S-80 PLUS PROGRAM

CURRENT STATUS REVIEW

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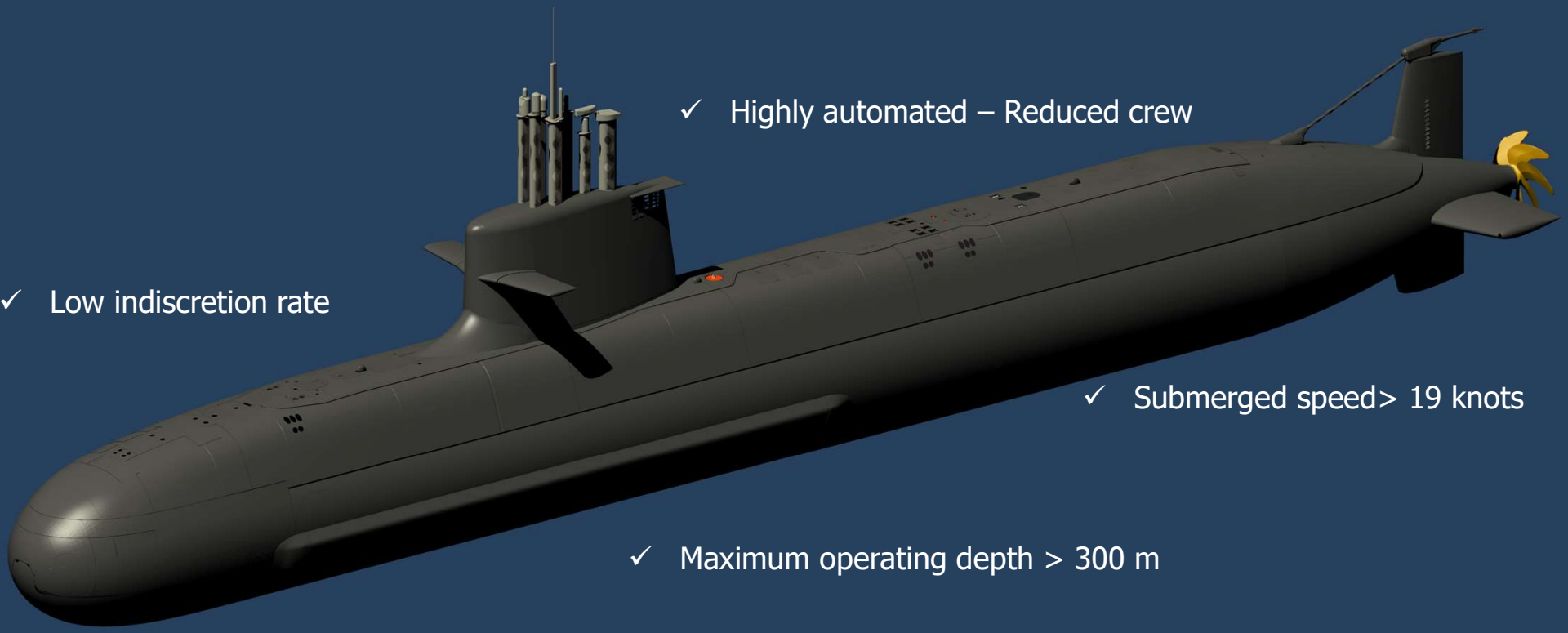
S-80 PLUS FEATURES

- ✓ Long range conventional submarine enhanced with anaerobic propulsion
- ✓ Highly automated – Reduced crew
- ✓ Low indiscretion rate
- ✓ Submerged speed> 19 knots
- ✓ Maximum operating depth > 300 m



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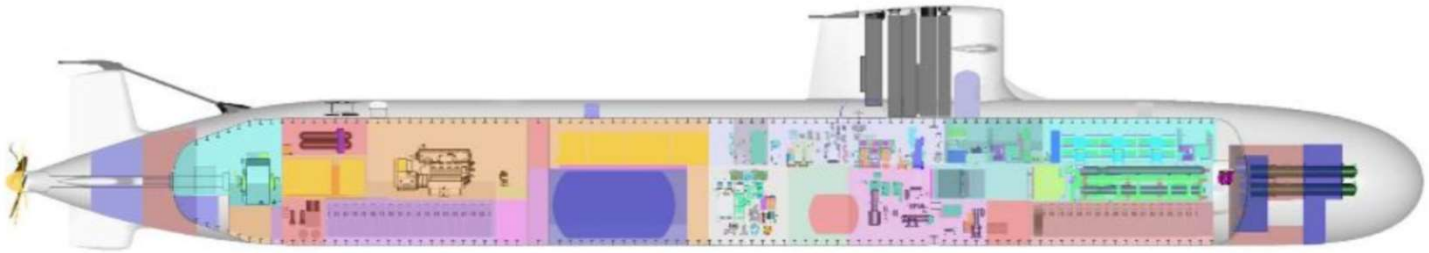
S-80 PLUS FEATURES

GENERAL CHARACTERISTICS

✓	Overall Length	80.81 m
✓	Overall Beam	11.68 m
✓	Overall Draft	13.69 m
✓	Diameter	7.30 m
✓	Surface Disp.	2,695 t
✓	Submerged Disp.	2,965 t
✓	Draught	6.21 m
✓	Endurance	50 days
✓	Accommodation	32 crew + 8 special forces



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S-80 PLUS FEATURES – COMBAT SYSTEM

COMBAT SYSTEM MAIN PERFORMANCES

- ✓ Anti-surface (tactical and shore missile) Warfare
- ✓ Anti-submarine warfare
- ✓ Selective Missile Land Attack
- ✓ Designed to Full Combat Group Integration for first strike action
- ✓ Special Operations and discreet evacuation of Civil Personnel
- ✓ Intelligence Gathering, Reconnaissance and Surveillance
- ✓ Sequential Mine-laying

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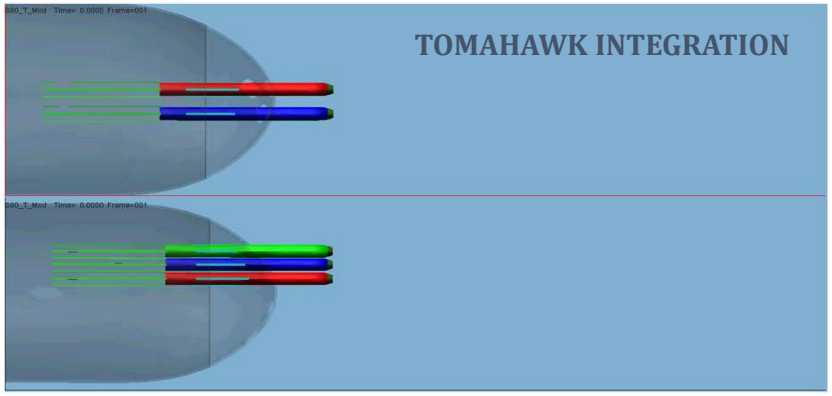
S-80 PLUS FEATURES – WEAPON SYSTEM

Weapon Handling and Discharge Equipment

- ✓ 12 off stowages with hydraulic motors
- ✓ 6 off positive discharge TLTs



- Weapons:
  - DM2A4
  - Sub-Harpoon
  - Fitted for Tomahawk
  - Spanish Navy Mine
- Other weapons:
  - Mk48
  - Blackshark
  - Spearfish
  - TP2000
  - Exocet Missile
- Torpedo countermeasures system

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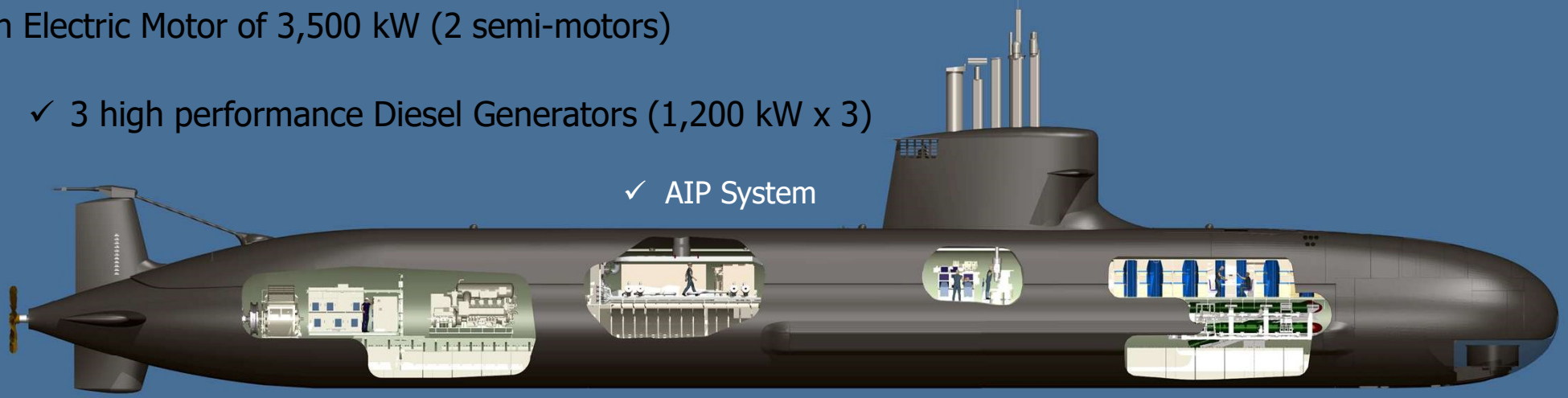
S-80 PLUS FEATURES – PROPULSION PLANT

- ✓ Main Electric Motor of 3,500 kW (2 semi-motors)
- ✓ 3 high performance Diesel Generators (1,200 kW x 3)
- ✓ AIP System



- ✓ 2 Battery rooms with 180 elements each

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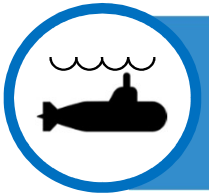
S-80 PLUS FEATURES - AIP SYSTEM

Fully automated power plant based on low pressure fuel reforming (ethanol) and PEM fuel cell technologies.

- **Long submerged endurance** (up to 3 weeks)
- **Liquid fuel** to maximize endurance

- Design for no major component substitution **between overhauls** (6 years/>5000 h)
- LRU embarkable through **logistic hatch**



- **Full depth range** (periscope to MOD)
- **Tropica**l to **sub-artic** environments

- **High availability** all around the world
- Consider **new threats** and environmental sustainability

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S-80 PLUS FEATURES - SAFETY

SAFETY ASSURANCE

- ✓ To demonstrate that frequency and severity of credible hazards have been reduced to an acceptable level or to ALARP region
- ✓ **NSubCode** approach based on "Goals", "Functional Objectives", "Performance Standards" and "Design Verification" have been followed to achieved a highest level in Safety Assurance

MIL-STD-882 E SYSTEM SAFETY

Phase 1 –Preliminary Hazard List and Analysis

- Preliminary Hazard List (PHL)
- Preliminary Hazard Analysis (PHA)

Phase 2 – Detailed Hazard Analysis

- System and Sub-system Hazard Analysis (SHA, SSHA)
- Software Safety Integrity Analysis (Software SIA)
- Operating and Support Hazard Analysis (OSHA)

Phase 3 – Supporting Safety Studies and Risk Quantification

- Fly-by-wire Analysis
- Safety Case Report

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S-80 PLUS FEATURES - SAFETY

CTSUB THIRD PARTY CERTIFICATION

- ✓ CTSUB program is a result of US Navy SUBSAFE and Spanish Armada cooperation
- ✓ CTSUB certification ensures the submarine is watertight and resistant to maximum operating depth and in case of water ingress, it is capable to safely get to the surface.

- ✓ CTSUB certification ranges from materiel verification, design assessment of watertight integrity systems, design assessment of flooding recovery systems, construction & testing verification processes, in-service certification and re-entry control during maintenance.

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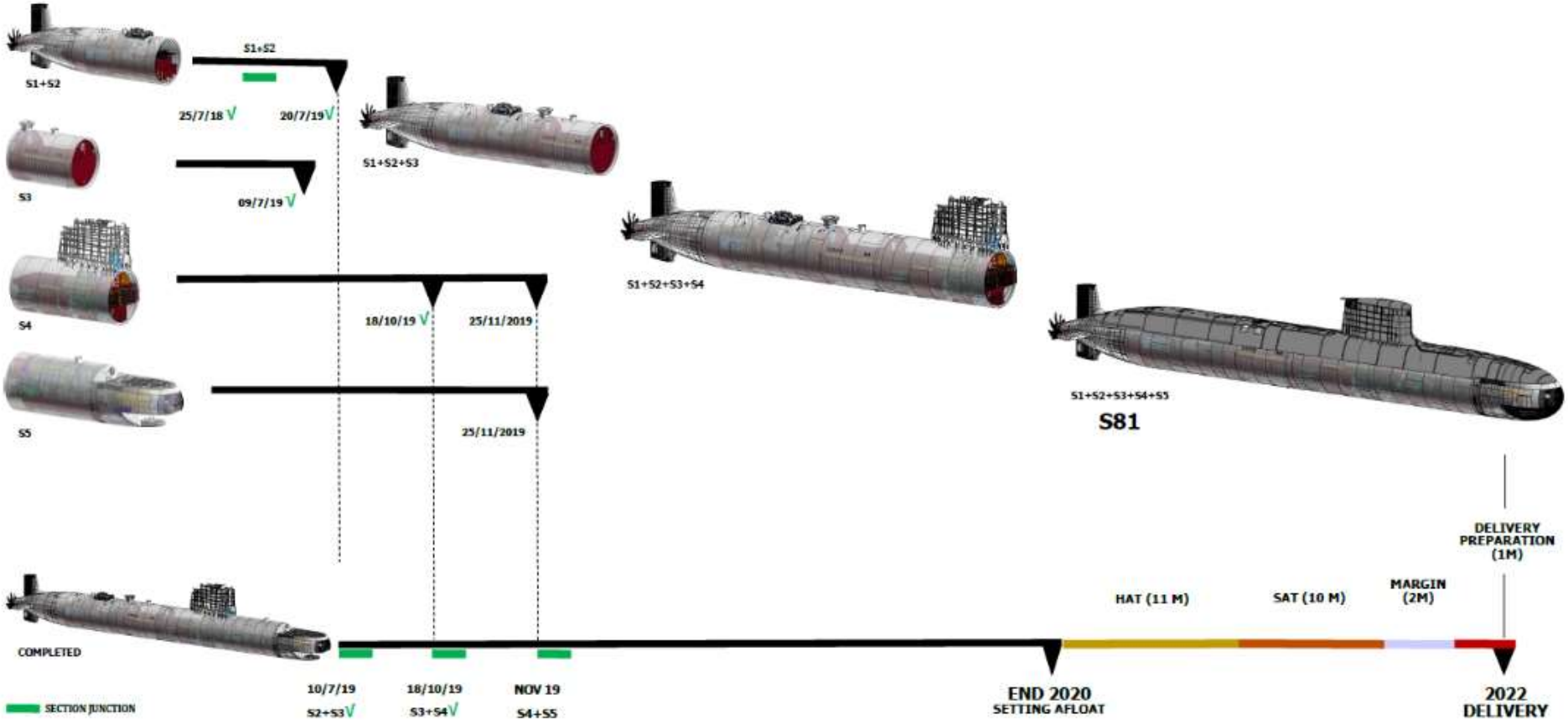
S-80 PLUS CONSTRUCTION MILESTONES



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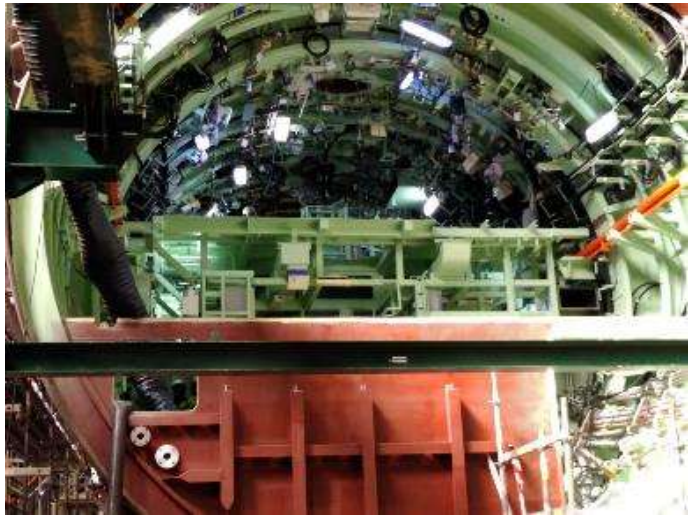
S-80 PLUS CONSTRUCTION MILESTONES

Milestones Section 4

- ✓ Center Auxiliaries Platform (Jul, 2019)
- ✓ Forward Auxiliaries Platform (Aug, 2019)
- ✓ Command and Control Platform (Sep, 2019)



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S-80 PLUS CONSTRUCTION MILESTONES

Milestones Section 5

- ✓ Accommodation modules (Jul, 2019)
- ✓ Fore Electrical Module (Nov, 2019)
- ✓ WHSE Platform (Nov, 2019)

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S-80 PLUS CONSTRUCTION MILESTONES

Joined Submarine, Dec 2019

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S-80 PLUS CONSTRUCTION MILESTONES

2020

2021

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S-80 PLUS PROGRAM STATUS – AIP SYSTEM

AIP SYSTEM DEVELOPMENT STATUS

- ✓ **S-80 Program has successfully completed the AIP development.**
- ✓ After a rigorous decision making process, the MoD selected **Abengoa as the optimum alternative to supply the ethanol reformer for the S-80 Class Submarines.**
- ✓ Abengoa had met the S-80 Programme schedule and milestones, **supplying full size equipment verified on endurance test.**

Robust support to AIP engineering and technology development in partnership with Collins Aerospace

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S-80 PLUS PROGRAM STATUS – AIP SYSTEM

AIP SYSTEM DEVELOPMENT STATUS

The ethanol reformer navalized unit is:

- ✓ Designed to **military specifications**
- ✓ Developed to **meet platform requirements** (functional and physical integration)
- ✓ Ready to continue accumulating **'flight hours' until late 2021**, when it will be embarked in the AIP section of the S-83 submarine (where the first AIP will be installed)

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CONCLUSIONS

- ✓ **S-80 Plus is ready** for the export market
- ✓ S-80 Plus Submarine is the **only 3,000 tonnes AIP submarine under construction worldwide**
- ✓ The modular design provides **flexibility to accommodate new requirements** from international navies
- ✓ **On going trade-offs** include: different weapons and discharge system, Lithium-ion batteries, enhanced SOF and UxV deployment and others
- ✓ **R&D already funded for integration of Lithium-ion batteries**
- ✓ **International supply chain**, not tied to specific national industry constraints

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Thank you for your attention

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