

# Synapsis **Integrated Navigation System**

**INS CERTIFIED**

Intelligent Bridge Control / Integrated Bridge System



Type approved acc. to IMO and IEC INS Standards

Human-centered design meets smart functionality

Intelligent system architecture for safety and flexibility

Worldwide diligent customer services

# Synapsis Integrated Navigation System (INS)

The “Synapsis Intelligent Bridge Control” series was the world’s first integrated navigation system (INS) to be type-approved according to IMO performance and IEC test standard MSC.252(83)/IEC 61924-2. Synapsis NX represents the next level of INS.

Synapsis NX features task-oriented multifunctional workstations that integrate all relevant navigation systems. Thanks to a new generation of user interfaces, operators will experience most intuitive operation. Navigators receive a validated picture of the prevalent situation, are released from superfluous workload, and are supported in right decision making. This means significant contribution to safer navigation and more efficient watchkeeping.

The advanced network infrastructure and smart system components contribute to a more flexible bridge system integration, increase navigational safety, and make bridge operations more efficient. Overall, the system architecture provides integrated redundancy and reduces hardware cost.

## BENEFITS AT A GLANCE

- Full INS compliance – reduced workload, increased safety
- Advanced functionality of applications and as a system
- “Any function, any place” increases situation awareness
- Human-centered software design reduces human error risk
- Standardized software for flexible configuration
- Standardized hardware keeps logistic simple and reduces service time cost
- Built-in redundancy and maximum data availability
- Proven sensors for reliability and accuracy, even under harshest environmental conditions
- LAN-based radar sensor ensures brilliant performance and almost unlimited flexibility
- Smart system architecture for high flexibility in system design and workstation configuration
- Simplified installation and cheaper cabling
- Designed for low maintenance, and cost-effective updating / upgrading

  
**SYNAPSIS**<sup>®</sup>  
Intelligent Bridge Control





## WHY DECIDE FOR WORKING WITH RAYTHEON ANSCHÜTZ?

Raytheon Anschütz has decades of experience and an unsurpassed expertise in navigation technology and navigation system integration. Raytheon Anschütz also stands for flexible handling of customer requirements, reliability and continuity in customer relations and excellence in customer service.

### **Dedicated project management**

- Experienced individual support from early system layout to setting in operation
- Coordination and project planning in project-specific engineering teams
- Competent advice regarding IMO and class requirements
- Intimate knowledge in products and technical feasibility
- Firm, reliable project processing and delivery as promised
- Technical support with the know-how of a manufacturer
- Total system design including wiring, circuit and connection diagrams
- Meticulous product and system testing
- Approvals, factory acceptance test, setting to work

When deciding for Raytheon Anschütz, customers will always benefit from individual and dedicated customer services. After sales, customers can rely on a variety of services including highly qualified technical support – worldwide, wherever they navigate.

### **Worldwide first-class technical support**

- 365/24/7 service coordination and support for all products delivered
- High transparency and regular updates about service status
- Reduced administrative workload for customers
- Global network with own hubs in Germany, Singapore and Panama
- Performance monitoring and training program for more than 200 service stations
- Proven spare part supply chain with 20+ large depots
- Maximum uptime thanks to highest first time fixed rates
- Customer-oriented after sales management
- Maintenance contracts



## SYNOPSIS – STATE-OF-THE-ART INTEGRATED NAVIGATION

Raytheon Anschutz offers customers proven navigation system solutions and expertise in navigation system integration, based on more than 110 years in the navigation business and more than 1,100 integrated navigation and bridge systems (INS / IBS) supplied.

With the Synopsis series, Raytheon Anschutz has introduced a state-of-the-art, high performance bridge navigation system. Synopsis uses task-oriented multifunctional workstations, which can be easily configured according to customer's individual requirements – from a radar or ECDIS workplace up to a fully integrated multifunctional workstation. The intelligent integration of data and function supports safe decision making and precise navigation by providing reliable and validated information, and the automatization of routines simplifies operation and reduces workload and stress.

## SYNOPSIS NX SMART SYSTEM ARCHITECTURE

Synopsis NX workstations are based on the Small Marine Computer (SMC). The SMC hosts a common software backbone called Bridge Integration Platform (BIP), which is the heart of each workstation. The BIP takes over central services of the system and ensures, for example, consistent use of data, system-wide target association, and consistent alert handling throughout the system. Navigational applications are added on top and provide a harmonized interface to the user.

The use of standard hardware components and the distribution of the radar video as well as sensor data via LAN increase redundancy, flexibility and scalability.

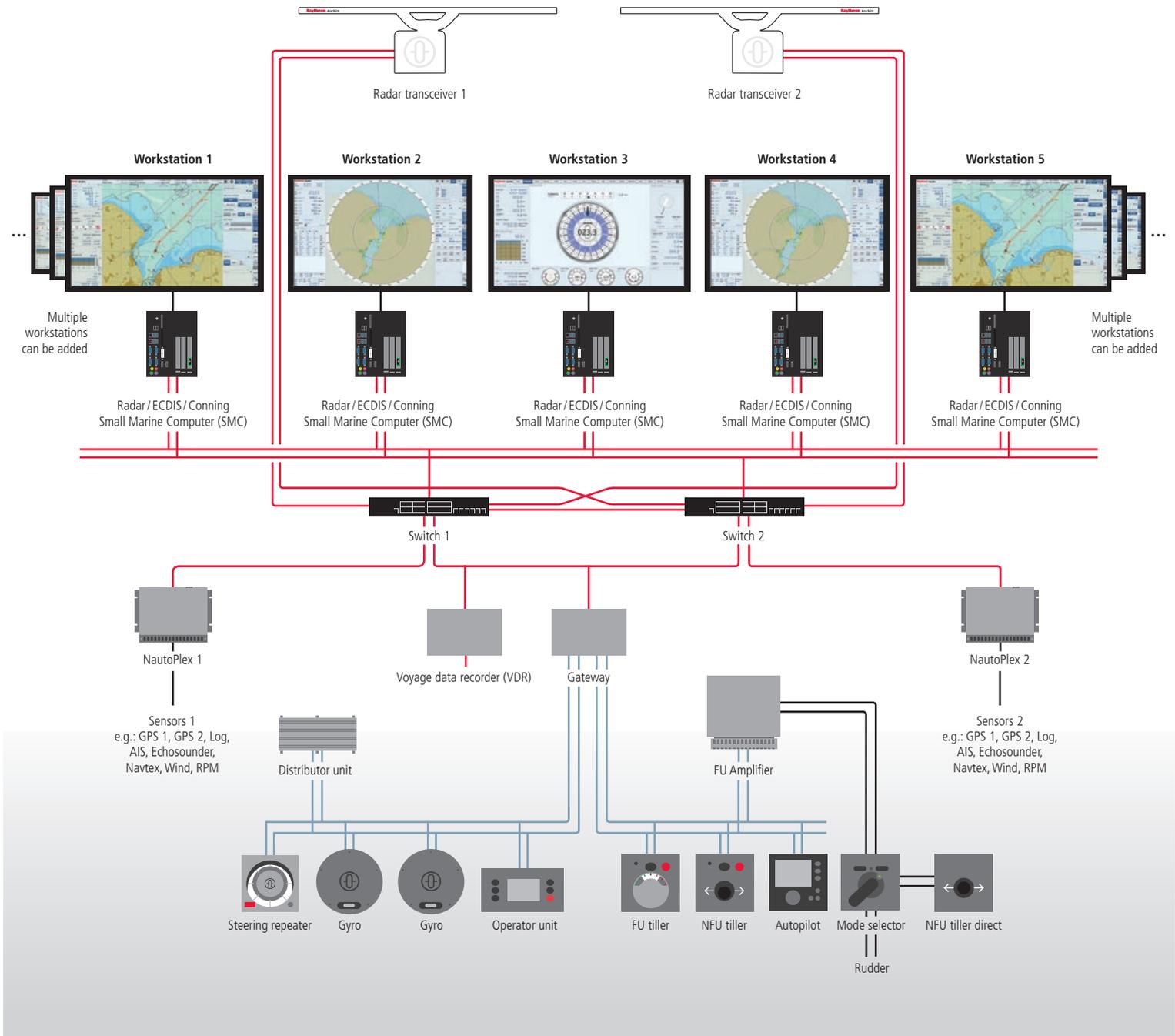
With regard to safety, the system concept is designed so that even a single point of failure leads to reduced redundancy, but not to reduced functionality. Each function at each workstation with full redundancy contributes to secure ship operation.

- No need for analog radar video distribution
- No reduced performance due to damping in the video distribution
- No need for extensive cabling of sensors to workstations
- No need for NMEA boosters for serial attached sensors
- No reduced functionality in case of single point failures





## SCHEMATIC DIAGRAM OF NETWORK TOPOLOGY



Synapsis NX fulfills basic IMO requirements as well as highest class notations such as NAUT (AW) and NAUT (OSV). The core components provide the backbone for the system and the shared services, workstations and applications can be flexibly added as needed in the individual project. The new system architecture reduces complexity of the system for easier installation, higher reliability and better resistance to failures.

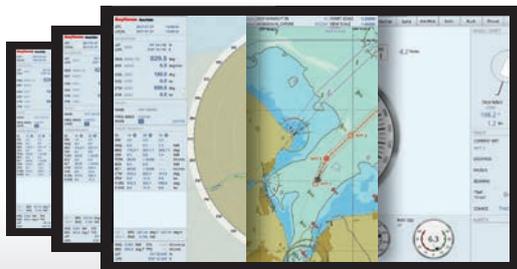
- The NautoScan NX radars distribute the raw radar video via redundant LAN to all connected workstations.
- The NautoPlex collects and distributes sensor data via redundant LAN to all connected workstations.
- Each workstation is connected to the redundant LAN and configured according to customer requirements, providing data processing and distribution for navigational applications.

# SYNOPSIS NX SYSTEM COMPONENTS



## Multifunctional workstations

Synopsis NX Workstations can be easily configured according to customer's individual requirements – from a radar or ECDIS workplace up to a fully integrated multifunctional workstation. All workstations use a standardized HMI, provide central and local change of colors and dimming and share individual and situation-specific user settings. The workstations also integrate data and operation of other systems such as autopilot, AIS or NAVTEX.



## Human-centered software design

A “human-centered” software design improves right situational assessment and decision making, simplifies operation, and altogether increases safety. The new Synopsis NX series was designed in an agile development process under continuous participation of users and UI experts. As a result, Synopsis NX is the first navigation system with a modern and extremely intuitive user interface.



## State-of-the-art LAN for flexibility and safety

All information of the navigational sensors from and to Synopsis NX Workstations can be distributed within a safe, redundant LAN in accordance with the IEC 61162-450 Light Weight Ethernet (LWE) standard. The system design offers high flexibility in bridge system layouts (e.g. installation of hardware in a separate 19” rack off the bridge, for improved ergonomics, service access, and maintenance). New workstations can be easily added.



## 12" Synopsis Touch Panel

The new Synopsis Touch Panel (STP) is available for mounting into the consoles as a centralized display for alert management (INS, bridge level or as NAUT(OSV) CAM-HMI) or other specific functions (via Conning NX software modules). The STP is a 12" powerful panel PC with multifunctional touch display, solid-state disk and low-noise passive cooling.





### Intelligent infrastructure software framework

As part of each workstation, the Synapsis Integration Platform concentrates and processes all central services of the navigation system such as data storage and distribution, health monitoring, redundancy and backup management, alarm monitoring and data display. This makes possible an easy configuration, modification or even extension of the respective tasks on a workstation (e.g. (chart-) radar, ECDIS, conning). The platform also allows for the integration of further sensors and systems.



### Standardized hardware components

The Small Marine Computer (SMC) is the standard for all Synapsis Workstations. It features an ultra-compact design, solid-state disk, powerful processing capabilities, and passive cooling. The NautoPlex serial to LAN converters collect sensor data as well as status information. The data is converted and distributed to the workstations via LAN. The NautoPlex series reduces need for cabling, simplifies project engineering and commissioning, and finally, allows flexible system layouts.



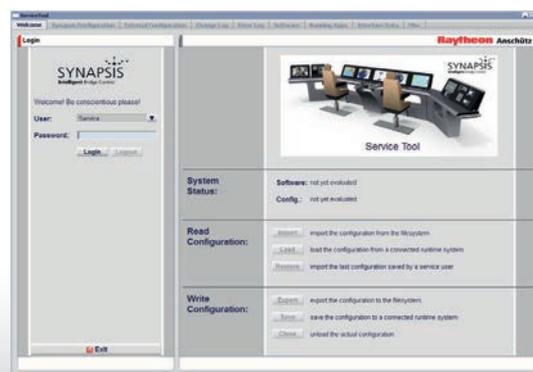
### NautoScan NX – superior LAN-based radar sensor

The new NautoScan NX radar transceivers use state-of-the-art network technology. Key benefits are the redundant Gigabit LAN video distribution and the raw data processing on workstation level for high flexibility and optimized performance. The radars feature a future-proof design with built-in reliability and have been optimized for easier installation and cost savings at shipyards.



### Remote Diagnosis Option

Synapsis Remote Diagnosis is a new service which allows Raytheon Anschutz' shore-based service experts to check actual system status and download parameter and error logs. This ensures optimized service actions with predictable result and avoids unnecessary attendance, altogether resulting in lower service cost. Synapsis Remote Diagnosis is easy to integrate with low hardware efforts.



# SYNOPSIS APPLICATIONS, SENSORS, STEERING SYSTEMS

## Radar NX

Raytheon Anschutz introduces the next generation radar software, Synopsis Radar NX. Consistent with the human centered software design, a team of experienced marine radar users, UI experts and skilled SW developers created a remarkably intuitive user interface. Optimized grouping of data and current settings allow a superior overview and instant determination of the situation and interpretation of the radar picture. The quick access bar makes the most often used operations and functions available at a fingertip, including touch operation. Radar NX features an advanced tracker to offer high performance in tracking and anti-clutter processing. A wide range of functions, including radar video merge, is available.

## ECDIS NX

With Synopsis ECDIS NX, Raytheon Anschutz offers an advanced electronic chart display and information system (ECDIS) in a modern, state of the art design. Thanks to an unparalleled intuitiveness, ECDIS NX effectively supports the daily tasks and use cases of navigators and contributes to safe ECDIS operation and navigation. Important operational functions are available at a single click, and indications can be fixed or retracted as needed, based on navigator preferences, in order to offer a maximum chart display. Optional upgrades in functionality beyond IMO-requirements include highly precise track control Cat. C, digital radar video overlay including display of merged multi-radar video sources, tender tracking, and additional chart formats such as ARCS and BSB.

## Track control system with ECDIS NX and NP5000

In combination with Anschutz NautoPilot 5000 series, Synopsis ECDIS NX is approved for track control Category C to offer highest precision in automatic steering.

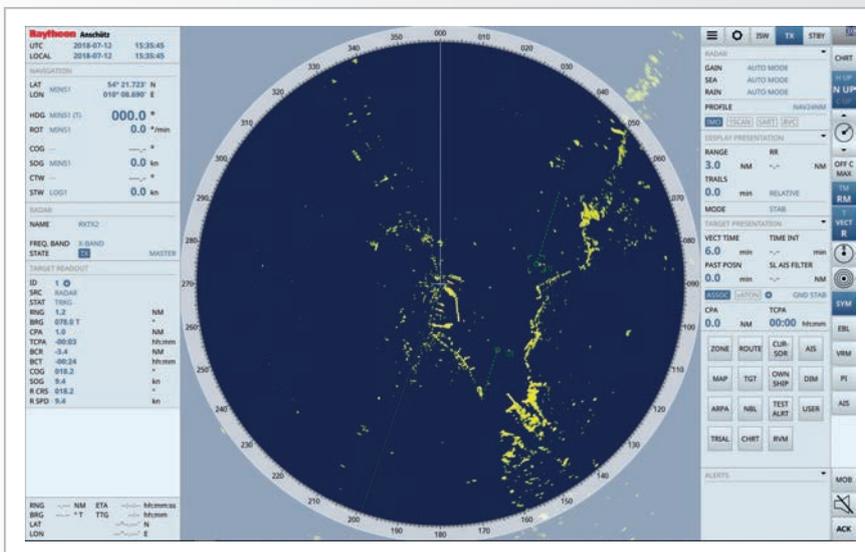
## Conning NX

Synopsis Conning NX is the centralized navigation data display for the ship's command. It presents bridge navigation and machine status data conveniently at a glance and hence contributes to efficient and safe navigation. Conning NX was developed on the valuable feedback from users and customers and offers as an option the flexible configuration of display pages. For this, Conning NX software features a stock of flexible graphical elements – like widgets – which can be selected, adapted and combined as needed. Various functions can be activated and configured by the operator as needed. Conning NX is a versatile and extremely capable software.

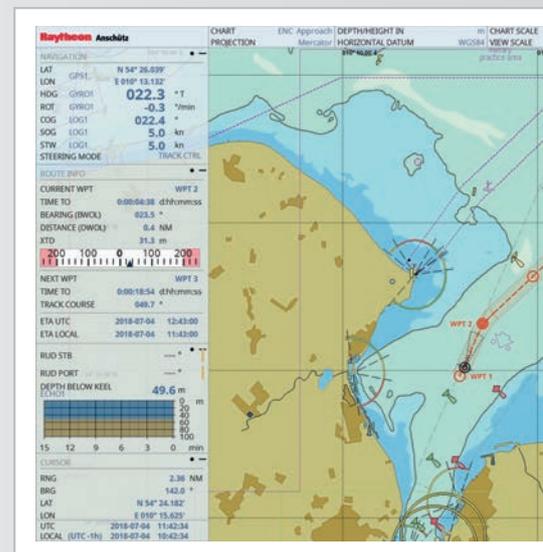
In addition, together with the Synopsis Touch Panels, Conning NX can provide the HMI for a centralized alert HMI (CAM-HMI) of the INS, on bridge level or as a bridge alert management system for DNV Class Notation NAUT(OSV).



Synopsis Radar NX



Synopsis ECDIS NX





### Anschütz autopilots

Anschütz autopilots use proven steering algorithms that are known by seafarers for their outstanding steering performance and precision. The autopilots are designed for ease-of-use and offer valuable functions. Depending on the autopilot type, this can include course and track control modes, an acceleration monitor and fuel-saving capabilities. Synopsis NX also offers a seamless integration of autopilot capabilities.

### Anschütz heading sensors

Anschütz gyro compasses are known for their superior accuracy and reliability even under harshest environmental conditions. The Standard 22 is the most popular gyro compass on the market – thanks to its accuracy and robustness, its reliability and functionality, as well as its long maintenance intervals and cost effectiveness over lifetime.

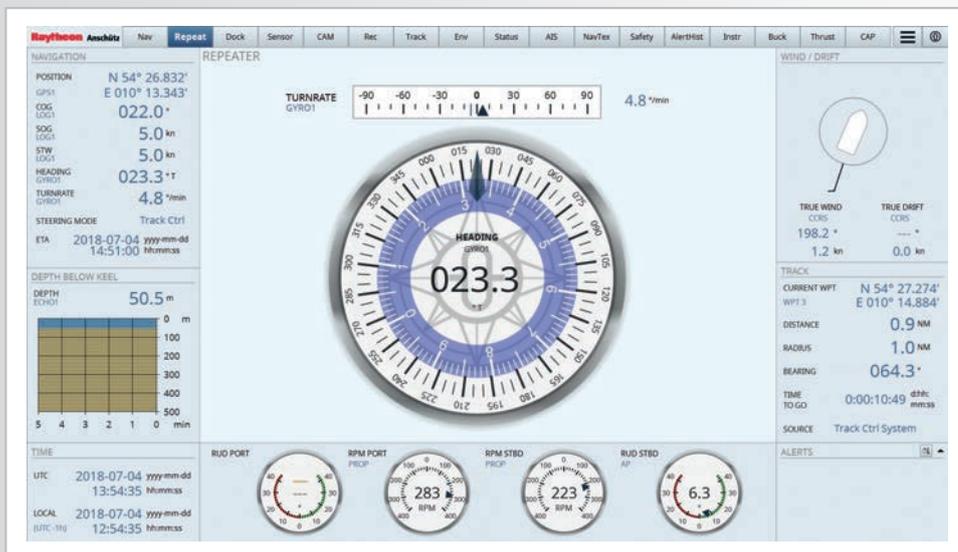
Standard 30 MF is the latest Anschütz gyro compass and the perfect choice for customers who require a maintenance-free gyro compass. Based on hemispherical resonator gyro (HRG) technology, it offers an outstanding lifetime performance (significantly better than FOG).

### Anschütz steering systems

NautoSteer AS is the next generation of a sophisticated manual steering gear control system for customers that require reliability, safety and an outstanding functional range. The modular system architecture of NautoSteer AS allows for standardized and cost-effective solutions as well as individual and advanced system configurations.



### Synopsis Conning NX



# ADVANTAGES OF AN INS

Synapsis has also set the standard as the world's first system in compliance with the IMO and IEC standards for integrated navigation systems (INS). The INS features a kind of „artificial intelligence“ to offer advantages with regard to safe and efficient operation.

## Sensor and data management

Synapsis NX workstations feature central management of sensor data and consistent use of the best data set throughout the system. All sensor data in the navigation network is monitored and analyzed with regard to availability, integrity and reliability. Corrupted sensor data, as well as malfunction and disturbance, is detected, marked and excluded from selection and distribution. Operators can choose the best data set to be distributed automatically to all network participants.

Benefits:

- Consistent data and operations
- Safe navigation based on validated sensor information
- Less workload for navigators

## Target and zone management

The central target management provides target association between S-band radar, X-band radar and AIS sensors. From this, system-level targets are created, which are further processed throughout the navigation network to appear consistently on any radar or ECDIS display. Consequently, target-related alerts (e.g. CPA) are based on system-level targets.

Benefits:

- Reduced / single alerting, less workload
- Immediate and clear situational assessment
- Faster decision making

## Alert and status management

Synapsis NX Workstations automatically observe the performance and status of all workstations and sensors connected to the network. A redundant “hot standby” mode is increasing safe navigation. Moreover, an intelligent, centralized bridge alert management collects and analyzes alerts and determines, with regard to system configuration and status, whether the situation is sufficiently critical to set off an alarm, or whether the watch officer should only receive an alert of lower priority. Furthermore, any alert integrated into the system can be viewed and silenced at any workstation acc. to bridge alert management standard MSC.302(87).

Benefits:

- Automated redundancy handling
- Having fewer alerts to attend to reduces stress and workload
- Attention is directed to the critical alarms on the bridge only

## User management

Synapsis NX workstations include user management to store and share user settings for either a single application or the entire system. This includes the possibility to define standardized user profiles or standardized settings for certain maneuvering situations such as docking, harbor or open sea. Further user support is provided by central display dimming and central color palette switching.

Sensor selection

The screenshot shows the 'SENSOR SELECTION' window in the Raytheon Anshita navigation software. The window is divided into several sections:

- Navigation Data:** Position (N 54° 27.125', E 010° 13.672'), SOG (5.0 kn), STW (5.0 kn), Heading (043.5°), Turnrate (4.8°/min), and ETA (2018-07-04 14:54:00).
- SENSOR SELECTION:** A table with columns for Selection Mode (Auto), Position, SOG, COG, HDOP, SATS(U), and Status. It lists various sensors like GPS1, GPS2, GPS3, LC, GYRO1, GYRO2, LOG1, LOG2, and ECHOD1/ECHOD2.
- Heading and Turnrate:** A table showing heading (043.6°) and turnrate (4.8°/min) for GYRO1 and GYRO2.
- STW (Speed Through Water):** A table showing STW (5.0 kn) and transverse speed (-0.1 kn) for LOG1 and LOG2.
- SOG (Speed Over Ground):** A table showing SOG (5.0 kn) and transverse speed (-0.1 kn) for LOG1.
- Depth:** A table showing depth (48.3 m) for ECHOD1 and (51.0 m) for ECHOD2.
- Wind:** A table showing wind speed (3.8 kn) and direction (359.3°) for WIND1.
- Manual Input:** A table for manual input of position, latitude, longitude, fix date, UTC, and fix time.

Central alert management

The screenshot shows the 'CENTRAL ALERT MANAGEMENT' window in the Raytheon Anshita navigation software. The window displays a list of alerts with icons and text:

- INS APPROACHING ATON
- INS TGT MGMT GUARD ZONE INTRUSION BY 1 TARG
- INS XTD GREATER THAN 200 m
- INS TGT MGMT 1 NEW TARGET(S) FROM AIS
- INS - INS Group Alert: CROSSING SAFETY CONTOUR
- INS CROSSING DANGER OR HAZAR
- INS CROSSING SAFETY CONTOUR
- INS NET SWITCH1: LINK FAILURE

The interface also shows navigation data like position (N 54° 27.247', E 010° 13.911'), SOG (5.0 kn), STW (5.0 kn), heading (054.3°), turnrate (4.8°/min), and ETA (2018-07-04 14:55:00). A depth scale on the left shows 50.5 m.



Raytheon Anschütz Nav Repeat Dock Sensor CAM Rec Track Env Status AIS NavTex Safety AlertHist Instr Buck Thrust CAP

### SYSTEM STATUS MFC4

Explanation: No-Information Available Active Degraded Failure

SWITCH1 SWITCH2

SI0001 SI0002 SI0003 EXTIO1 EXTIO2 EXTIO3

ALERTS

System health status at a glance

### Alert history

Status AIS NavTex Safety AlertHist Instr Buck Thrust CAP

Total Alerts: 7 Unacknowledged: 6

2018-07-04 14:00:44
2018-07-04 13:53:43
2018-07-04 13:53:21
2018-07-04 13:44:26
2018-07-04 13:58:47
2018-07-04 13:58:47
2018-07-04 13:52:01
2018-07-04 14:00:42

WIND / DRIFT

TRUE WIND COGS 054.7 TRUE DRIFT COGS 0.0

0.5 km 0.0 km

TRACK

CURRENT WPT WPT 3 N 54° 27.274' E 010° 14.884'

DISTANCE 0.5 NM

RADIUS 1.0 NM

BEARING 090.1°

TIME TO GO 0:00:05:42 dhk: mms35

SOURCE Track Ctrl System

ALERTS

TGT MGMT 2 of 7 2018-07-04 13:53:43

GUARD ZONE INTRUSION BY 1 TARGET(S)

EXPORT ALERT AGGREGATION

Raytheon Anschütz Nav Repeat Dock Sensor CAM Rec Track Env Status AIS NavTex Safety AlertHist Instr Buck Thrust CAP

### ALERT HISTORY

625 of 625 displayed

Time UTC	Type	Event	Cat.	Source	Alert Text
2018-07-04 14:01:56	WARNING	Raised	A	INS	COURSE CHANGE IN 5 MIN OR LESS
2018-07-04 14:01:32	WARNING	Rectified	A	INS	APPROACHING ATON
2018-07-04 14:01:25	ALARM	Rectified	A	INS	APPROACHING ATON
2018-07-04 14:01:25	ALARM	Raised	A	INS	APPROACHING ATON
2018-07-04 14:00:51	WARNING	Ack	B	AP	Heading jumped
2018-07-04 14:00:51	WARNING	Rectified	B	AP	Heading jumped
2018-07-04 14:00:51	WARNING	Ack	B	INS	NET-SWITCH1: LINK FAILURE
2018-07-04 14:00:21	ALARM	Rectified	A	INS	CROSSING SAFETY CONTOUR
2018-07-04 14:00:05	ALARM	Rectified	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:59:44	CAUTION	Raised	B	INS	APPROACHING ATON
2018-07-04 13:58:47	ALARM	Raised	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:57:20	ALARM	Rectified	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:56:37	ALARM	Raised	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:55:38	ALARM	Rectified	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:55:04	ALARM	Raised	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:54:25	ALARM	Rectified	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:53:57	ALARM	Raised	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:53:43	ALARM	Raised	A	TGT MGMT	GUARD ZONE INTRUSION BY 1 TARGET(S)
2018-07-04 13:53:21	ALARM	Raised	A	INS	XTD GREATER THAN 200 m
2018-07-04 13:52:53	ALARM	Rectified	A	INS	CROSSING DANGER OR HAZARD
2018-07-04 13:52:48	ALARM	Raised	A	INS	CROSSING DANGER OR HAZARD

Time Filter: Minimum age of messages: 0 h Maximum age of messages: 1 h ARCHIVE: off EXPORT

ALERTS

TGT MGMT 1 of 8 2018-07-04 14:02:12 Mhmm35

GUARD ZONE INTRUSION BY 1 TARGET(S)

# RAYTHEON ANSCHÜTZ – EXCELLENCE IN WORLDWIDE SERVICE

Raytheon Anschutz, with its international companies, is close to the most important shipping routes and close to the world's leading shipyards. Shipyards and ship owners can rely on on-site technical support and supervision of installations, provided with the know-how and flexibility of a developing and manufacturing company.

## 365/24/7 – CUSTOMER SERVICE

**Highly skilled coordinators. Personal support.  
Transparent service status. No delays.**

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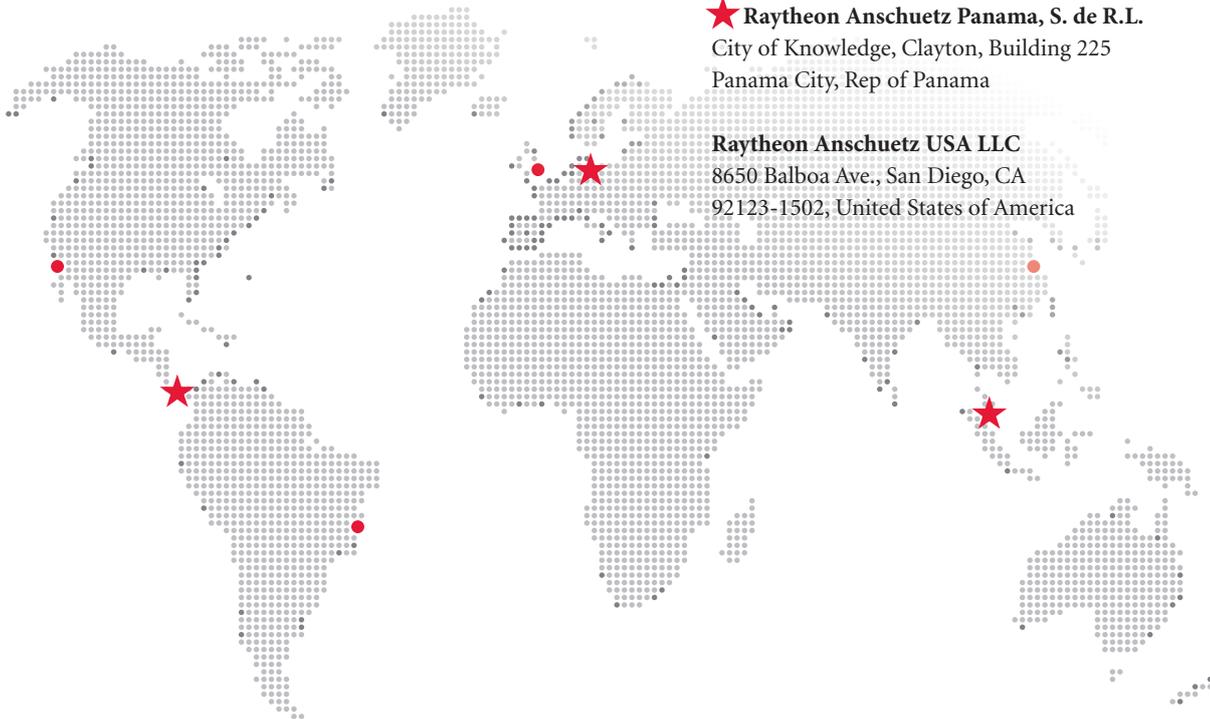
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