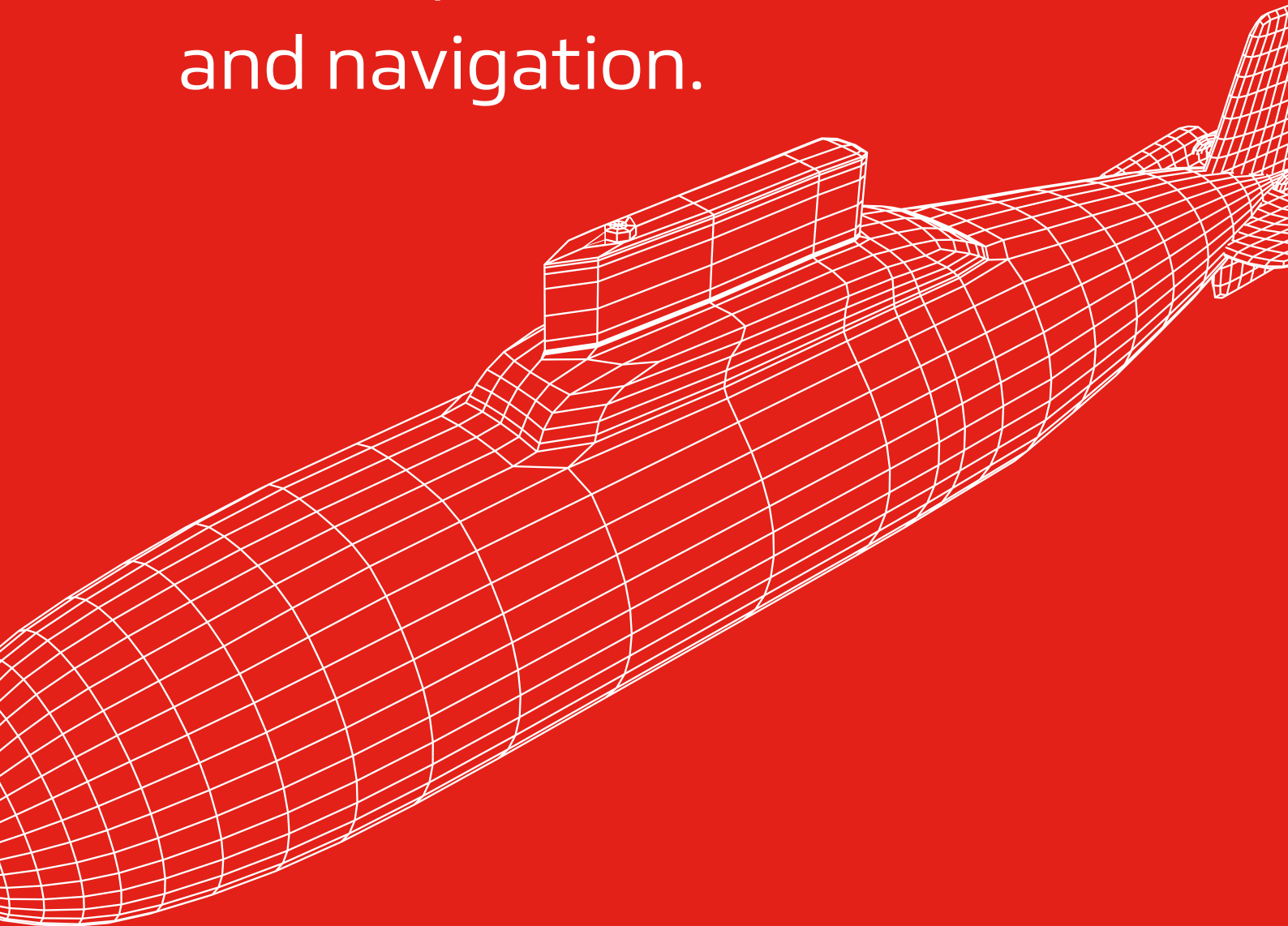# Submarine Systems

Control, automation and navigation.

Making the difference

Anschütz provides submarine customers with tailored solutions for reliable, safe and efficient navigation, 3D steering control, data management and automation.

Our strength is our portfolio of state-of-the-art submarine systems and the ability to translate customer needs into smart solutions. We create systems that offer superior reliability and efficiency at an optimal price-performance-ratio.

Our systems are based on an open architecture approach to reach highest levels of interoperability, performance and maintainability. At the same time, our systems are characterized by military off-the-shelf (MOTS) and commercial off-the-shelf (COTS) hardware, standard network infrastructure and modular software. Thus, we realize significant cost savings in hardware, installation, and operation. Our systems fulfill highest standards in safety and security. Flexible system architectures together with our engineering and management skills enable us to adapt our systems to specific needs supporting our customers to achieve their goals.

Our solutions are based on our unique long-term expertise in naval system integration, our insights in submarine operations and modern, smart technologies. That makes us a trustworthy and long-term partner for more than 50 navies operating submarines. Based on such a strong foundation, our goal is to take submarine navigation and control to the next level, offering a multitude of benefits to our customers.

The world´s leading
Navigation Company.

We offer both highly customizable and off-the-shelf submarine solutions for new build and retrofit projects, as well as wide ranging aftersales services.

Empowering submarines worldwide

With many years of experience, own user-level operational expertise and technical know-how, we have become the world-leading provider of naval navigation systems. Customers benefit from our first-hand knowledge in submarine navigation and control systems, system integration and system safety.

We own a modular product range for navigation, 3D steering control, automation, tactical operation, data management and more. All our products are fully designed and manufactured in Germany with a clear focus on reliability, scalability and user experience. We continuously drive product improvement and innovation across our product portfolio, in order to meet and exceed our customer's operational requirements.

Customized submarine solutions

Our products provide a high-performance basis for highly integrated, customized system solutions, embedded within modern network infrastructure and scaled to the individual customer requirements. Our special strength is the adaptation of our solutions to make them the perfect fit to individual customer needs.

We design, manufacture and integrate systems in close cooperation with the future operators of the systems. Analyzing their needs and understanding the available technologies enables us to develop superior, efficient and cost-optimized solutions.

Our program managers support customers in developing their requirements, which then result in the optimal solution in compliance with military standards and regulations.

Trust the technology leader

We are proud that we have been able to establish trusting business relationships with more than 50 navies worldwide. Customers appreciate the functional scope and reliability of our systems as well as our performance, flexibility and customer orientation. Our submarine references include:

- German Navy 212 Class
- Norwegian/ German Navy 212CD Class
- Portuguese Navy 209PN Class
- Hellenic Navy 209 and 214 Class
- Turkish Navy 209 and 214 Class
- Republic of Korea Navy 209 and 214 Class
- Israel Navy Dolphin Class
- Indian Navy Shishumar Class
- Indonesian Navy 209 and DSME 1400 Class
- South African Navy 209 Class
- Pakistan Navy Agosta Class

In the domain of naval surface combatants, we have delivered integrated navigation and bridge systems for major programs in Germany (e.g. F125 or K130) and UK (e.g. Type 45, Type 26, Type 31e), but also small and very cost-effective navigation and tactical bridge systems to small combatants.
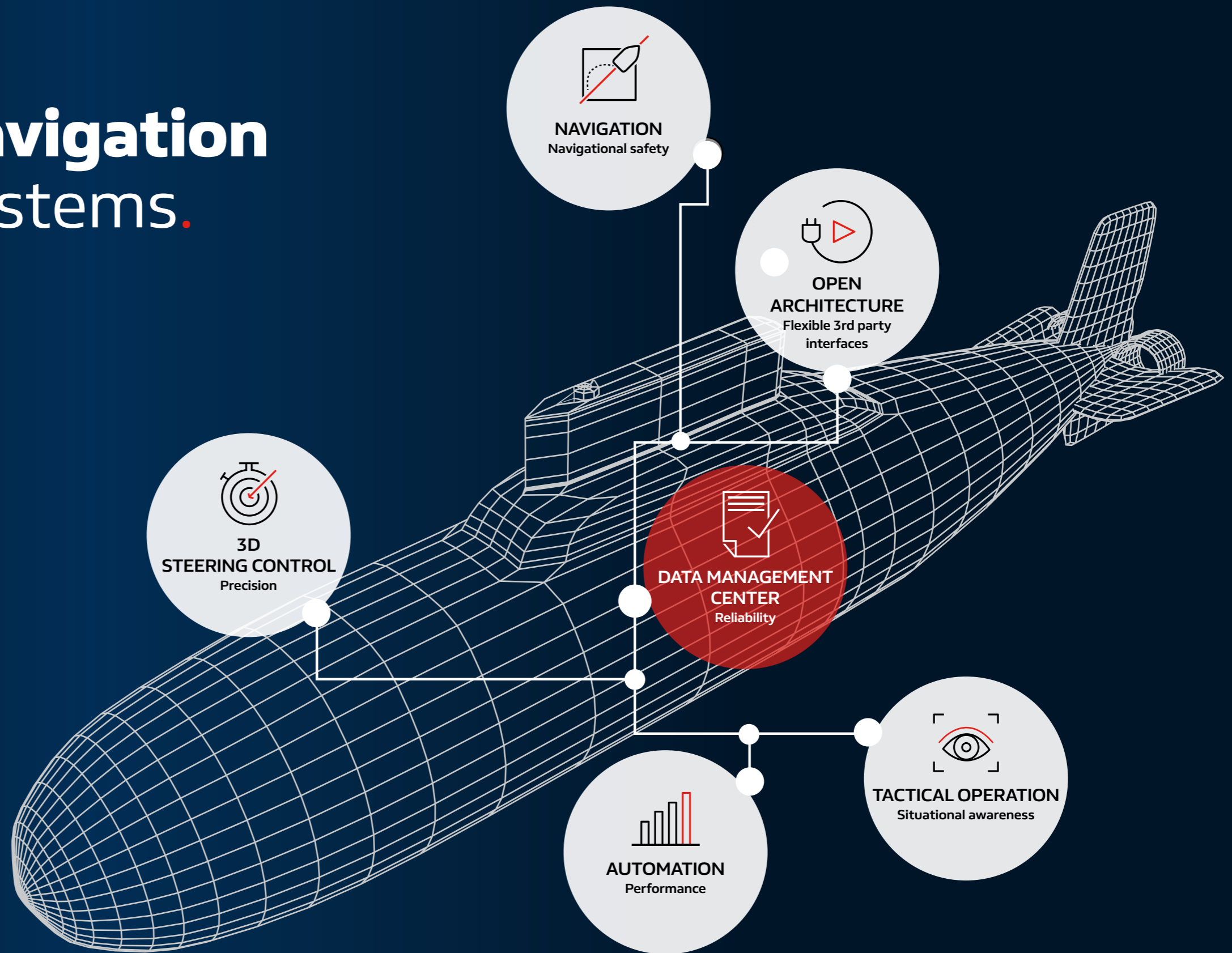
Integrated navigation
and control systems.

We develop submarine solutions that efficiently match the conditions on board and the requirements of the Navy and its missions. Leveraging our skills in development and system integration, the merits of our modern open system architecture, and our expertise across a broad range of technologies, we push forward the creation of new functionalities, as required by customers, and the customization of our existing submarine systems. By fostering the integration between the combat and navigation domains we also add new features that enhance the submarine capabilities in terms of navigation, 3D steering control, tactical operation, automation, and data management.

In doing so, we rely on standardized MOTS and COTS hardware, a system-wide common infrastructure software and modular software applications as the interface to the end user. This approach allows for the flexibility needed to realize the efficient, low-risk adaptation of systems to the requirements of an individual customer.

- **Navigation**
  ECDIS/WECDIS, Tactical navigation,
  Multifunctional consoles, Nav command tables, Sensors

- **3D Steering control**
  Submarine steering console, 3D autopilot,
  Rudder position transmitter

- **Tactical operation**
  Command & control systems,
  Mission management systems

- **Automation**
  Wireless battery monitoring system, Hoistable masts
  electronics, Weapon transport & stowage system,
  Tube control system

- **Data management**
  Navigation data management center, Data distribution unit,
  HyNav

NAVIGATION
Navigational safety

OPEN ARCHITECTURE
Flexible 3rd party interfaces

3D STEERING CONTROL
Precision

DATA MANAGEMENT CENTER
Reliability

TACTICAL OPERATION
Situational awareness

AUTOMATION
Performance

Customized submarine solutions
created from a standardized, open architecture technology base

More reliability and performance, less cost.

We offer a range of solutions from a single system up to seamless integration of critical capabilities like navigation, 3D steering control, tactical operation, automation, and data management into a single, harmonized and secured system. Which end of the range is chosen may depend on customers' design philosophies, actual requirements and if it is a new build or refit project.

Added functional value

- Maximum situation awareness as any function can be attended and controlled from any display (applies for integrated systems)

- Safe navigation through using and presenting validated, task-oriented data on clearly structured displays

- Precise 3D steering control and autopilot integrated with navigation supported by new algorithms

- Intuitive user interfaces and a consistent operational concept ease familiarization and reduce error

- Entire solution is fully adaptive to changing operation / mission requirements

Standardized hardware, modular software

Our systems are built upon powerful standardized hardware, thoroughly tested and proven in use to ensure high stability, durability and availability. In combination with the modularization of software, this approach enables submarine operation to be mission-adaptive and no longer restricted by the hardware configuration onboard. The hardware is also capable of running a single function, e.g. steering, or multiple functions in parallel.
Our hardware is designed for low space and power requirements, and the common use across our portfolio reduces logistics in terms of spare parts, documentation, maintenance and repair.

Less cost for system design and integration

The system architecture with standardized interfacing leads to significant reduction of effort and cost in system design, documentation and other non-recurring costs. Moreover, the scalable hardware can host several functional controllers, e.g. rudder control, hoistable masts, tube control, and applications as required by the respective program. This further realizes massive savings of procurement cost, integration efforts, space consumption, weight, cabling, and logistics efforts, without any functional constraints.

Integration of customer-specific equipment

We support customer-specific functionality and equipment. Our platform is sensor agnostic and interfaces with 3rd party systems, e.g. inertial navigation sensors proven in various programs for worldwide navies. The solutions include subcontract management, offer additional opportunities of local supplier incorporation,
and help the customer to overcome the challenges of fleet wide commonality, logistics and training.

System safety and security

We have vast experience in delivering standard and customized security solutions to the customer. Our solutions are based on the analysis of customer requirements with regard to security, confidentiality, integrity and availability of our systems. In terms of "functional safety", we have implemented a comprehensive safety management system. The methodology of our safety analysis is based on the IEC 61508 and MIL STD 882, but we are able to follow specific customer requirements.

Our portfolio
of submarine systems.

Our portfolio of submarine products provides full flexibility to adapt to customer requirements.
It is the base on which to form customer-specific systems and the starting point for an evolutionary development of functionality.
We can deliver further military-proven sensors and submarine products like pressure-resistant repeaters and rudder position transmitters.

Navigation consoles with WECDIS

Our warship electronic chart display and information systems (WECDIS) provides a multitude of naval features for operation in special missions, including navigational and tactical overlays, and waterspace management. The WECDIS can be hosted on a horizontal display (Nav command table, qualified according to IEC-60945 / Mil-Std shock) or on a multifunctional console, providing additional features for tactical operation and surveillance.

Navigation data management

Data management solutions provide a submarine private cloud to all connected network processors, from navigation and automation systems to combat management systems, including red/ black separation. The main advantage is the secure availability of high-quality navigation data.

- Multi-redundant hot-standby function for an intelligent management of redundancies
- Integrated navigation filter to enhance accuracy and reliability of navigation data
- Common and consistent data thanks to Kalman filter algorithms
- Spatial and time correction, automatic plausibility and integrity checks
- Extended dead reckoning capability
- Tactical data handling

Nav command table

Navigation data management

Submarine steering control

S^{2}VTD-Mod probe

Battery monitoring system

Hoistable masts electronic unit

Submarine steering console with 3D autopilot

We design submarine steering consoles that define the standard in high-precise, reliable depth and course control. User-friendly displays and operating concepts with a well-structured presentation of data, and a scope of features support the helmsman in controlling the submarine safely and simply. Our 3D autopilot uses latest control techniques to learn the submarine's behavior
from simple trial maneuvers. The consoles can be delivered as a lean, multifunctional console for one-man operation, or two-man operation.

Bathymetric measurement system

The S^{2}VTD-Mod probe is an advanced device for high precision measurement and evaluation of sea water salinity, sound velocity, temperature, density and pressure. It features both a time of flight and a CTD sensor system and is thus providing highly reliable and consistent data for tactical and submarine's safety related decisions.

Battery monitoring system

The battery monitoring system continuously indicates the most important data on the condition of the batteries and consequently supplies decision aids for operational and tactical intents. Featuring wireless technology, the system measures voltage and temperature of every battery cell as well as the current and calculates all relevant data of the complete battery bank of the submarine. The wireless layout of the sensors reduces integration and exchange efforts as well as potential failures, e.g. due to signal cable breaks.

Automation systems

Using our technological expertise and decades of experience in designing submarine systems, we have extended our portfolio into the automation of hydraulic and mechanical systems. The hoistable masts electronic unit (HMEU) controls hoisting, retracting and positioning of masts consisting of one or more telescopic elements. The weapon transport & stowage system controls the processes for stowing and handling torpedoes on board. The tube control system controls all functions of the weapon tubes. Other systems in this area can easily be realized based on the same automation technology on customer request.

Experienced **in customizing** submarine systems.

We have years of expertise and experience in understanding our customers' requirements and translating them into appropriate technological solutions.

The environment and requirements for submarines highly differs from other military projects.

Our team of program managers, engineers and service personnel is 100% focused on this environment and have gained experience over decades. This gives us the ability to consult with our customers about their requirements and jointly develop a customer-specific, efficient and cost-optimized solution.

But acting as system integrator is more than satisfying technological requirements. The steadily growing importance of nonfunctional requirements such as IT-security, system safety, program management, logistic support, subcontract management, and much more are considered in our development with equal dedication.

Well managed programs to ensure execution to expectation

Program management – process and cornerstone to ensure customer value - translates customer requirements into the organization, acting as trusted partner to the customer, ensuring execution to expectation. Program management works closely with the engineering team, with the supply chain, and with quality management to deliver high-quality systems as promised.

Subcontract management

Our robust subcontract management department handles customer-specific requirements and complex, high-value work packages. Skilled subcontract managers are supported through modern tools to ensure quality, regular audits, risk mitigations, and cost down initiatives. Where applicable we focus on involvement of local industry and technology transfer to create innovative solutions, providing local service support and maintenance, or adding capabilities to existing products.

Local industry participation

We have gained long experience in the handling of local industry participation. The whole process – from understanding the requirements through identifying appropriate areas in its scope of supply and services to surveying and qualifying local partners, preferably SMEs – has been implemented in a structured procedure. We aim for a long-term relationship, and to maximize customer value through worldwide strategic alliances.

PLANNING

DESIGNING

PRODUCING

SETTING TO WORK

HARBOUR/ SEA TRIALS

TRAINING

AFTER SALES

Programs & projects

We are with you, from start to finish.
We plan your project with you and ensure that you receive what you have ordered from us – a quality product, on time and in full compliance with standards such as ISO 9001 and 14001.

Logistics engineering

We enable high availability of your systems at present and in the future.
We analyse our products to define and implement the optimal logistic support measures.

Quality assurance

We make sure that we deliver quality as a part of normal business.
We are committed to ensuring accuracy in our products and diligence in our processes in order to assure you safety.

Engineering

We design solutions that fit your needs best.
Hand in hand with Programs & Projects, our experienced team design and engineer innovative customer-specific solutions to meet and exceed your expectations.

Purchasing

We ensure value for money and relieable supplies throughout the life cycle of your vessel.
We put ourselves in your position to work out the best and most efficient solution, incl. local industry participation.

System testing & approval

We power up your system to meet acceptance criteria during harbour and sea trials.
We integrate, configure and test your system in order to ensure functionality, quality, and performance as promised.

After sales support

We offer support through the lifeline of your vessel.
Whenever, wherever and in whatever you may need support, we will assist you with our knowledge as both the manufacturer and the designer of your integrated system.

Partner for lifetime service and refits**.**

We support customers as a long-term partner.
We have an international reputation as one of the world's largest and most reliable service providers.

We have decades of experience in offering commercial and naval customers excellent tech-nical support, maintenance and repair works.

Specially trained technicians are skilled in dealing with military and security-sensitive projects. A particular focus is customer support during installation, setting into operation and testing. We also offer land-based and ship-based training for crews and maintainers, as well as simulator equipment.

Integrated logistics support (ILS) and In-service support (ISS)

Naval ships typically require excellent system performance ensuring high availability and should be adaptable to emergent operational requirements. Logistic support needs to be organized with the aim to keep function and stability at the level of modern, rapidly developing technologies. In addition, logistic support means keeping the ships free of any obsolescence and ensuring the supply of the systems with all necessary spare parts.

We offer ILS and ISS packages that take all of the customer specific requirements into account at predictable cost (fixed budget, performance-related payments).

ILS and ISS packages offer all relevant logistic support and after sales service measures as a prerequisite for maximum system availability, mission readiness, and economical and effective operation:

- Technical support, advice and training
- Continuous services for the provision of material datasets and fundamentals for hardware and software
- Services for existing demands like obsolescence elimination or product change
- Retrievals for technical solutions, functional and technical enhancements, concepts and studies
- Refreshing through technical updating, including documentation updates

Expertise and experience in refit solutions

During the lifetime of a submarine, at least one midlife modernization is executed in order to keep up with changing operational requirements and technological developments. We have the special ability to integrate new functions into the existing system environment on board and to replace old systems, including third-party systems. This may happen during a major refit program performed by a shipyard or as an exchange of just a single system, e.g. if this has become obsolete.

For the latter our team guides you through the process of defining new requirements, planning and performing the deinstallation of the old and installation of the new system as well as executing all processes to commission our new system.

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