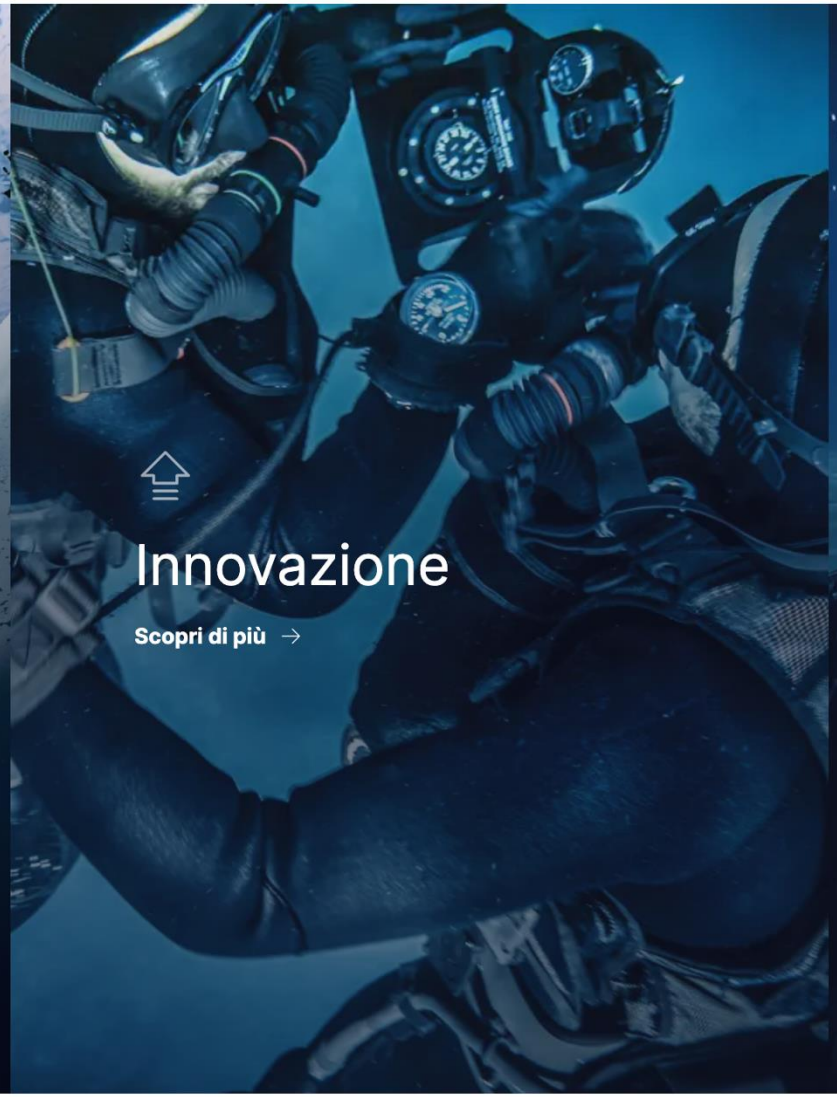
RECENT PNRM PROJECTS INVOLVING ISME NODES

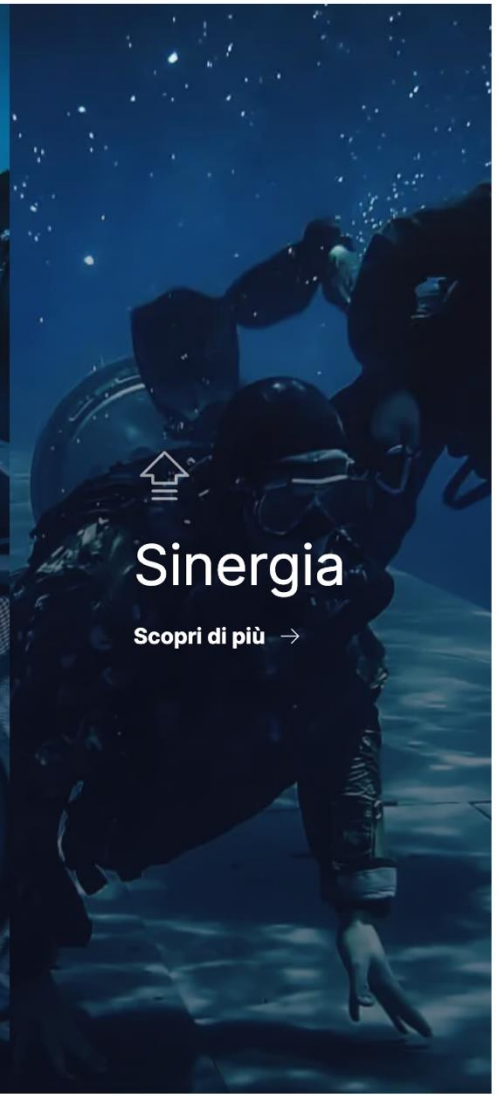
ISME activities within PNS


PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA
Home
Chi Siamo
Governance
Bandi
News&Eventi
Attività
Contattaci
Area Riservata
Le finalità del PNS
"Promuovere, facilitare e coordinare la cooperazione delle molteplici articolazioni operanti nel settore della subacquea, al fine di conseguire il potenziamento della ricerca tecnico scientifica e dell'innovazione tecnologica, l'incremento della competitività dell'industria nazionale e la tutela della relativa proprietà intellettuale"
(Decreto istitutivo del PNS, novembre 2023)
https://www.pnsitalia.com/

I PILASTRI DEL PNS







PNS
POLO NAZIONALE
DELLA DIMENSIONE
SUBACQUEA

Governance

Ministero delle Imprese
e del Made in Italy

Ministero
dell'Università
e della Ricerca

Ministero per la Protezione civile e le
Politiche del mare

MARINA
MILITARE

DIFESA
SERVIZI
GENERIAMO VALORE

AIAD
ITALIAN INDUSTRIES FEDERATION FOR
AEROSPACE, DEFENCE AND SECURITY

CRUI
Conferenza dei Rettori
delle Università Italiane

CoPER
CONSULTA DEI PRESIDENTI
DEGLI ENTI DI RICERCA

PNS-2024-R-01 – SIMILARS (Phase 1 out of 3 in 2025)

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

SEGRETARIATO GENERALE DELLA DIFESA / DNA

Studio e definizione di interfacce standard per **lancio, recupero** e interazione tra **veicoli autonomi** subacquei e piattaforme **cooperanti**

W•SENSE	FLYSIGHT	FINCANTIERI	GRAALtech Robotics, from idea to the sea.	SAIPEM
ISME Integrated Systems for Marine Environment	Università di Genova	UNIVERSITÀ DEGLI STUDI FIRENZE Da un secolo, oltre.	UNIVERSITÀ DI PISA	P4G POSITIVE GOING ELETTRONICA

PNS-2024-R-02 – OPTIMUS (Phase 1 out of 3 in 2025)

Sistema di gestione e ottimizzazione dell'energia nei sistemi autonomi subacquei

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

FINCANTIERI

ECODRONE

EVERYBOTICS

GRAALtech
Robotics, from idea to the sea.

SEGRETARIATO GENERALE DELLA DIFESA / DNA

SIT Technologies

ASSOCIAZIONE SMLAB
SMART MANUFACTURING LAB

Università di Genova

UNIVERSITÀ DEGLI STUDI DI TRIESTE

UNIVERSITÀ DEGLI STUDI DI CASSINO E DEL LAZIO MERIDIONALE

Politecnico di Torino

PNS-2024-R-03 – MURENA (Phase 1 out of 3 in 2025)

Multistatic Underwater Reconnaissance Experimental Network Asset

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

SEGRETARIATO GENERALE DELLA DIFESA / DNA

WASS
SUBMARINE SYSTEMS
a FINCANTIERI Company

FLYSIGHT

FINCANTIERI
FUTURE ON BOARD

Gt

LSI
Leonardo Sistemi Integrati S.r.l.

LEONARDO

MDM

DEFENCE TECH
SAFETY BY INNOVATION

TecNav
systems

IN SUPREMÆ DIGNITATIS
1343

FLORENTINA STUDIORUM UNIVERSITAS

SOL PER NOCTEM

W • SENSE
INTEGRATED CABLELESS SOLUTIONS

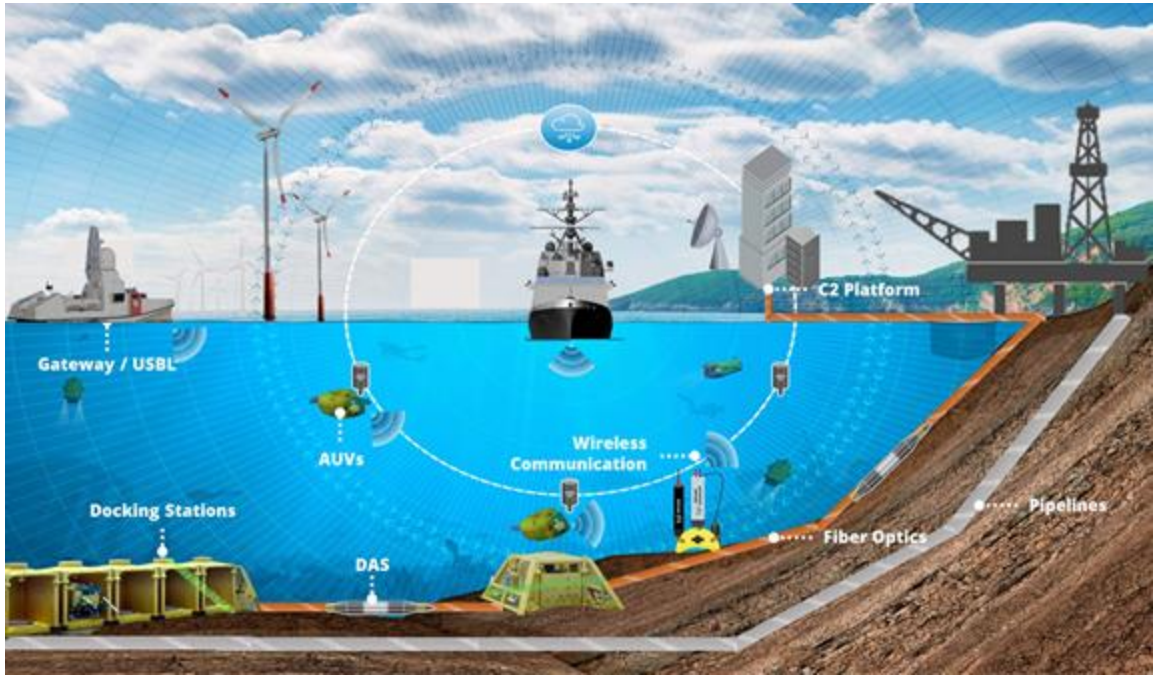
PNS-2024-R-04 – TARAS (Phase 1 out of 3 in 2025)

Tecnologie **A**vanzate di **R**ete per mezzi **A**utonomi **S**ottomarini

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

SEGRETARIATO GENERALE DELLA DIFESA / DNA

TARAS



W SENSE INTEGRATED CABLELESS SOLUTIONS · LEONARDO · FINCANTIERI FUTURE ON BOARD · SAIPEM · GRAAL tech Robotics, from idea to the sea. · MDM · WASS SUBMARINE SYSTEMS a FINCANTIERI Company · SitepItalia

AALEA · NEXT INGEGNERIA DEI SISTEMI · SPARKLE · FLYSIGHT · TecNav systems · ISME Integrated Systems for Marine Environment · Università di Genova · Università Politecnica delle Marche · SAPIENZA Università di Roma

PNS-2024-R-05 – SHARK (Start in 2026)

Submarine High-Tech **Autonomous** Research Kraft

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

SEGRETARIATO GENERALE DELLA DIFESA / DNA

GEM ELETTRONICA
a LEONARDO company

FINCANTIERI
FUTURE ON BOARD

GRAAL tech
Robotics, from idea to the sea.

MDM

BlueThink

EDGE LAB

SAIPEM

Università di Genova

UNIVERSITÀ DEGLI STUDI FIRENZE

IN SUPREMÆ DIGNITATIS 1343
UNIVERSITÀ DI PISA

PNS-2024-R-07 – DEXTIMUS (Start in 2026)

Sviluppo di un **manipolatore** impiegabile come **payload per UUV modulare**

PNS
POLO NAZIONALE DELLA DIMENSIONE SUBACQUEA

SEGRETARIATO GENERALE DELLA DIFESA / DNA

SAIPEM

AALEA

GRAAL tech
Robotics, from idea to the sea.

3D RESEARCH

EVERYBOTICS

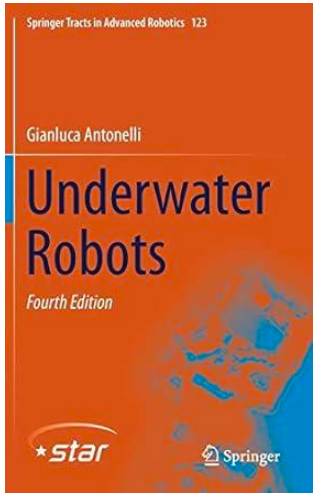
Università di Genova

UNIVERSITÀ DEGLI STUDI FIRENZE

UNIVERSITÀ DEGLI STUDI DI CASSINO E DEL LAZIO MERIDIONALE – 1979 – SOL PER NOCTEM

La conservazione dei mari italiani: soluzioni tecnologiche innovative

Breve tassonomia delle piattaforme robotiche esistenti



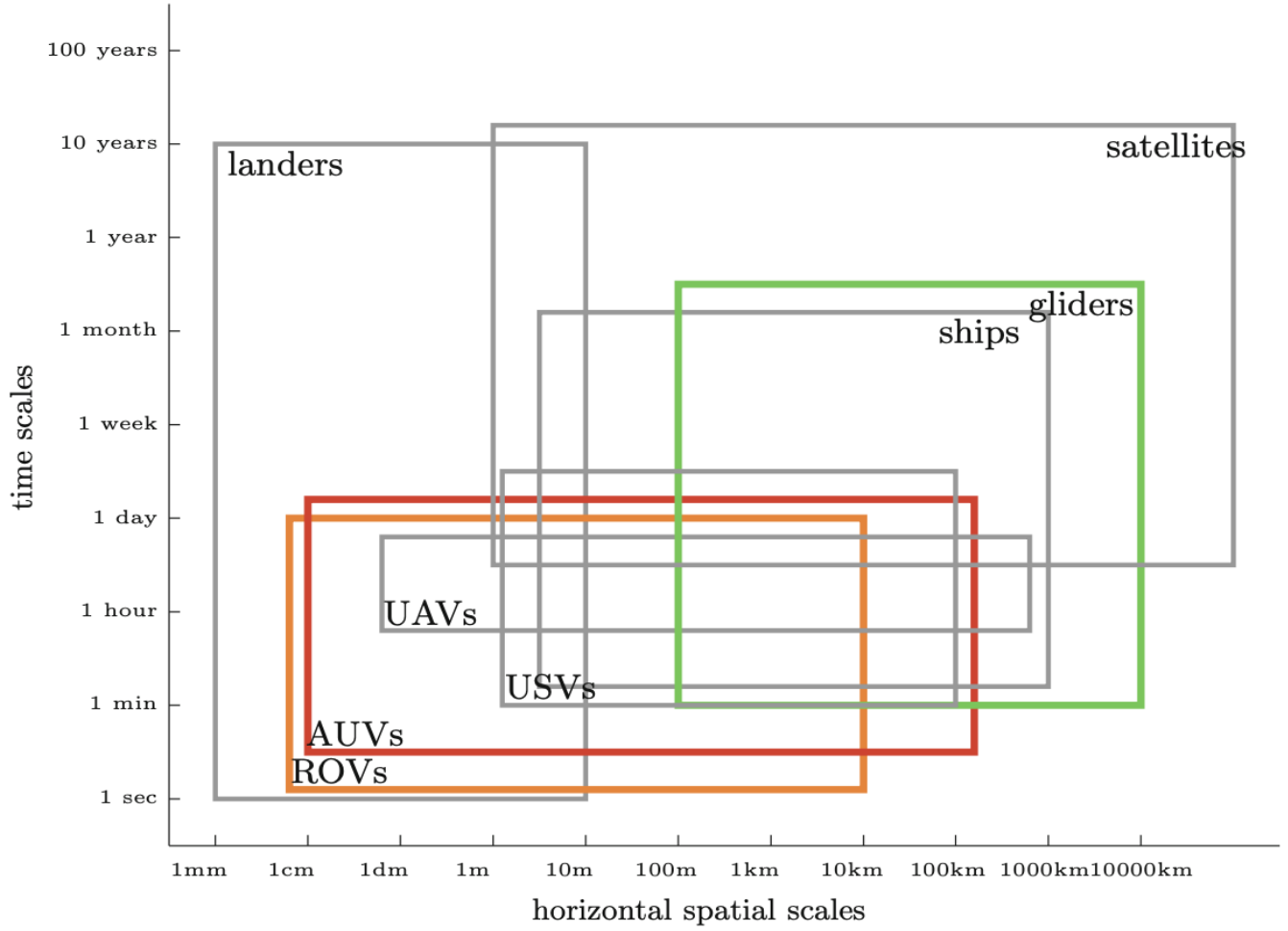


Fig. 1.5 Temporal and spatial resolution and coverage of sensor platforms for the marine environment, the underwater vehicles have been coloured (elaborated from the original courtesy of A. Sorensen, Norwegian University of Science and Technology, Norway)

Capacità dei robot marini

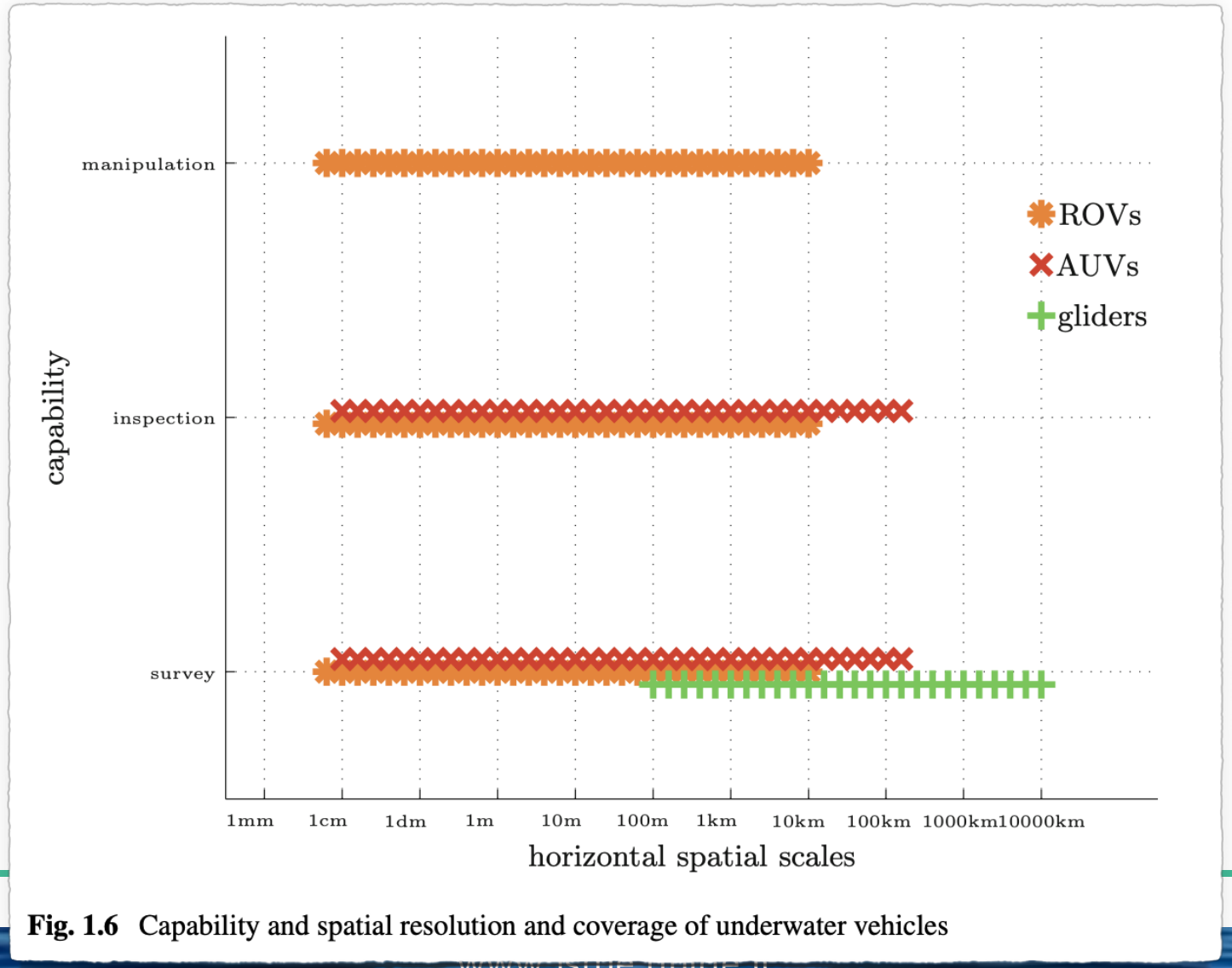
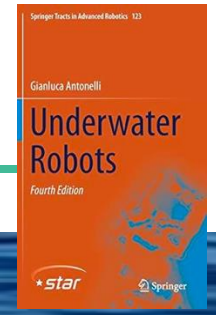


Fig. 1.6 Capability and spatial resolution and coverage of underwater vehicles



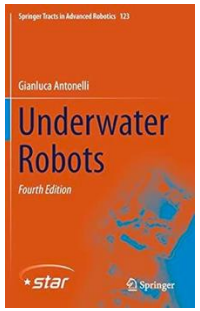


Fig. 1.9 Proof of concept for a Woods Hole Oceanographic Institution vehicle equipped with a manipulator, named Jaguar (courtesy of H. Singh)

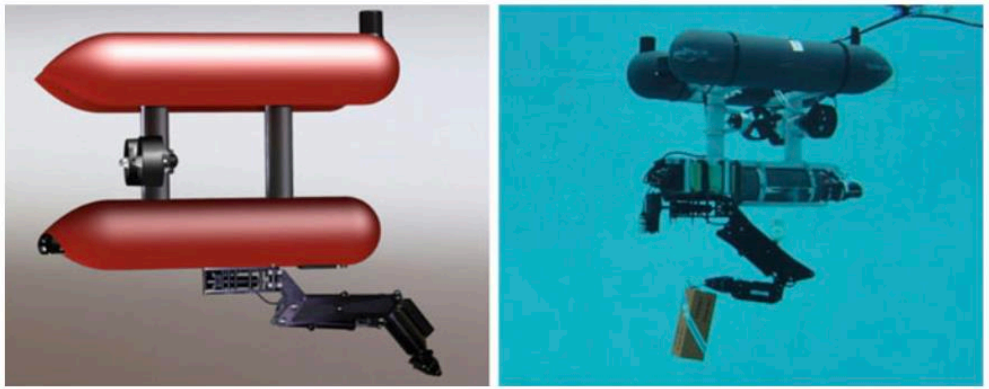


Fig. 1.10 Girona500 equipped with a CSIP arm developed at the University of Girona (Courtesy of Pere Ridao, Centre d'Investigaciò en Robótica Submarina (CIRS), Computer Vision & Robotics Research Team (VICOROB), University of Girona)

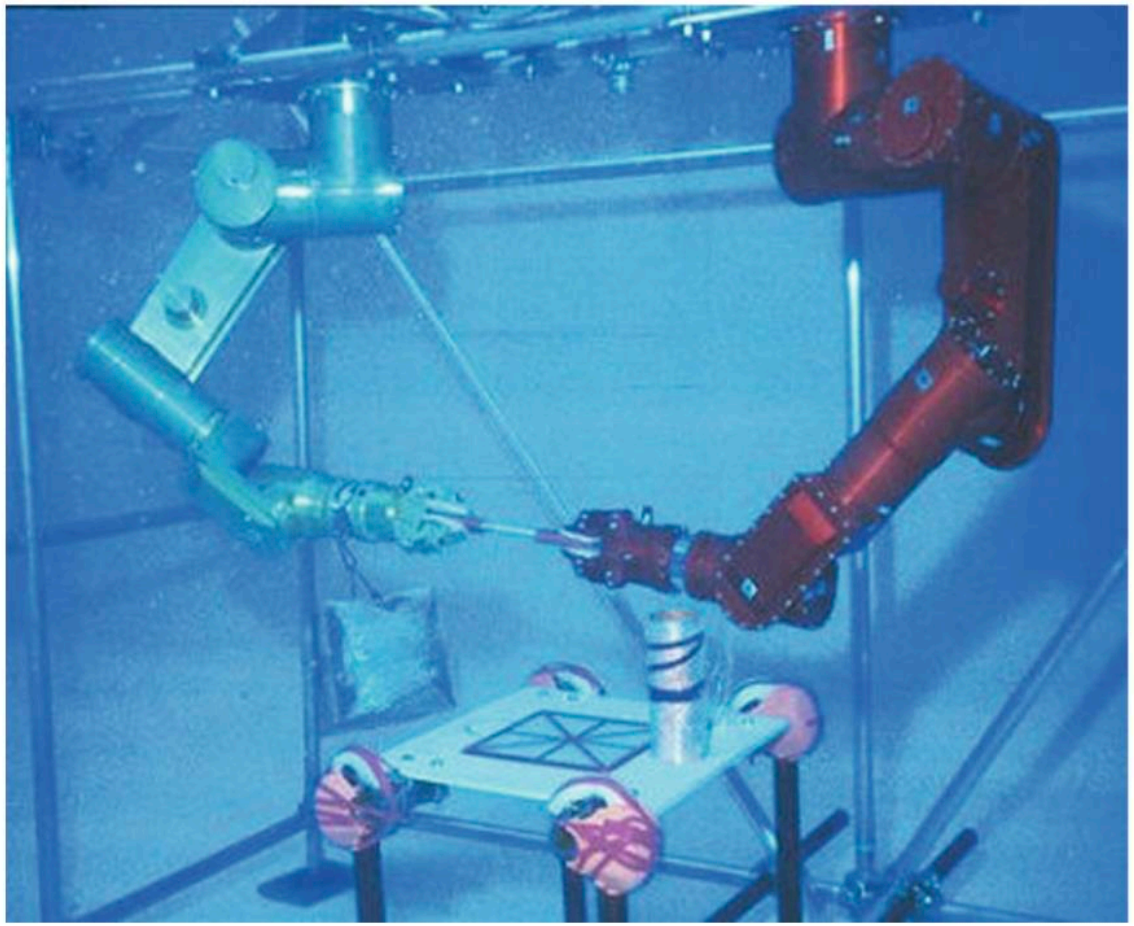


Fig. 1.8 Coordinated control of two seven-link Ansaldo manipulators during a wet test in a pool (courtesy of G. Casalino, Genoa Robotics And Automation Laboratory, Università di Genova and G. Veruggio, National Research Council-ISSIA, Italy)

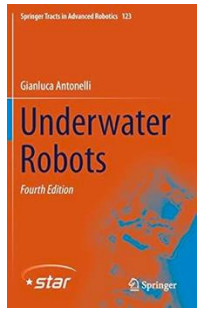


Fig. 1.13 The DexROV vehicle on the crane in the configuration with two 6-DOFs arms (courtesy of Jeremi Gancet, Space Applications Services, Peter Weiss, Comex, Alessio Turetta, Graaltech and DexROV Consortium)

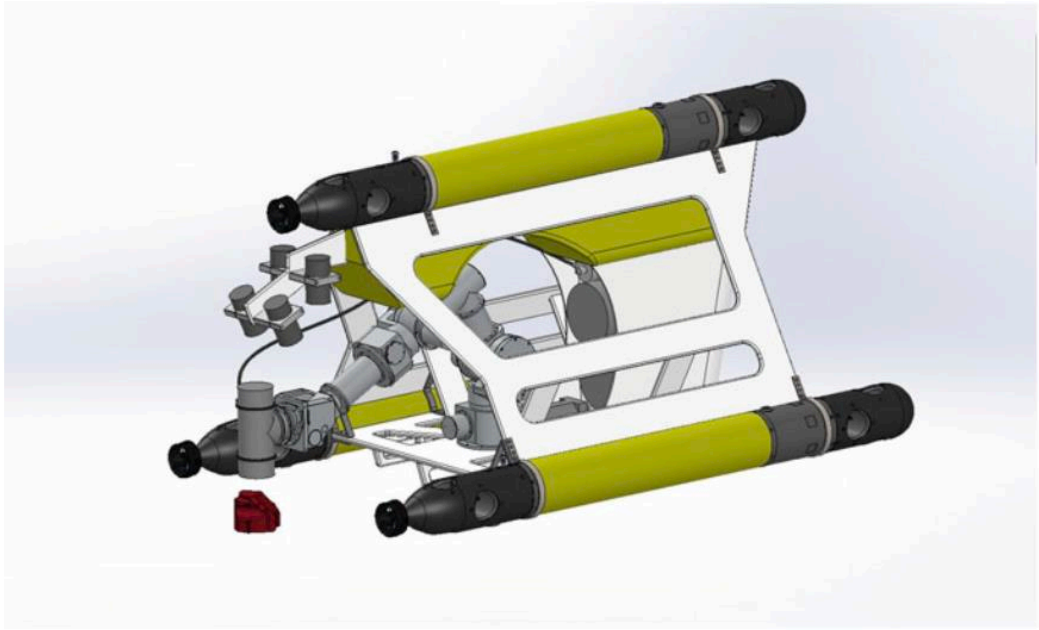


Fig. 1.14 Concept design for the ROBUST vehicle, the laser designed for in situ spectroscopy can be recognized at the arm end effector (courtesy of Alessio Turetta, Graaltech)

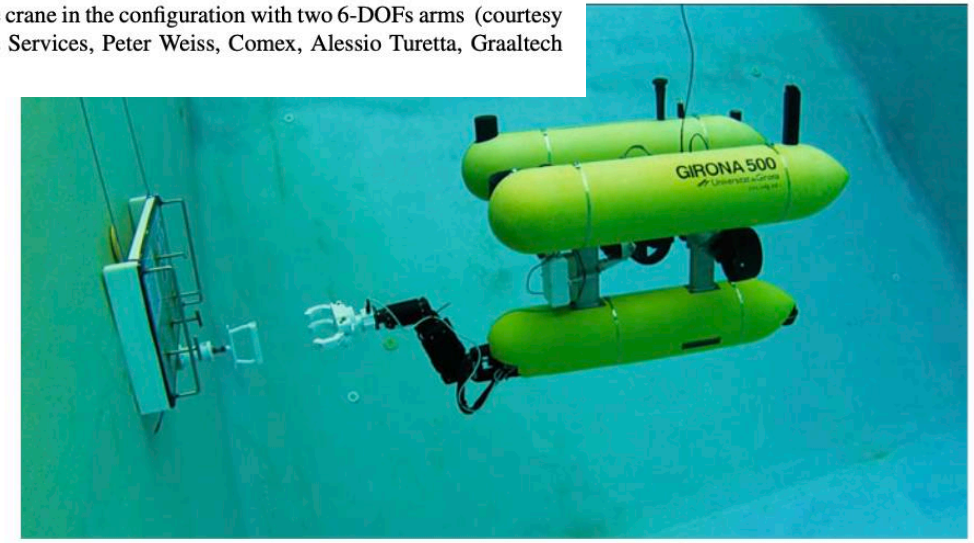
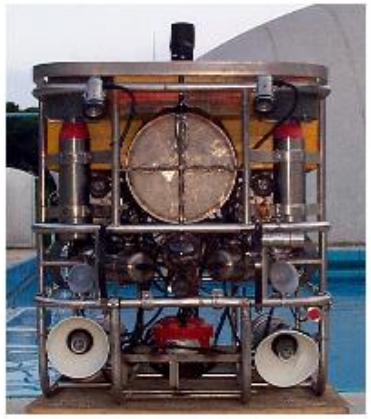


Fig. 1.12 More recent development of the UVMS used under the TRIDENT project (courtesy of Pere Ridao, Centre d'Investigaciò en Robótica Submarina (CIRS), Computer Vision & Robotics Research Team (VICOROB), University of Girona)

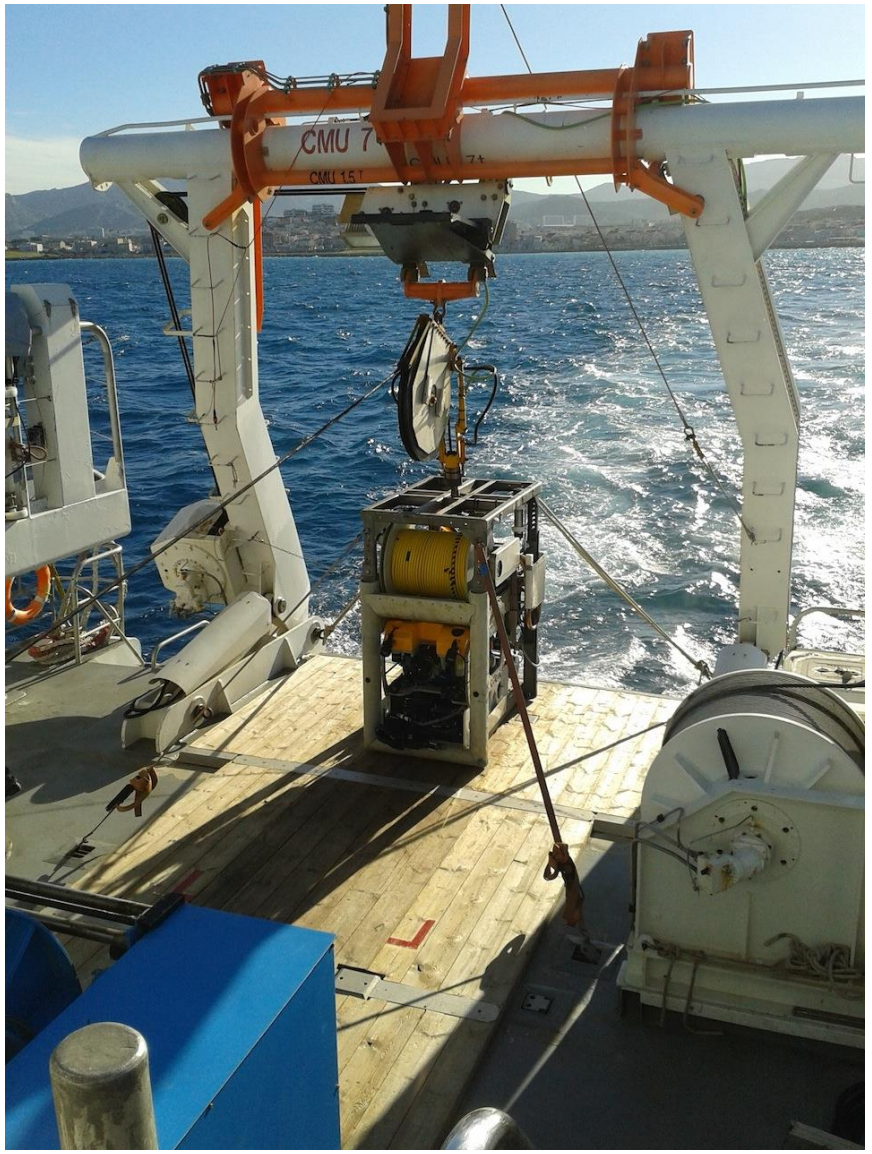


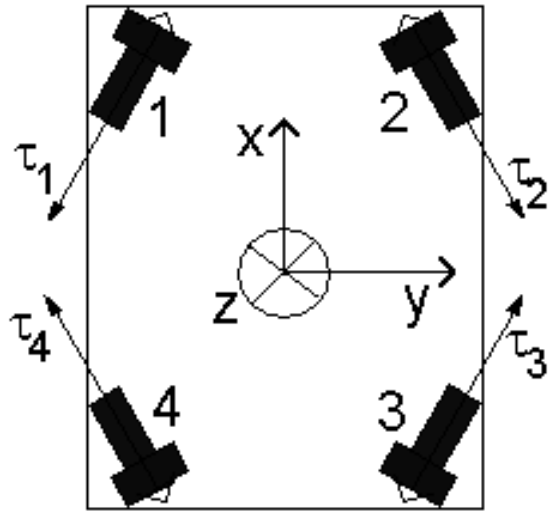

ROMEO


ROMEO


ROMEO


ROMEO


CMU 7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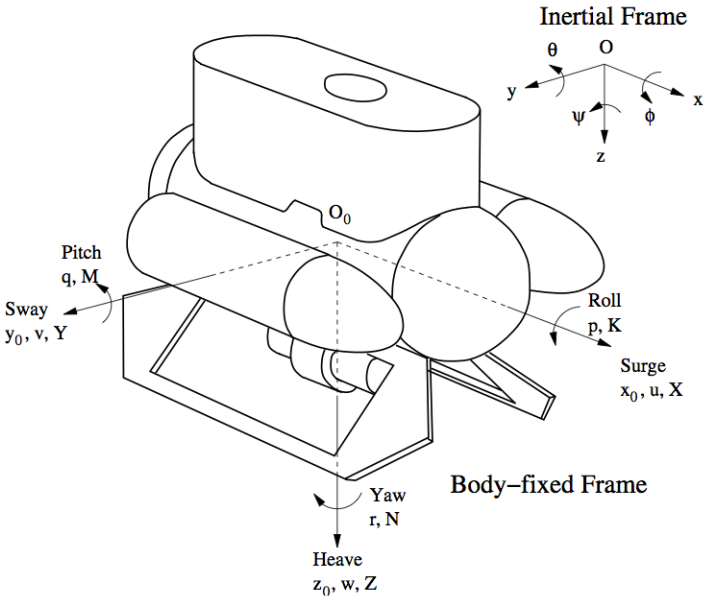
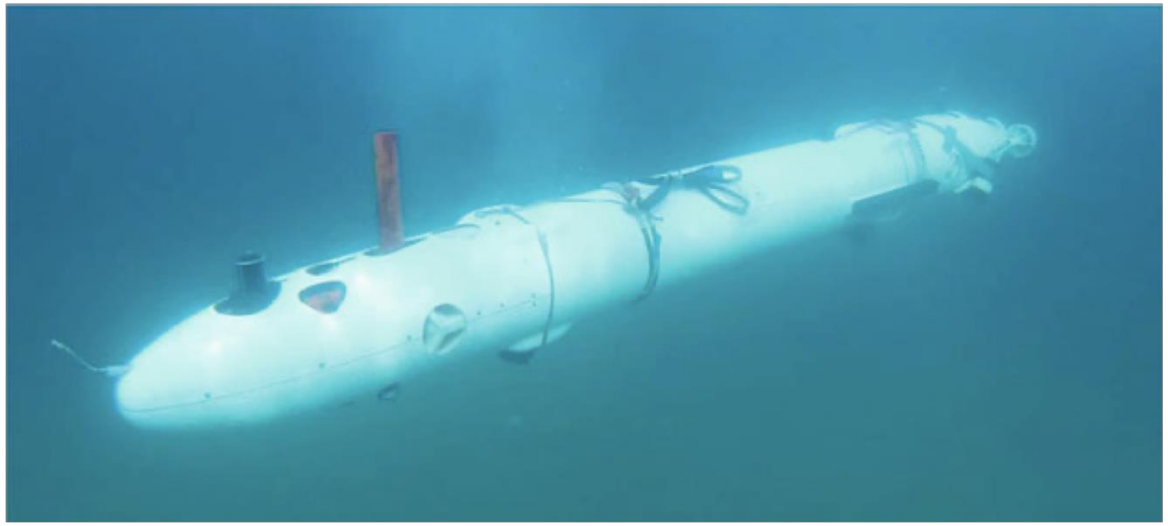
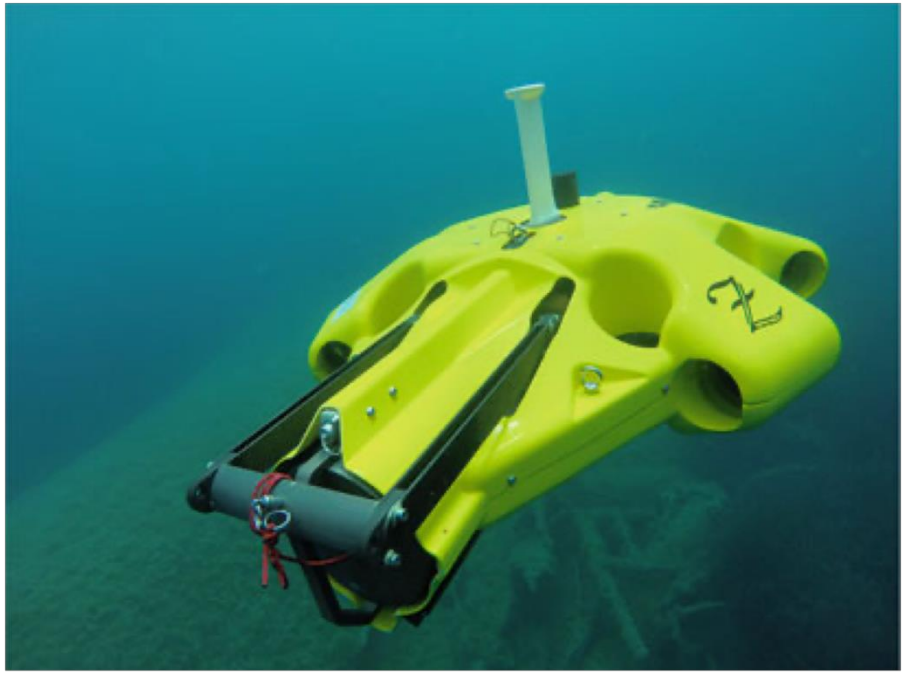

Inertial Frame
θ
O
y
x
ψ
ϕ
z
O0
Pitch
q, M
Sway
y0, v, Y
Roll
p, K
Surge
x0, u, X
Yaw
r, N
Heave
z0, w, Z
Body−fixed Frame

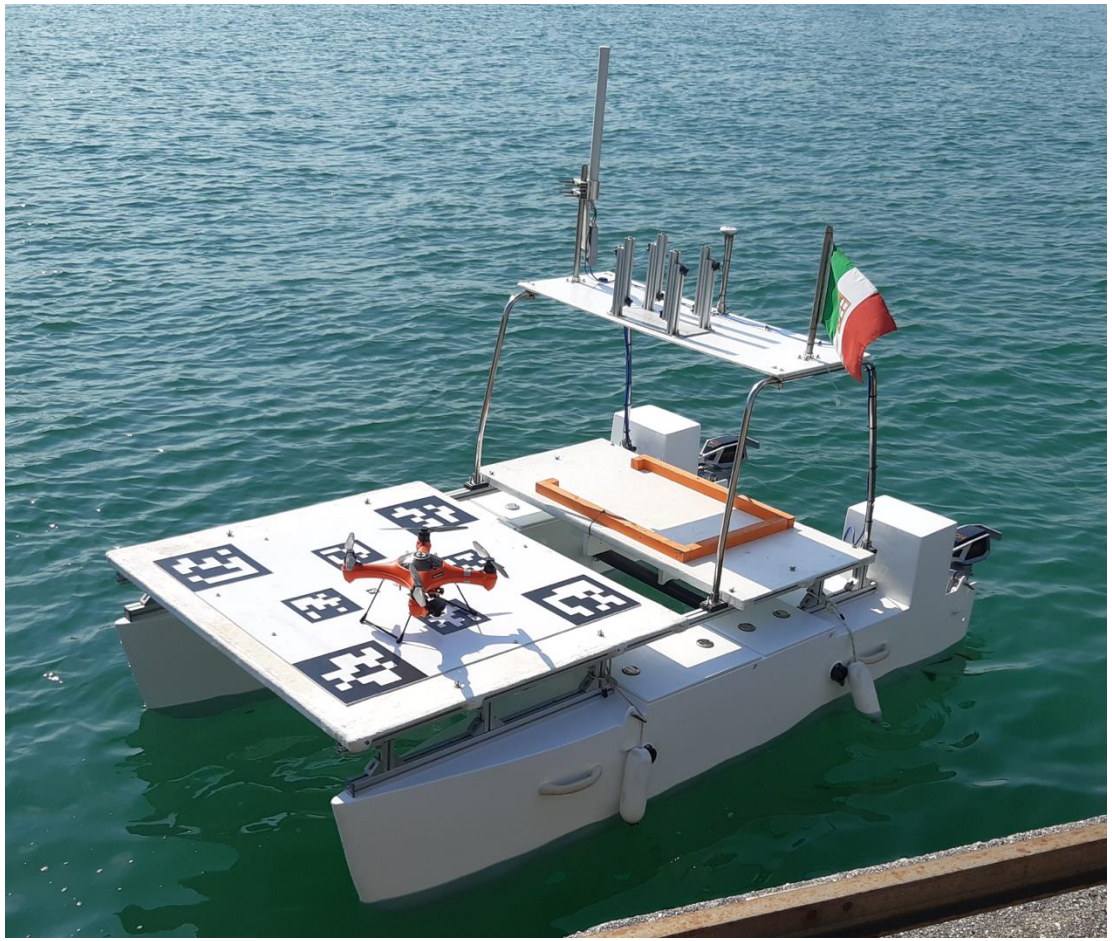
Control of Autonomous Underwater Vehicles, Fig. 2 The Typhoon AUV research prototype jointly developed by the University of Pisa and the University of Florence (Italy, 2013)

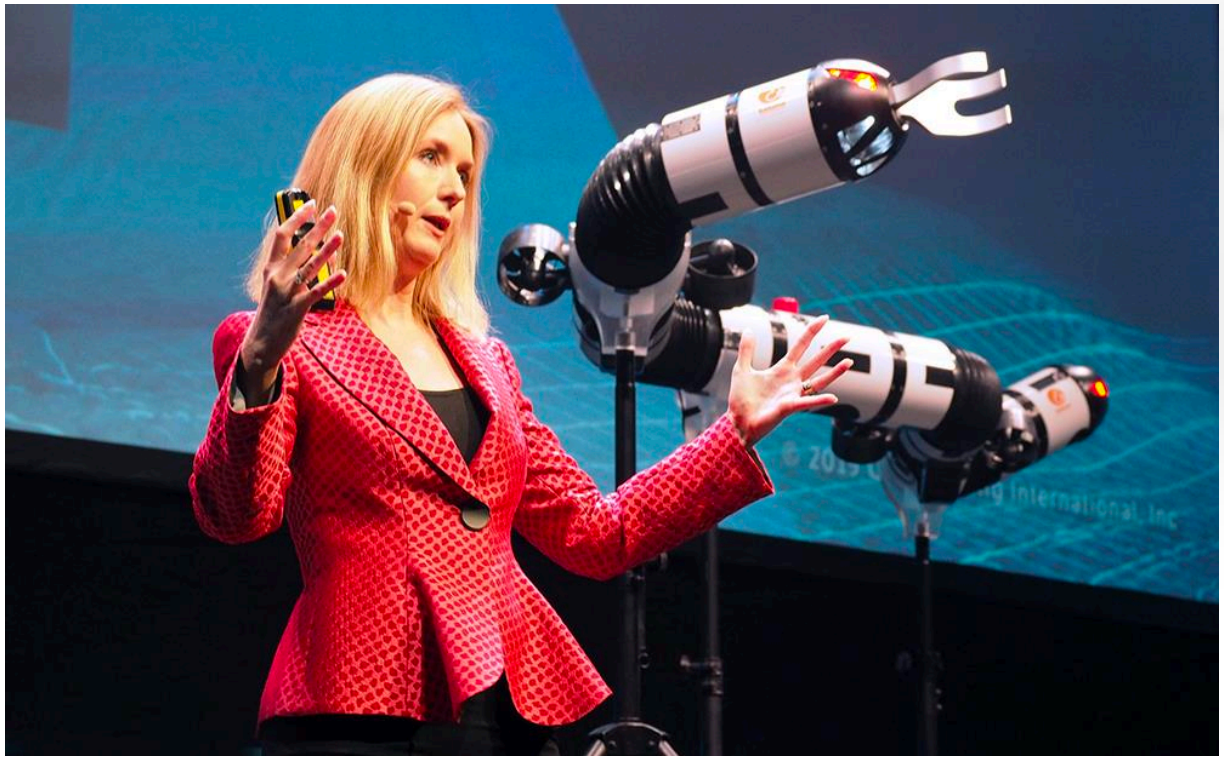




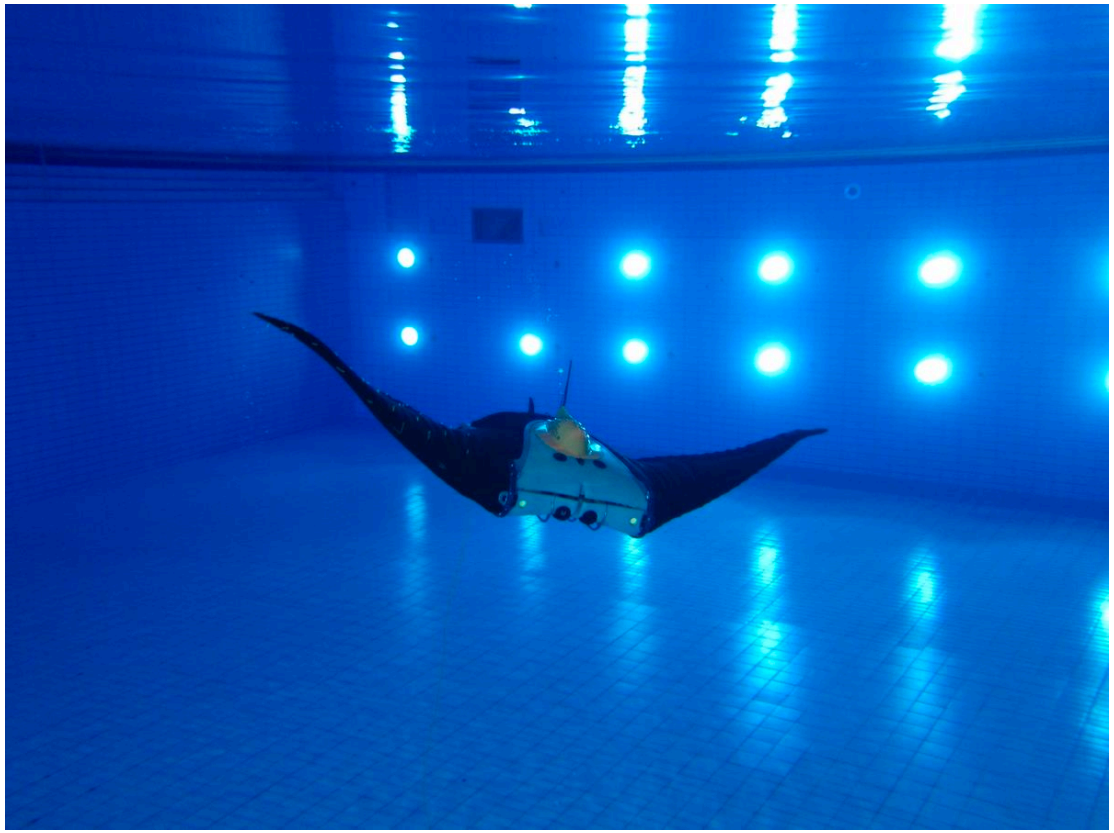
Control of Autonomous Underwater Vehicles, Fig. 4 Zeno: another example of a compact (1 m long) and fully actuated AUV rated for a depth up to 120 m. Jointly developed by the company MDM S.R.L. – Florence, and the University of Florence (2018)

M. H. Ang et al. (eds.), *Encyclopedia of Robotics*,
https://doi.org/10.1007/978-3-642-41610-1_16-1



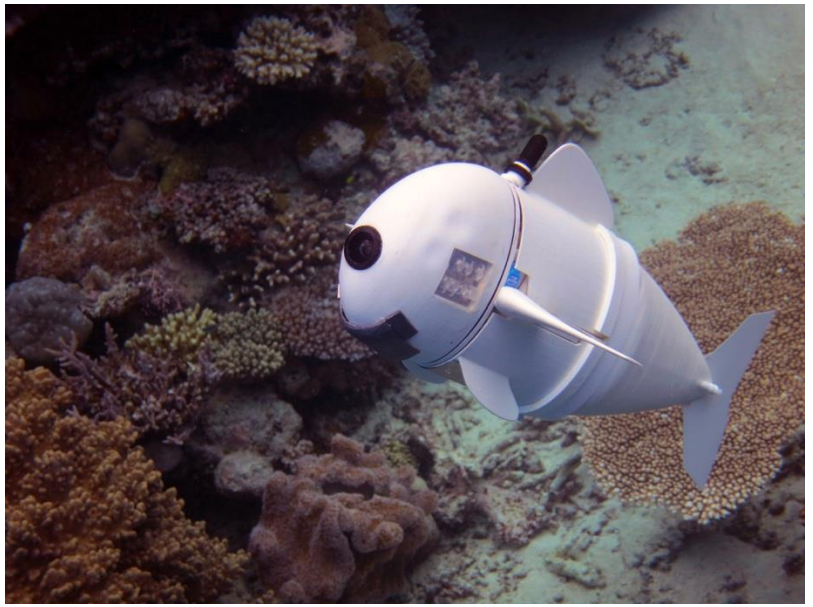


Professor Kristin Ytterstad Pettersen,NTNU Trondheim



EVOLOGICS (Germany),

The BOSS Manta Ray is an autonomous underwater bionic vehicle the company has been developing since 2013 within the framework of the Bionic Observation and Survey System project.



MIT, 2018

ISME, UNIVPM (Ancona)

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University of Bologna – Giuseppe Notarstefano- giuseppe.notarstefano@unibo.it


Grazie !