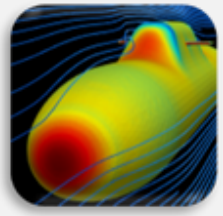
U212 NFS programme update

How it will exploit technology

Combined Naval Event 2023












Agenda

- Programme overview update
- Technical overview - Focus on:
  - New development systems
  - On the horizon technologies
  - Over the horizon needs and technological challenges
- Conclusion

Programme overview update

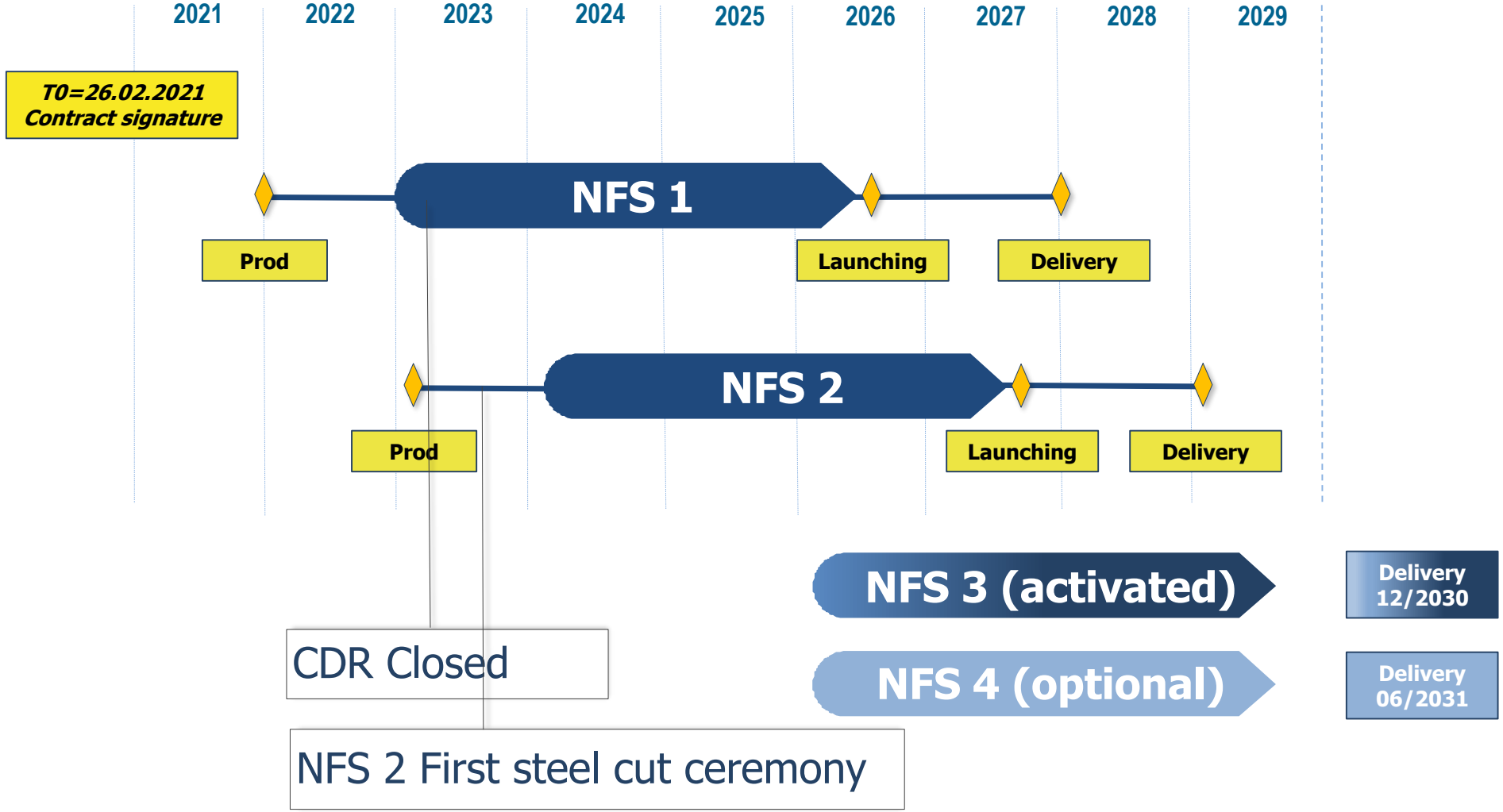
The U212 NFS Contract was signed on 26 February 2021:

- Contract **committed** scope:
  - Development of U212 NFS submarine;
  - Production of U212 NFS n.1 and n.2 and related ILS and TS;
  - Development of Li-Ion Battery System;
  - Development and production of the training centre.

- Contract **uncommitted** scope**:**
  - Production of U212 NFS n.3 and n.4 and related ILS and TS

- Amendment for NFS 3 activation within Jun 2023

Programme overview update



Technical overview – System Engineering

Design evolution

- System Engineering document set developed:
  - System Requirement Review (SRR) passed ☑
  - System Design Review (SDR) passed ☑
  - **Critical Design Review (CDR) passed** ☑
- System Engineering software database based on:
  - **DOORS Req. database updated** ☑
  - **Rhapsody system NFS model assessed** ☑
- With SE approach, IT Navy gained:
  - a complete, organized and functional set of assessed requirements/link/solutions
  - a new approach to the future submarine design challenges with higher and consolidated knowledge
  - to be faster and effective in development decisions

Technical overview

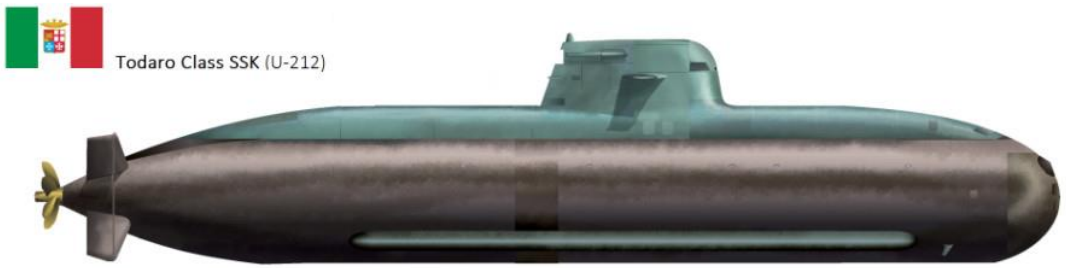
Why NFS

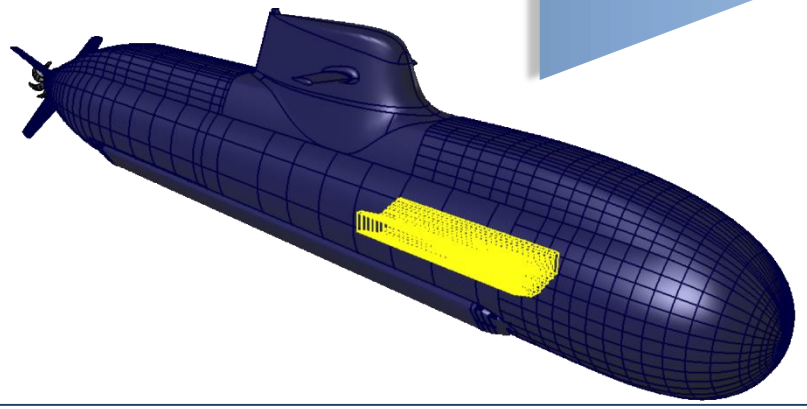
to maintain the consistency and update of the Italian Navy submarine fleet, in order to ensure adequate underwater domain surveillance and control capability, taking into account the future complex scenarios of underwater operations

How NFS

Todaro Class
REVOLUTION (AIP)

Near Future Submarine
EVOLUTION (LBS)



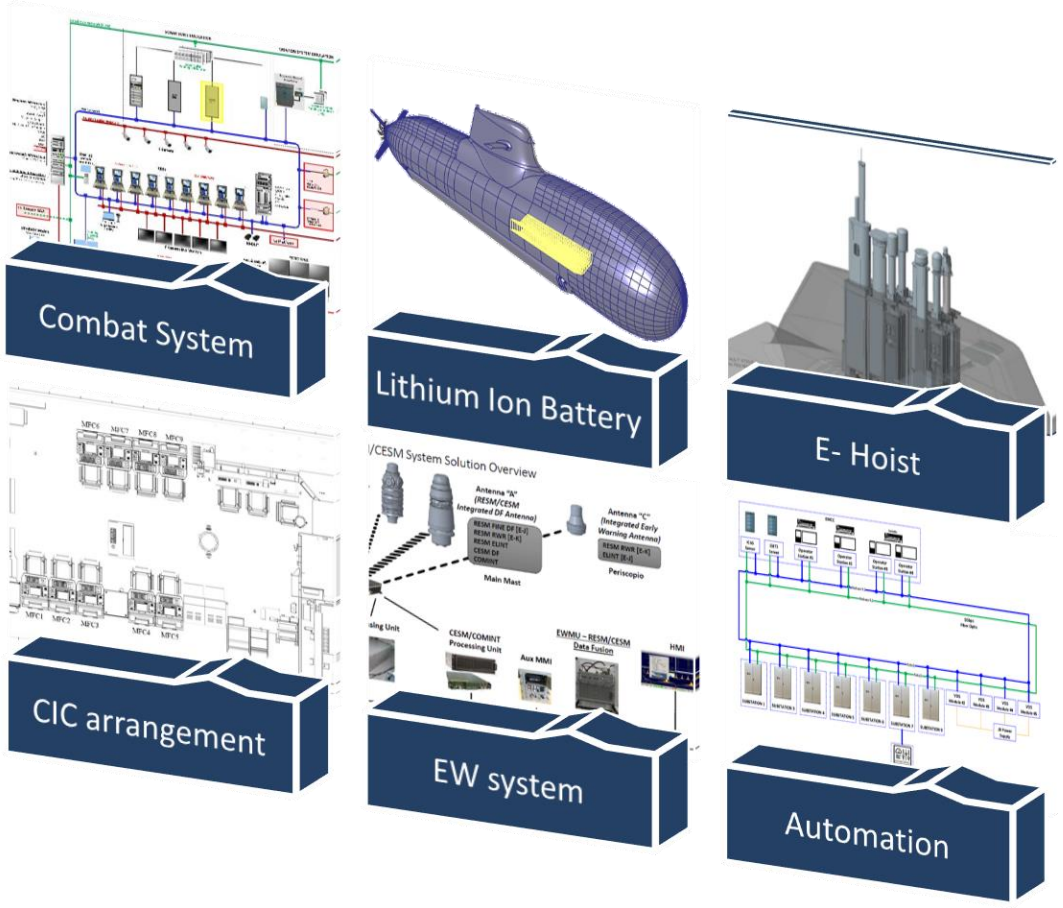


Technical overview

Main features

- Length overall — approx. 59 m
- Height above sail — approx. 12 m
- Maximum diameter — approx. 7 m
- Surface Displacement — approx. 1600 ton
- Crew members — approx. 29
- Propulsion Engine — Permasyn
- Propeller — 7 blades
- Diesel Generator — 970 kW
- Battery System — Lead Acid/R&D Li-Ion
- Fuel Cell — 8+1 moduls

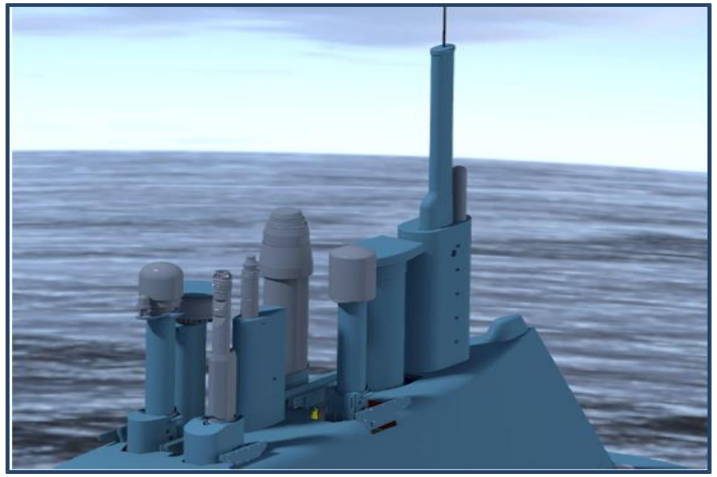
New developments



Improved design **to enhance operational flexibility and overall state of the art capabilities.**

Technical overview – New Development Platform Systems

L3HARRIS™
Calzoni S.r.l.



- Electric masts as base for future development in the direction of a full electric submarine
- Better modularity and re-configurability
- State of the art technology

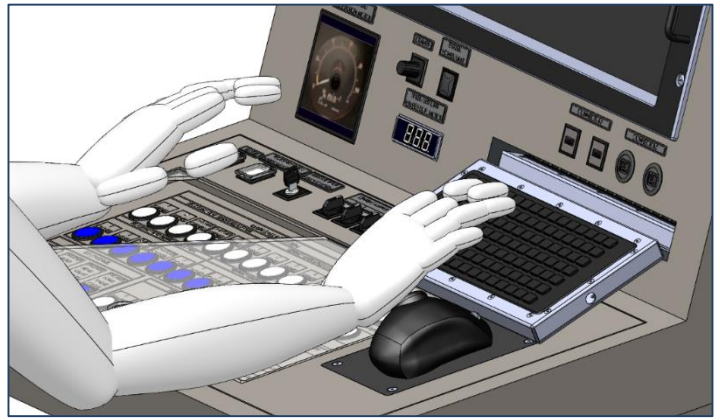
FINCANTIERI
NexTech

- State of the art architecture to ensure a new long lasting series of submarine platform control systems
- Modularity to follow submarine development in years
- Applicable to U212A design

Technical overview - IPCS

INTEGRATED PLATFORM CONTROL SYSTEM:

- Status:
  - CDR passed
  - Hardware/Software prototypes production
- New features:
  - **New Cyber secure design**
  - Updated integrated architecture
  - Enhanced Interfaces performances
  - New maintenance and onboard training capabilities



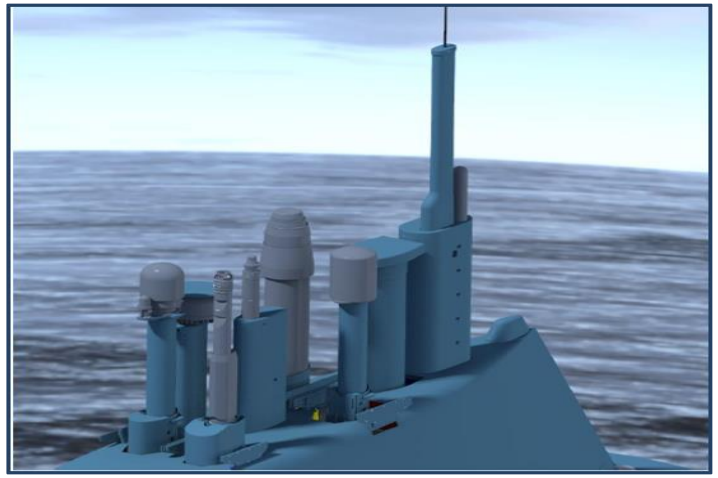
PLATFORM and COMBAT MANAGEMENT SYSTEM consoles material:

- New carbon based composite material
- Fire resistant - Flame retardant
- Neither Toxic nor Harmful
- compliancy to MIL-STD-2031 tested

Technical overview – E-Masts

E-MASTS:

- Status:
  - CDR passed
  - Hardware/Software prototypes production
- New features:
  - Full electric
  - Modular architecture
  - New operational set up capabilities
  - Fast reconfiguration
  - New interfaces capabilities (CMS – IPCS)
  - Ready for new capabilities integration

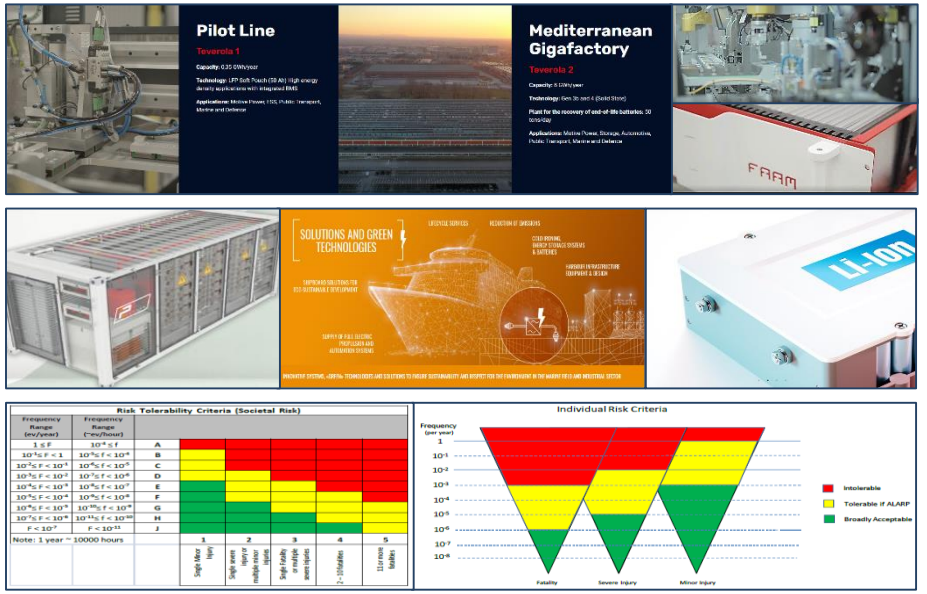


Technical overview – Lithium Battery System

Special team for a great challenge..

Fincantieri with strategic partners:

FIB/FAAM
Power For Future (J.V. Fincantieri SI and Faist Electronics)
T.U.V. Rheinland
CETENA



and OCCAR with IT Navy experts, drive the development of the whole Lithium Battery System.

Technical overview – Lithium Battery System

WHY LITHIUM

Assumption

- Higher performance
- Higher modularity and scalability
- Less maintenance
- Game changer in underwater domain
- Highest Grow rate in technology benchmark

Updated feedback

- Higher operational capability confirmed by tests
- Integrated design ready for "follow on" technologies
- Confirmed after lifecycle/maintenance evaluation
- Designed ready to be applied to any architecture
- Semi solid/Solid State design batteries (2026-20230)

Technical overview – Lithium Battery System

Development main drivers

DRIVER

- Best performances in highest safety
- Adaptable architecture to follow fast development in cells technology
- Applicable to U212A design
- Holistic approach

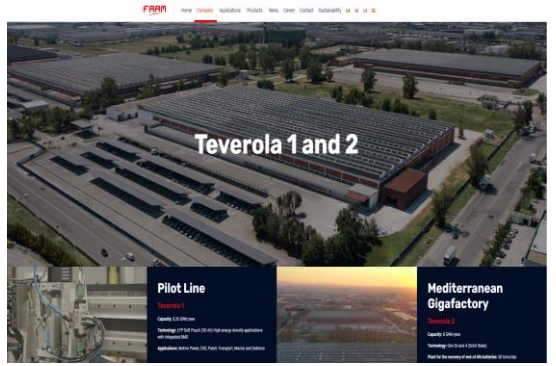
Solutions Update

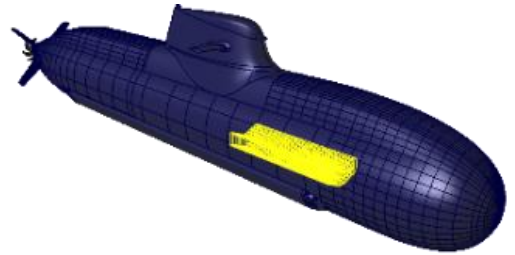
- HAZID/Risk&Safety assessed with TUV Rheinland
- Cells/Module prototypes developed with Producer
- U212A design applicability register updated and assessed with Fincantieri/Suppliers
- Production/integration/maintenance/support/recycling evaluations applied with Contractor and suppliers

Technical overview – Lithium Battery System

LITHIUM BATTERY SYSTEM INTEGRATION on NFS:

- Status:
  - Development end by 2023
  - Hardware/Software prototypes and functional Mock-UP production/testing/certification
- Integration activities:
  - By 2023 phase 2 activation
  - 1:1 Battery test laboratory qualification
  - 1st complete battery land based qualification
  - Battery onboard - HAT-SAT





Phase 2 activities are considered depending on the development phase positive results (2023).

Technical overview – Combat System

Design 'mission oriented':

- Surveillance on a Multidomain Spectrum (Above and Under water)
- Detection – Classification – Tracking
- Engagement
- Combat

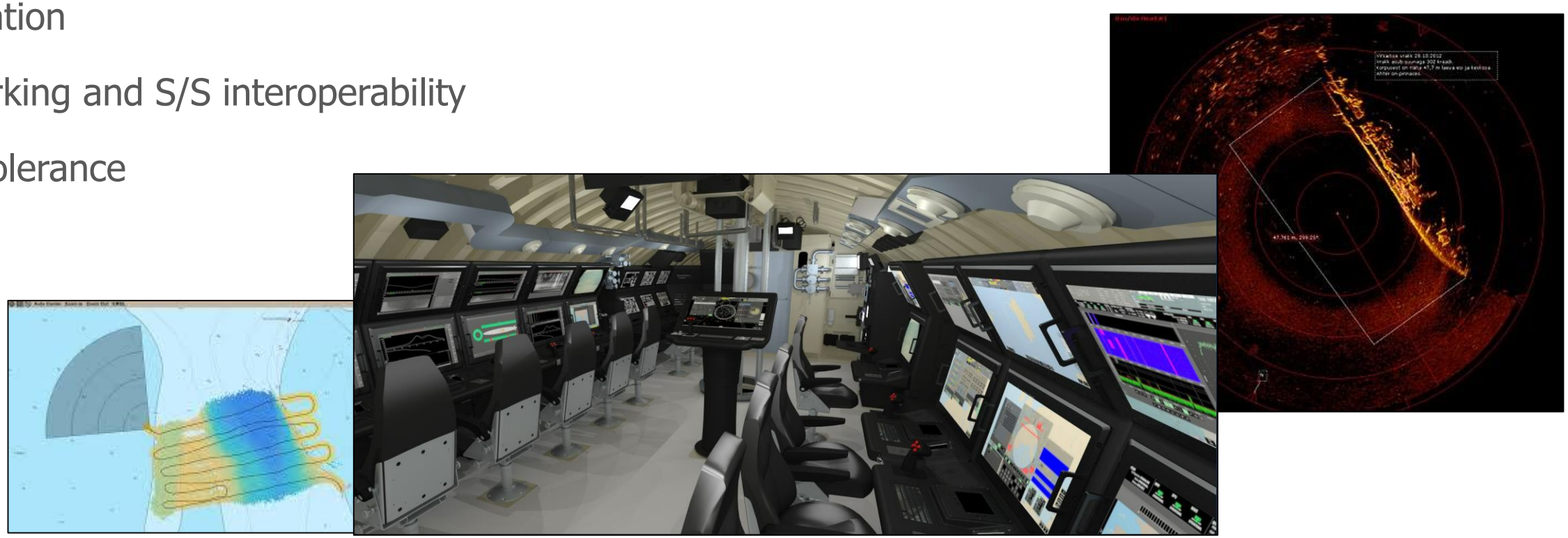
Main improvements:

- State-of-the-Art TMA algorithms
- State-of-the-Art sensors
- COMINT
- AI and Augmented Reality
- **Cybersecure by design**

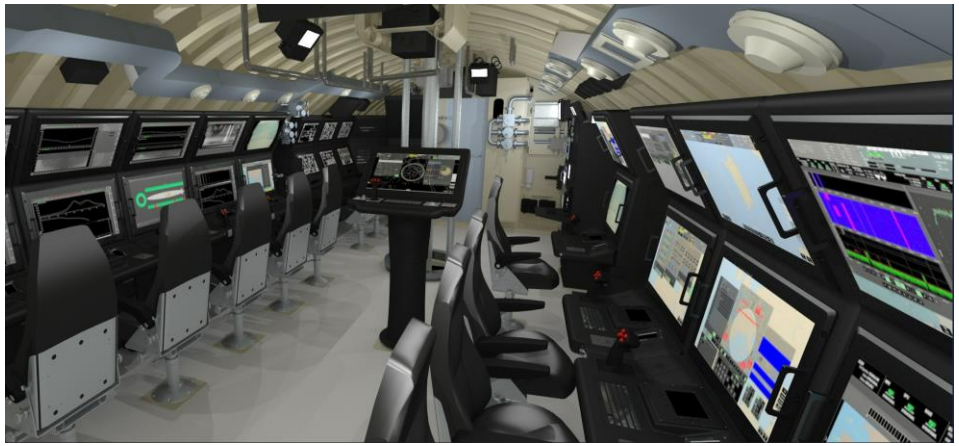
Technical overview – Combat System

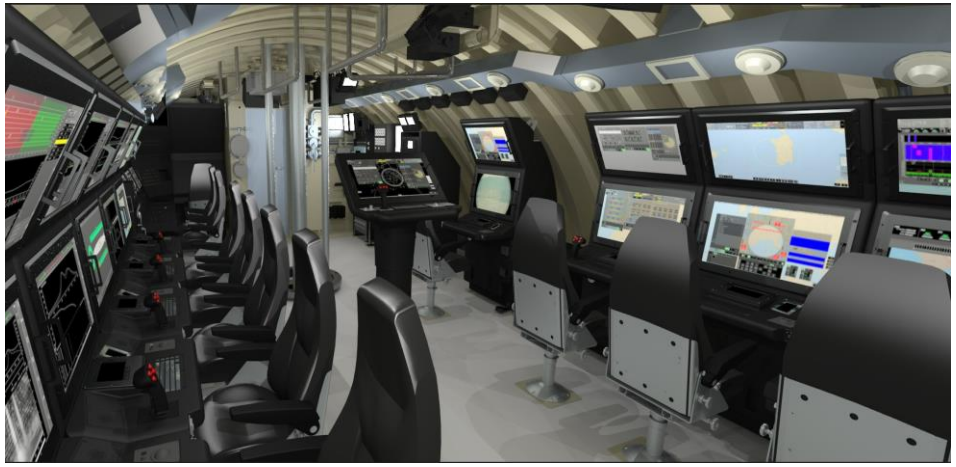
Design improvement based on:

- Virtualization & application hosted
- Integration
- Networking and S/S interoperability
- Fault tolerance



Technical overview – Combat System



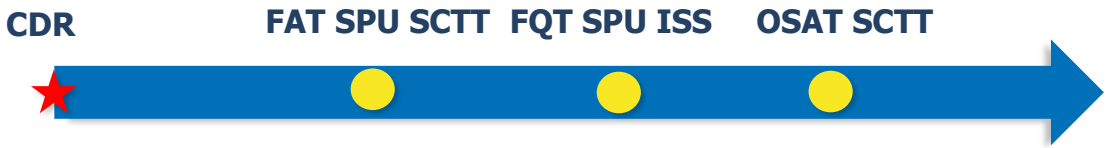


Technical overview – Combat System

- CMS - Combat Management System:
  - Incremental HMI prototyping base assessed on ITNavy feedback;

  - New Generation Multifunctional Consolle prototype delivered
  - New Commanding officer consolle design assessed

- ISS – Integrated Sonar System:
  - SW Development through incremental SW builds;

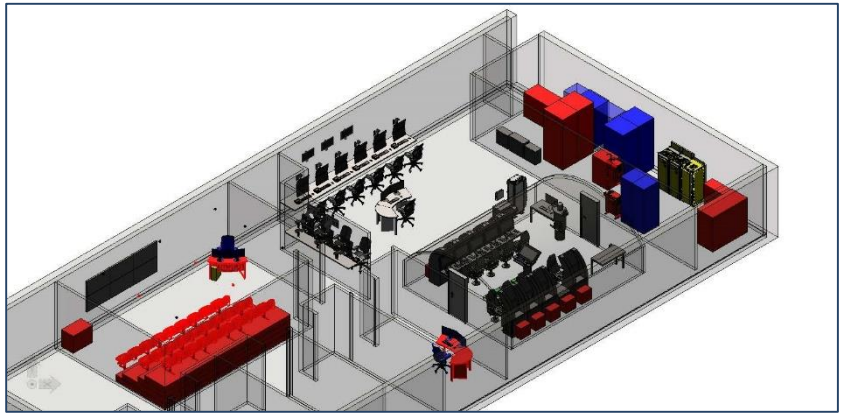


  - Additional improoved functionalities have been assessed.

Technical overview – Platform & CS new Training Center

Submarine Command Team Trainer (SCTT)

- Status:
  - Delivery of renewed NFS SCTT premises by 2023
  - Customization of Scenario Generator and Animator SW assessed with direct support of ITNavy Submarine Training Center
- Features:
  - CMS – EWS – Periscopes systems integrated simulators

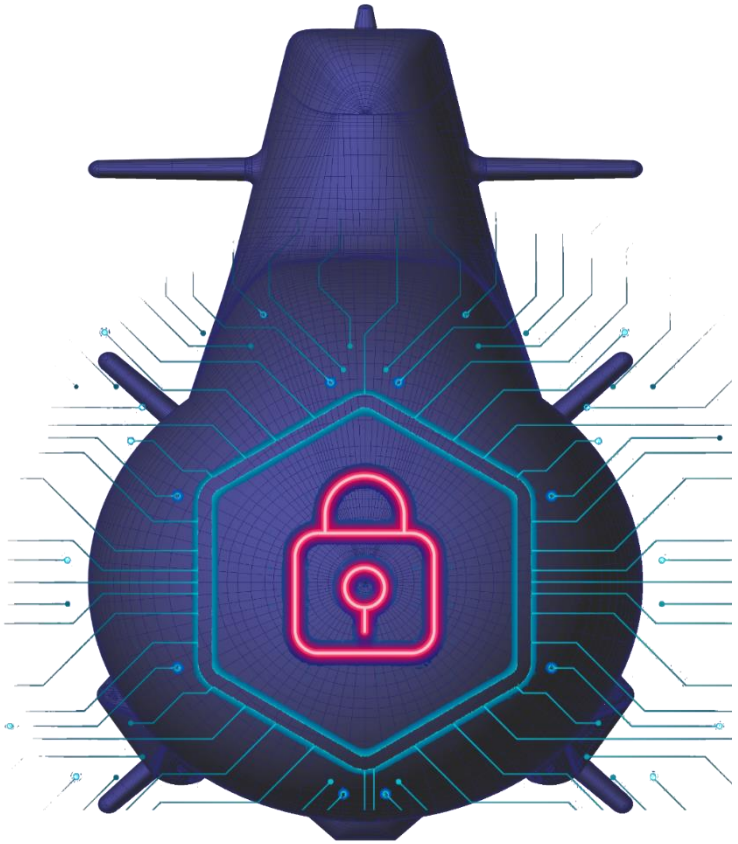


Submarine Control System (SCS)

- Status:
  - SCS main hardware and software development assessed, prototypes production started
  - Interfaces activities for cabin movement modules assessed with Contractor and suppliers (Rheinmetall – Cetena – Fincantieri Nextech – Avio)
- Features:
  - New multiplatform (U212A – NFS) training system

Technical overview – Cybersecure by design approach

IT Navy cybersecurity guideline have been applied for all digital systems in the unclassified domain



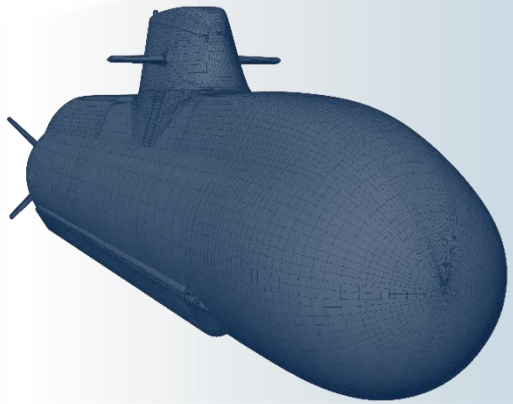
1. Assess cyber risks during the preliminary design phase
2. Evaluate residual cyber risks
3. Verify the application of selected cybersecurity requirements
4. Assess the cyber resilience via penetration test activities

Technical overview – Defence technology excellences

Prime Contractor	Main Sub-contractors					
FINCANTIERI	LEONARDO Combat System Integrator	elt ELETTRONICA GROUP EW Systems	L3HARRIS Calzoni S.r.l. E-Hoists, valves and Periscopes	thyssenkrupp Platform, tubeset and FC System	ELAC SONAR A COHORT PLC COMPANY Sonar suite	indra TLC
	SIEMENS Propulsion and distribution	mtu Diesel Genset	FINCANTIERI NexTech Automation	Avio Aero A GE Aviation Business Steering control	FINCANTIERI FIB S.r.l. TÜVRheinland CETENA a FINCANTIERI company Lithium Battery System	DEFORM Steel

framework of worldwide industrial excellences

Technical overview – on the horizon technologies

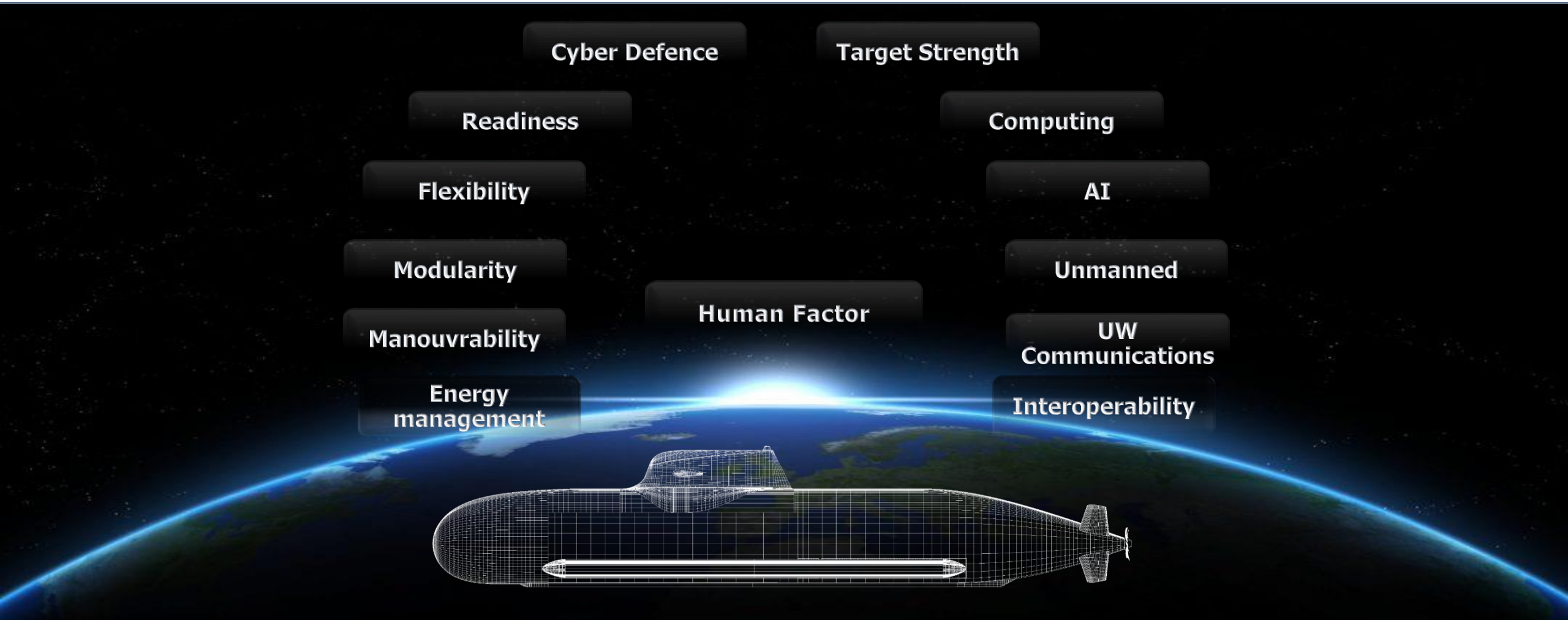


- Enhanced SF support
- New IPCS
- New CMS
- New Sonar System
- New E-MASTS
- New LBS
- New ESM

New Cybersecure design

- New Decoy System
- New TA System
- New missile capability
- 8th mast payload
- Unmanned launching sys.
- ROV friendly rescue eq.

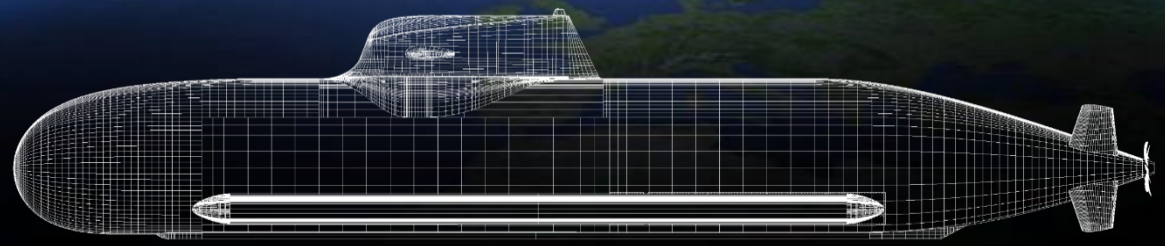
Technical overview - over the horizon challenges for PTF & CS



Technical overview - technologies to answer to upcoming needs

Propulsion & Manouvrability	Structures & materials	Energy	AI & Computing	Modularity	Unmanned & UW Comms	Target Strenght
• Rim-Driven Prop. • Electric actuators • Positioning systems	• Composites • Nano-Structure • SMART Materials	• New Battery Sys • Storage Sys. • New FC • Micro Genset • Underwater grids	• Quantum computing • Machine learning	• Modular sensor set • Modular payload management • UW Interfaces	• UUV • UAV • UW infrastructures • SF support systems	• Hull design • Smart Metamaterials • Energy control

worldwide investments in those transversal R&D field can substantially impact Submarine technologies development and next years of submarine design



Conclusion

NFS programme design driver is to develop at the state of the art any aspect of submarine technology

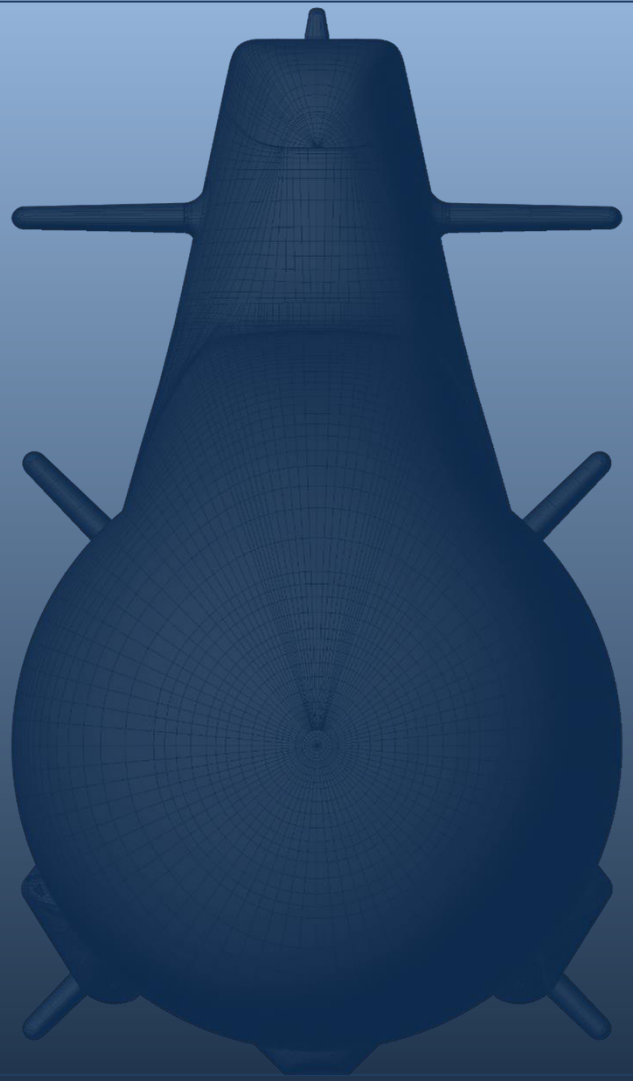
NFS programme, in OCCAR, is open

- to partnership for the programme or part of it
- to common logistic support partnerships for submarine units or single systems

NFS programme represent a design reference for

- new submarine design development and acquisition programmes
- common underwater & submarine R&D related programmes
- state of the art technology for midlife update of U212 design submarines or common systems

Thank You



Address	U212 NFS Via Tiburtina, 1238 00131 Rome • Italy
Phone	Office: +39 (0) 683 463 -152
Web	nfs.questions@occar.int www.occar.int