Surface Ship Navigation Systems
Cutting-Edge Solutions for Integrated Navigation and Retrofit

- Advanced integrated navigation
- COTS/MOTS technology
- Customized solutions for overhaul and retrofit
- Worldwide technical service and logistic support
Excellence in Navigation tailored to the grey fleet

Through the past decades Raytheon Anschütz has proven to be a predictable partner for navies and shipbuilders worldwide. More than 1,500 commercial shipping companies and more than 50 navies all over the world rely on navigation systems made by Raytheon Anschütz every day.

For naval surface vessels, Raytheon Anschütz offers dedicated knowledge and expertise in system integration for almost any ship type, ranging from small patrol boats and OPVs through frigates, destroyers and corvettes, up to aircraft carriers. The experiences from the large number of commercial installations, ranging from operations round the clock to unique user interfaces for error-tolerant operation, are the basis for advanced, navy-specifically developed solutions suited for both, newbuild and retrofit purposes.

The core business centres on sophisticated and tailor-made products and systems for the ship’s navigation and control up to fully integrated navigation solutions, including the ship’s conning, command and control and platform management. The range of commercial products is extended by special military equipment such as a marine inertial navigation platform, based on a ring-laser gyro, or the advanced navigation data management center, which is the core of our integrated naval solutions.

Each program is accompanied closely by a team of specialists, if needed including on-board surveys to identify project-specific requirements. Thanks to a long lasting experience and own user level operational expertise we have the intimate know-how in navigation system integration with regard to system construction, requirement engineering and standards applied.

All solutions can be extended with customized Integrated Logistics (ILS) and in-service support (ISS) contracts to contribute to highest availability of equipment and ship.
Today’s navigation does not rely on stand-alone systems anymore, but rather requires a fully redundant system featuring a combination of various degradable navigation sensors with the goal of cost effectiveness and highest degree of availability and integrity.

Integrated navigation on a naval vessel encompasses a mixture of commercial off-the-shelf and military standard equipment, depending on the mandated shock levels at the individual position.

Multifunctional workstations with a consistent HMI are the base for a compact but efficient system design that increase awareness and safety while allowing navies even to operate with smaller crew sizes. The focus on functional integration enables highly customized solutions with enhanced functionality as well as a scalable system design to meet all redundancy requirements and to increase reliability and operational safety.

Being the latest generation of the Raytheon Anschütz integrated bridge and navigation system, Synapsis Intelligent Bridge Control offers scalable bridge workstations with intelligent redundancy management, advanced functionality and ease of operation as well as reliability and ship safety.

If required, we can provide a fully functional integration of a navigation and a command and control (C2) system.

Based on an integral system concept, our solutions reach higher levels of integration and interoperability while at the same time being able to reduce engineering and logistic costs through use of industry standards and proven COTS/MOTS technologies. Simple and cost-efficient system upgrading is possible to cope with changing threats and rapidly evolving tasks. Interfaces with the ship’s backbone allow inclusion of other ship systems or special military applications.

When deciding for an integrated bridge and navigation system from Raytheon Anschütz, a customer decides for one responsible supplier for integration, maintenance and spares supply. Together with our worldwide service network and our integrated spare part supply chain we can offer a wide variety of worldwide after sales services to support all systems through their whole life cycle.
INNOVATIVE TECHNOLOGY

Multifunctional workstations
New Synapsis Multifunctional Workstations are set up to provide all information for reliable, safe and efficient operation. The workstations are tailored to integrate the functions of IMO radar, (W)ECDIS, conning and optional C2 system in any desired combination to allow full control and full data access at a dedicated workplace. Possible configurations are ranging from a stand-alone radar or ECDIS workplace to a full integrated multifunctional workstation. In an integrated solution, all workstations provide central and local switch over of color and dimming. As an option, further ship systems (such as the platform management) can be integrated into and operated through the new Synapsis Multifunctional Workstations.

- Full navigational data access at any workstation simplifies watch keeping
- ChartServer – functionality included chart material will be automatically exchanged between workstations and are all fitted with same up-dates
- Target designation are identical on all workstations – easy operation
- Standardized HMI with a common operating philosophy for easy operation
- Redundancy of equipment leads to additional safety
- Efficiency in spare parts logistics through standardized component
- Seamless integration of Anschütz steering control and track keeping system

All Synapsis Workstations use standardized hardware components to prevent from rapid obsolescence, to simplify logistics of spares for the customer and to decrease service costs.

System architecture
Necessary sensor information is provided by a suite of high performance and reliable sensors (e.g. Anschütz gyro compass, Marine Inertial Navigation System, echo sounder, speed log, P(Y) GPS and weather sensors). The sensor information is distributed consistently to all connected workstation within a real time capable navigation data bus, which provides full redundancy in distribution, and is stored independently at each workstation to maintain highest flexibility in bridge system layout. Status and performance of all workstation are automatically monitored by the new health monitoring to further enhance the availability of data and functions on the bridge.

All Synapsis Workstations feature the Synapsis Integration Platform as a standard software framework, which improves the operation of the ship through intelligent and modular integration of all data from sensors and selected ship systems. The Synapsis Integration Platform controls configuration, data and function of the bridge navigation system. In addition, it provides interfaces to the ship’s backbone, making not only possible the integration of additional applications or specific navy features, but also full scalability, future expandability, and quick repair and maintenance.
Advanced navigation data management center
Data management and distribution by Raytheon Anschütz is a customized approach tailored to specific applications and customer needs. The data distribution management collects, monitors and processes all the data from various connected to the navigation network. The data handling ranges from different navigational and other sensor data to decision aids for operational and tactical purposes. Typical interfaces to sensors and systems include navigation sensors, display and control units, external communication, automation and platform management as well as combat management system.

The data distribution to end users features the Consistent Common Reference System (CCRS) with an integrated degradation management, which continuously monitors the availability and quality of sensor information. The most reliable set of data is distributed automatically to all connected workstations to ensure consistent and common information. Thereby the multi-redundant hot-standby function provides an intelligent management of redundancies to ensure highest availability of sensor data.

HyNav navigation filter
The optionally integrated HyNav navigation filter provides navigation data with enhanced accuracy and reliability. HyNav’s combined Kalman filter algorithms feature spatial and time correction as well as automatic plausibility and integrity checks to ensure despatch of common and consistent navigation information. With its optional extended dead-reckoning capability the HyNav navigation filter provides navigation information even with loss of position and speed sensors.

SCOPE OF SUPPLY

Navigation workstations
• Multifunctional workstations
• Data distribution management
• Integrated alert management
• IMO radar and ECDIS
• Additional WECDIS functionality and WAIS
• Command and control (C2) system

Sensors
• Anschütz Standard 22 M gyro compass
• MINS ring laser gyro (Inertial navigation system)
• DGPS / Loran as well as P(Y)-code GPS
• Further navigation sensors
• Electro-optics for integration into C2 system

Controls
• Steering control systems
• Adaptive autopilots
• Track control systems

GMDSS stations A1 to A4
• MF / HF radiotelephone
• VHF radiotelephone
• Inmarsat C
• SSAS
• LRIT
• EPIRB
• SART
• VHF GMDSS handheld

External communication
• Inmarsat fleet broadband
**PROVEN NAVIGATION SOLUTIONS**

**Radar with SeaScout and video merging**
Raytheon Anschütz provides navigational radar with almost unequalled performance even under rough weather conditions. Exceptional performance is complemented by intuitive operation and ease of installation. The intuitive functionality provides effective decision support towards collision avoidance. A large PPI and a clear structured display of control functions and status indications ensure the user to concentrate on navigational tasks. Chart radar functionality and a video merging mode are also available.

**ECDIS with integrated WECDIS capabilities**
Our ECDIS provides all information and functions, which are required to plan and monitor routes, and contributes greatly to safety at sea. Its clear display design, together with intelligent functions such as the weather chart overlay and automatic route planning, make operation comfortable and easy. For operation on naval surface vessels, the ECDIS provides special navy features for WECDIS functionality such as additional military layers (AML) and WAIS.

**Command and control (C2)**
The C2 system provides the operator with an intuitive dashboard for all information required to support C2 operations like sensor correlation and fusion, track and target classification in different categories (e.g. military standards), and qualified tactical decision making. Additionally the control of all connected sensors such as electro-optics and radar is functionally implemented, allowing access to and control of all tactical parameters, engage to target (e.g. EO- and or effector follows the target), ship security or self-defense mission planning, and chart operations from only one single application and workplace.

**Conning**
The conning provides all relevant navigation data at a glance, customizable for each ship. Various functions can be activated and configured by the operator as needed, depending on the mission situation and the type of equipment. Important functions of integrated navigation, such as status/performance monitoring, automatic/manual sensor selection or central alert monitoring, are operated on the conning display.
Advanced steering control system
The latest generation of NautoSteer is a highly advanced steering control system, which can be configured to any steering control system with the relevant redundancy requirements. It is based on CAN bus technology and was developed in accordance with fail-to-safe principles to further improve operational safety. The new NautoPilot 5000 seamlessly integrates into the steering system and features a large graphical touch screen display and a multitude of benefits.

Proven sensor technology
The Standard 22 M gyro compass is a state-of-the-art system, specifically designed for the use on-board of naval vessels. It is based on most modern technologies to provide reliable, safe operation and intelligent system features. Horizon MF is a new compass system which allows maintenance-free operation. Navigation radars from Raytheon Anschütz use extremely sensitive trackers that offer high detection capabilities even under rough weather conditions. Further sensors can be added to the system as required for ship and mission.

Inertial navigation system
For all kinds of naval vessels the Marine Inertial Navigation System (MINS) is available for highly accurate inertial navigation at low lifecycle costs. It provides heading, roll and pitch angles/angular rates, linear velocity and acceleration, position, heave rate and status. MINS is based on proven, state-of-the-art strap down ring laser gyro technology.
Today, the typical life span of a surface ship can be up to 30 years or more. As the vessels age their operational capabilities deteriorate and they may no longer be able to cope with changing threats. In addition, features such as steering control and navigation are less accurate than modern systems.

A retrofit program always bears challenges with regard to individual requirements of ship type, mission, hull construction, ship system layout and interfacing. The size of the hull and the space available for installations as well as ship entry space restrictions are given. In addition, retrofitting an aging unit requires special skills as well as adaptable equipment in order to be able to marry technologies of different generations and to integrate new functional capabilities into existing bridge consoles.

With an experience of more than 100 years in developing and manufacturing leading navigation technology, Raytheon Anschütz is a reliable partner in the implementation of customized retrofit solutions for navigation systems aboard any type of naval surface vessel.

The wide range of Raytheon Anschütz navigation systems – from gyro compass and inertial navigation system through steering control, radar and ECDIS up to integrated bridge and navigation systems or data distribution management – already meet the stringent requirements of retrofit applications and suite a vast variety of refit requirements. If needed, our requirement engineering is available to analyse customer-specific demands, give advice and transfer the final set of requirements into a suitable technical solution.

Our retrofit solutions help to maintain reliability in operation and excellence in mission performance based on our strength in integration of high-performance sensors, heading, positioning and further navigation data as well as fully redundant steering control systems.

**OVERHAUL AND RETROFIT CAPABILITIES**

- Cost savings in operation, maintenance and spares
- Experienced management of refit programs by highly-skilled engineers
- Specialized knowledge makes possible the interfacing of different navigation technology generations
- Modular system structure to enable cost-efficient solutions that best meet individual requirements of the specific navies and their missions
- Standard hardware and software which are designed to be future proof which avoids rapid obsolescence and ensures ease of upgrade
- Proven COTS equipment with special military enhancements as required
- Technical documentation for interfacing and new to vessel equipment and system, if needed by using new documentation methods by means of electronic media
- Customized logistic concepts and worldwide service support directly from manufacturer

**BENEFITS AT A GLANCE**
Raytheon Anschütz supports its customers through the whole lifecycle of vessel and equipment – this starts with dedicated customer consultancy and program management until setting in operations, continues with customized logistics and worldwide service solutions, and ends up with tailored upgrade and retrofit suggestions.
We offer extensive know-how and personal support for naval system integration programs. Experienced engineers guide you from program outline and specification of systems through program realization to setting in operation. The customer benefits from the synergies of having all the important processes of project engineering, development and production centralized at the Raytheon Anschütz headquarter in Kiel, Germany. A close cooperation with the world’s leading shipyards mean high flexibility in order processing, engineering, testing and setting-in-operation.

Of course, integration of customer-specific requirements always remains possible. Therefore our requirement engineering analyses and understands customer needs, advises customers and transfers the final set of requirements into a suitable technical solution.

Proven standards
All solutions developed, produced and engineered by Raytheon Anschütz are in compliance with a quality management system according to ISO 9001-2008 as well as in compliance with an environmental protection system according to ISO 14001-2009.

We consistently use an iterative process of improvement concerning processes, projects, program and products and maintain the certification of the CMMI® (capability maturity model integration). Where required, program can be processed according to further military standards.

* CMMI is registered in the U.S. patent and trademark office by Carnegie Mellon University
Raytheon Anschütz offers a wide variety of services throughout the whole program, from early customer consulting and customized designs up to obsolescence management and worldwide maintenance during operation. For all solutions, a large worldwide service network is available for maintenance, repair and spare part logistics.

After sales management
Due to the long lifetime of a naval ship, military designed components with long term support do not keep up with the newest technology. To anticipate to the continuous need for obsolescence management Raytheon Anschütz offers long term based update und logistic services. This can include regular software updates for new integrated functionalities as well as customer specific updates. Customer-oriented handling of repairs and warranty processes complete the Raytheon Anschütz after sales management services.

In-service support (ISS)
Raytheon Anschütz offers ISS packages that support the respective customer with a low-risk, forward-looking support solution. Customized solutions cover performance-related payments to ensure highest availability at predictable costs for the entire period of performance. Further key factors are coverage of obsolescence and refreshing through technical updating, ensuring a suitable training level, and documentation.

Integrated Logistic Support (ILS)
Raytheon Anschütz looks back upon many years of experience in supporting its customers while always striving to utilize the latest tools in customizing logistics. An ILS proposal describes all relevant logistic support measures as a prerequisite for economical and effective operation of technical equipment.

Interactive Electronic Technical Documentation (IETD)
The amount and density of information as well as the required topicality and availability of technical documentation are good reasons to introduce an interactive electronic technical documentation (IETD) system. The Raytheon Anschütz IETD is based on modular design and allows retrieving technical information easily from the linked modules by use of hyperlinks and search terms.

Professional service network around the world
As one of the world’s largest service providers we take care of our products and systems on board over 30,000 ships around the world. We offer central service coordination, worldwide maintenance and repair as well as refit for the whole life cycle of a vessel.

We accompany you wherever your mission is taking place – You can rely on predictable and safe operation.
More than 200 service stations all around the world.