Navigation – e-Navigation – Navigational Equipment

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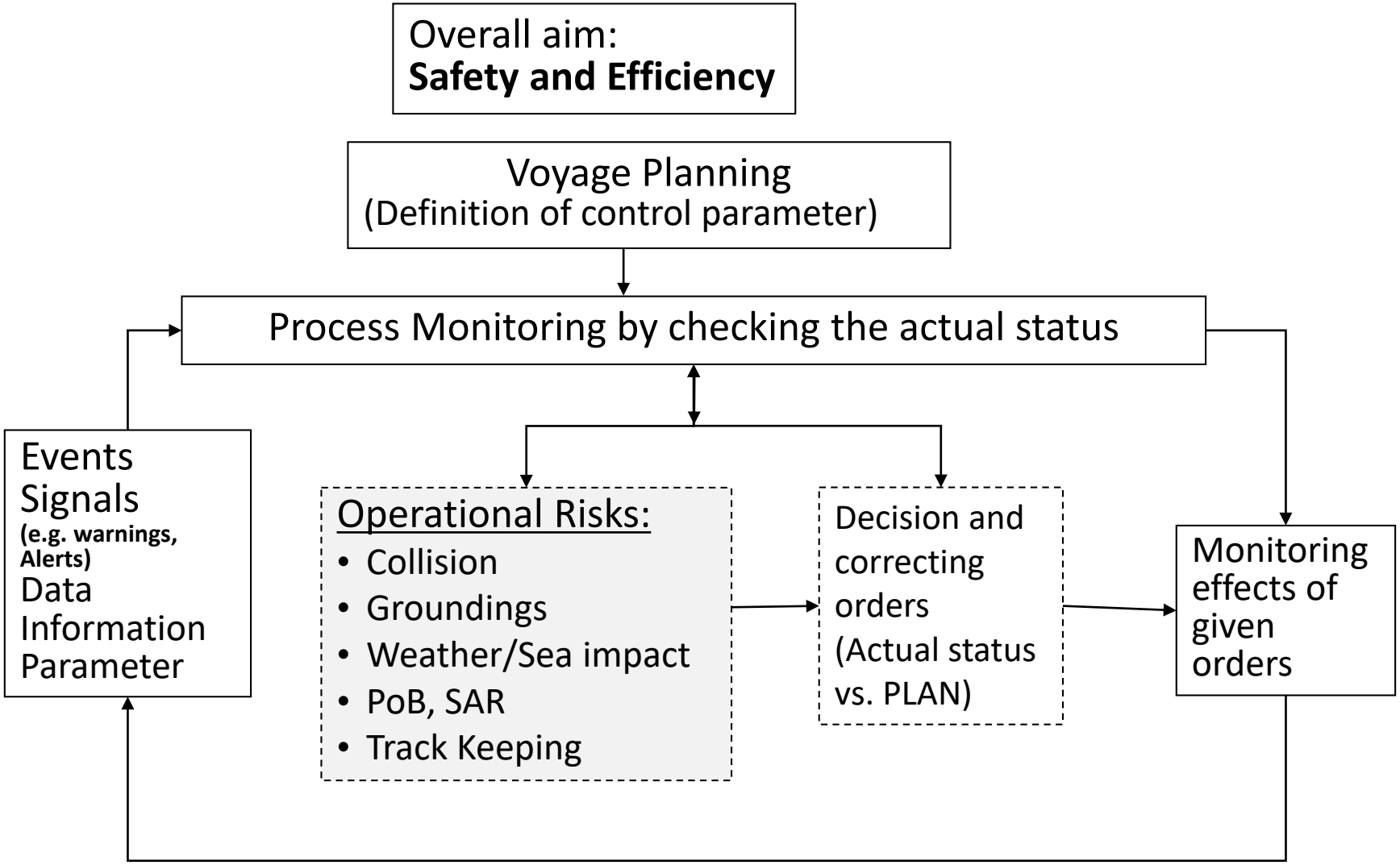
Wismar University of Applied Science

- What is ‘Navigation’?
- Navigational Instruments
- Automatic Identification Systems (AIS)
- ECDIS
- **Integrated Bridge Systems (IBS)**
- E-navigation
- Long-range identification and tracking of ships (LRIT)

To navigate a ship …



INTRODUCTION

Navigation – to move cargo SAFELY

Collision under conditions of good visibility in open sea

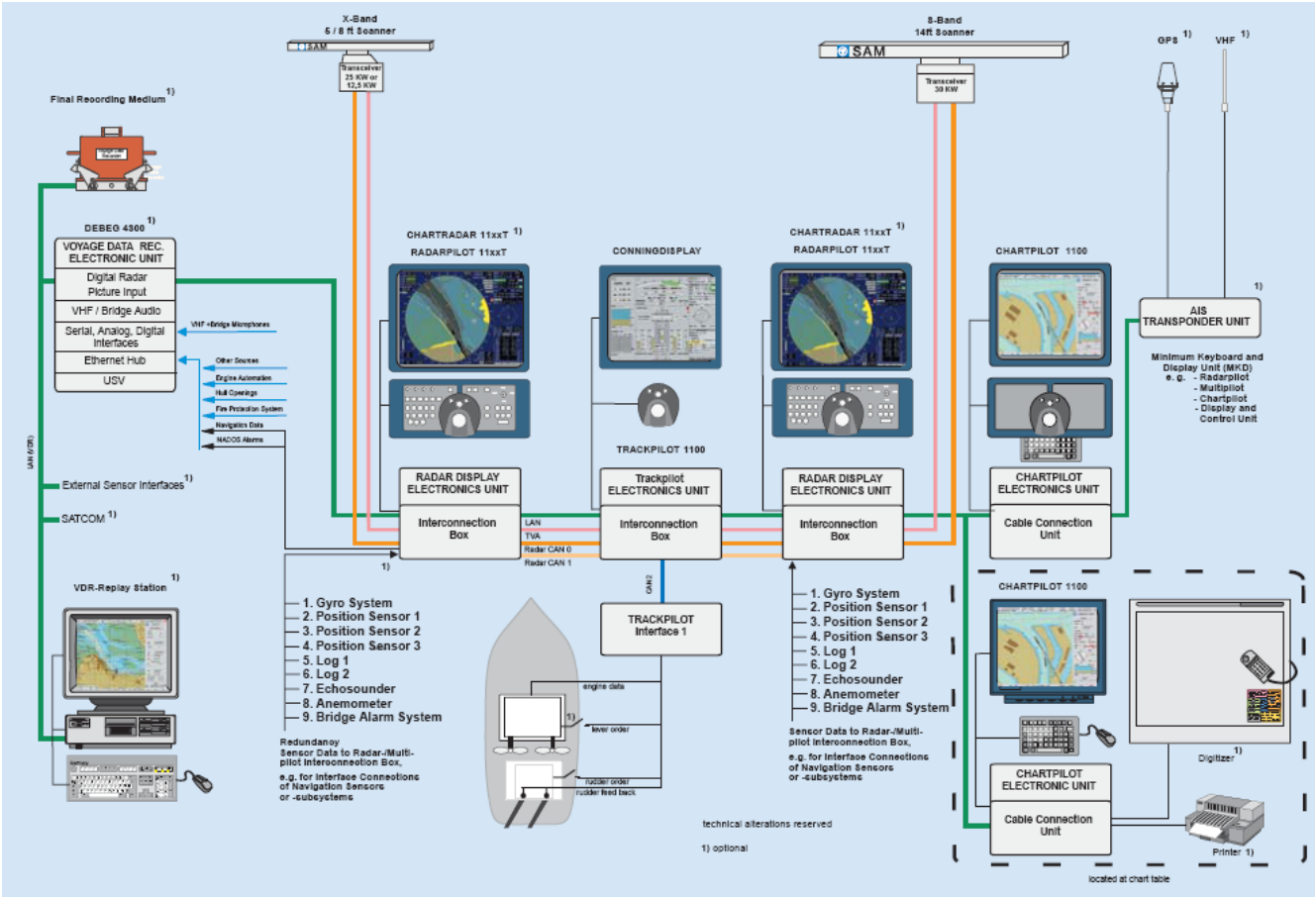
Source: Investigation Report of BSU

INTRODUCTION

Navigation – a challenging complex task ...

INTRODUCTION

Modern Navigation Equipment



INTRODUCTION

Navigation – Processes and Tasks

Ship Navigation process					
Voyage-planning	**Route-monitoring**	**Collision Avoidance**	**Ship steering**	**Alert-management**	**Condition-monitoring**
• Sea chart • Pilot • Cargo • Climate- & Weather • Route-check • ECDIS	•EPFS •ECDIS •Course-control •Track-control •Echo sounder •Log •Emergency-support-systems (PoB, SAR) •…	•Radar •ARPA •AIS •… •… •ECDIS	• Autopilot • Engine-telegraph • Heelingsys. • Waypoint • Communi-cation • ECDIS • UKC • STW, CTW • SOG, COG • ROT; RPM • Rudder	•Position lost •CPA/TCPA •Off Track •Off Course •Lost target •WOP •WP alarm •PoB •Fire/Explo. •Inrush of water •…	•Parameter-configuration •Editing Ship status - & Voyage data •Weather info •Navtex •Safety related messages

Definition

- An **integrated bridge system (IBS)** is defined as:
  - ⇨ a combination of systems which are interconnected in order to allow centralised access to sensor information or command/control from workstations, with the aim of increasing safe and efficient ship's management by suitably qualified personnel

- The IBS recommendations apply to a system performing two or more operations, namely:
  - ✓ passage execution;
  - ✓ communication;
  - ✓ machinery control;
  - ✓ loading, discharging and cargo control;
  - ✓ safety and security

❖ Therefore, by IMO definition, an IBS does not have to include an INS, although in many peoples' minds the term IBS remains synonymous with INS.

IMO has attempted to clarify such matters with its 'Recommendation on Performance Standards for Integrated Bridge Systems' and 'Recommendations on Performance Standards for an Integrated Navigation System'. They formed part of resolutions adopted by the Maritime Safety Committee (MSC) in 1996 and 1999, respectively.

- Performance standards for integrated bridge systems (IBS) were adopted by IMO in 1996 (Resolution **MSC.64(67)**)

- The revised SOLAS chapter V adopted in Dec 2000 and entering into force in July 2002 says in

  ➔ **Regulation 19**
  ***Carriage requirements for shipborne navigational systems and equipment**:*

  6. Integrated bridge systems* shall be so arranged that failure of one sub-system is brought to immediate attention of the officer in charge of the navigational watch by audible and visual alarms, and does not cause failure to any other sub-system. In case of failure in one part of an integrated navigational system†, it shall be possible to operate each other individual item of equipment or part of the system separately.

* Refer to resolution MSC.64(67), annex 1, Performance standard for integrated bridge systems.
† Refer to resolution MSC.86(70), annex 3, Performance standard for integrated navigational systems.

SOLAS requirements

- IMO's revision to SOLAS, which came into effect in July 2002, contains a regulation (Chapter V, Reg 15) on 'Principles relating to bridge design, design and arrangement of navigational systems and equipment and bridge procedures'.
- Although not IMO's most catchy title, it does help to define what should be observed in the design of bridges, including those with integrated systems.
- In particular, Reg 15 references the two IMO resolutions mentioned earlier in this article.
- This implies that, at least in time, the recommendations will become enforced properly. Requirements embodied within SOLAS have a much greater force than recommendations solely included in resolutions.
- Since the recommendations are referenced in footnotes the purist will rightly say that they do not form part of SOLAS. But in actuality, most maritime administrations take the footnotes very seriously.

- The **IBS** recommendations put requirements on: how the integration is performed; the type of information that has to be available and the way that it is displayed; and the way that data is exchanged.
- There is an emphasis on ensuring the integrity of data. A failure analysis should be 'performed, documented and be acceptable'.
- SOLAS does not imply that systems can be arbitrarily classified as integrated or not integrated. If a level of integration is reached that meets that identified in IMO's IBS resolution, then the recommendations in that resolution become applicable.

Integrated Bridge System (IBS) operational matters*

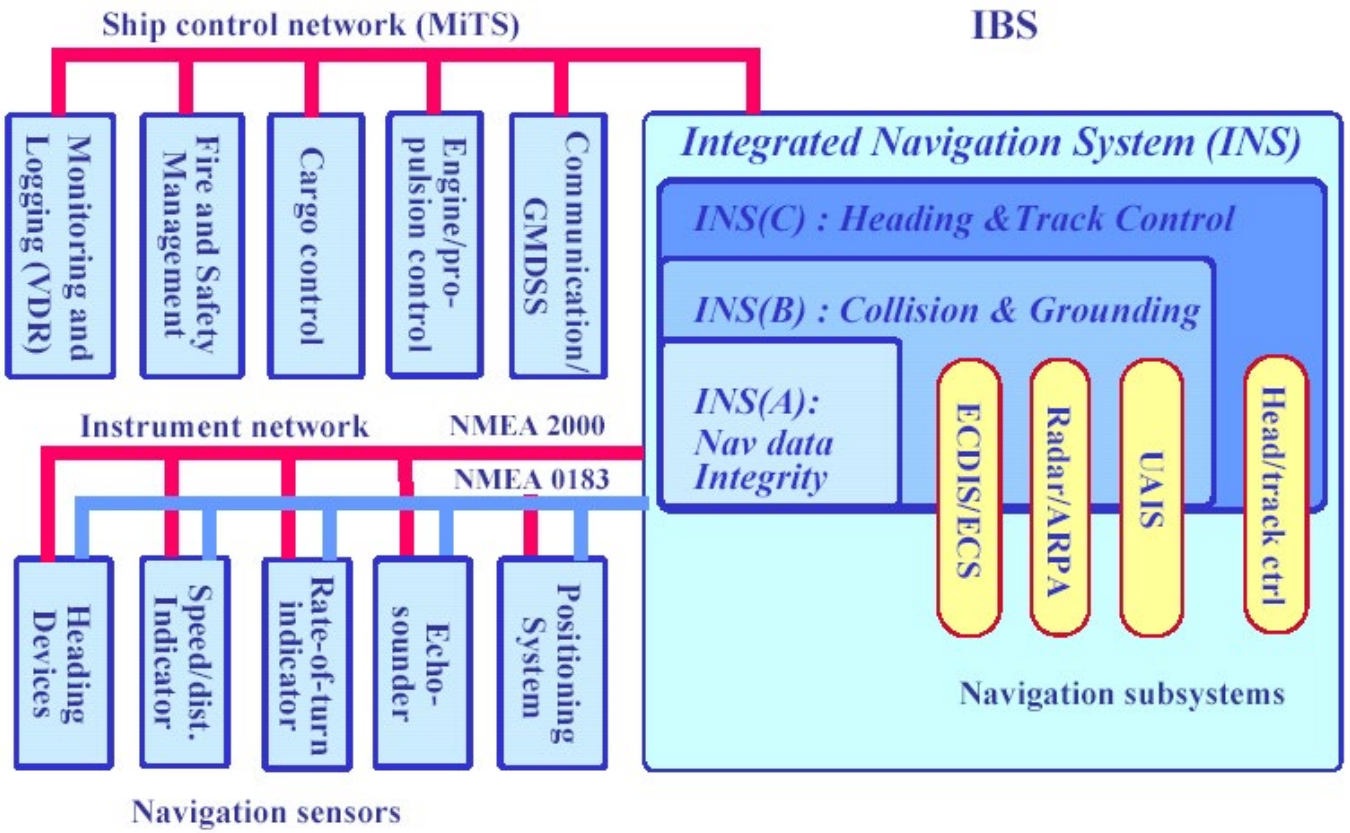
- A draft MSC circular on 'Guidance for the operational use of (IBS)' was agreed for approval by MSC 76.

  ➔ **MSC76** (12/02) approved **MSC/Circ.1061** ('Guidance for integrated bridge systems (IBSs) covering operational aspects')

  - The guidance has been developed to support the safe operational use of an IBS by promoting procedures necessary to ensure adequate knowledge of system functions for Mode Awareness, Situational Awareness and Workload Management.
  - **The aim of the guidance** is to define the basis for minimum criteria on the operation, training and quality control for IBS.
  - The guidance covers such matters as bridge procedures, emergency procedures, passage planning, record keeping, implementing new technology and training.

* NAV48(07/02)

IBS and INS


Ship control network (MiTS)
IBS
Monitoring and Logging (VDR)
Fire and Safety Management
Cargo control
Engine/pro-pulsion control
Communication/ GMDSS
Integrated Navigation System (INS)
INS(C) : Heading &Track Control
INS(B) : Collision & Grounding
INS(A): Nav data Integrity
ECDIS/ECS
Radar/ARPA
UAIS
Head/track ctrl
Navigation subsystems
Instrument network
NMEA 2000
NMEA 0183
Heading Devices
Speed/dist. Indicator
Rate-of-turn indicator
Echo-sounder
Positioning System
Navigation sensors

- The MSC70 (12/98) also adopted performance standards for **Integrated Navigation Systems (INS) ***

  ⇨ “a combination of systems that are interconnected to increase safe and efficient navigation by suitably qualified personnel”

- The purpose of an INS is to provide ‘aided value’ to the functions and information needed by the OOW to plan, monitor or control the progress of the ship.
- The INS supports mode and situation awareness.
- The INS supports safety of navigation by evaluation inputs from several independent and different sensors, combining them to provide information giving timely warnings of potential dangers and degradation of integrity of this information. Integrity monitoring is an intrinsic function of the INS.
- The INS aims to ensure that, by taking human factors into consideration, the workload is kept within the capacity of the OOW in order to enhance safe and expeditious navigation and to complement the mariner’s capabilities, while at the same time to compensate for their limitations.
- The function of passage execution in an IBS, as defined by the IMO, may be performed by an INS.

* MSC.86(70), annex 3, Performance standard for integrated navigational systems

INS – a core element of IBS

ANNEX 30

RESOLUTION MSC.252(83)

(adopted on 8 October 2007)

ADOPTION OF THE REVISED PERFORMANCE STANDARDS FOR INTEGRATED NAVIGATION SYSTEMS (INS)

INS – a core element of IBS

Integrated Navigation – MSC.192(79)

PERFORMANCE STANDARDS FOR INTEGRATED NAVIGATION SYSTEMS (INS)

1 Purpose of integrated navigation systems

1.1 The purpose of integrated navigation systems (INS) is to enhance the safety of navigation by providing integrated and augmented functions to avoid geographic, traffic and environmental hazards.

1.2 By combining and integrating functions and information the INS provides "added value" for the operator to plan, monitor and/or control safety of navigation and progress of the ship.

1.3 Integrity monitoring is an intrinsic function of the INS. The INS supports safety of navigation by evaluating inputs from several sources, combining them to provide information giving timely alerts of dangerous situations and system failures and degradation of integrity of this information.

1.4 The INS presents correct, timely, and unambiguous information to the users and provides subsystems and subsequent functions within the INS and other connected equipment with this information.

1.5 The INS supports mode and situation awareness.

1.6 The INS aims to ensure that, by taking human factors into consideration; the workload is kept within the capacity of the operator in order to enhance safe and expeditious navigation and to complement the mariner's capabilities, while at the same time to compensate for their limitations.

1.7 The INS aims to be demonstrably suitable for the user and the given task in a particular context of use.

1.8 The purpose of the alert management is specified in module C.

INS – a core element of IBS

3 categories of INS performance standards

1. INS(A) for systems that provide the minimum functional requirements of the INS including a consistent common reference system
2. INS(B) for systems that, in addition to the functional requirements of INS(A), provide the information needed for decision support in avoiding hazards
3. INS(C) for systems that, in addition to the functional requirements of INS(B), provide the automatic control functions of heading, track or speed.

Review of performance standards for INS*

- NAV51 agreed a revised draft structure of performance standards for Integrated Navigation Systems (INS) and established a correspondence group to continue the work in developing the text of the performance standards intersessionally.
- The draft structure provides the framework for the performance standards to be developed in several sections, to include purpose; scope; application; definitions;
  - Part A - Integration of navigational information to include system requirements;
  - Part B - Task-related requirements for INS to include operational requirements; compliance with SOLAS; configuration of INS; functional requirements for displays of INS; automatic control systems; back up and fallback arrangement; technical requirements;
  - Part C - Alarm management system;
  - Part D - Documentation requirements

➔ **STW36** (050110-14) validated the model course for 'Operational use of Integrated Bridge Systems (IBS)/Integrated Navigation Systems (INS)'

* NAV51(07/05)

Revision of the performance standards for INS and IBS*

- Progress was made in the development of draft revised performance standards for integrated navigation systems (INS).

- A Correspondence Group was re-established to finalise the drafts and also to develop revised performance standards for integrated bridge systems (IBS), to include an alert management module and Bridge Resource Management (BRM) Guidelines.

* NAV52(07/06)

Revision of the performance standards for Integrated Navigation Systems (INS) and Integrated Bridge Systems (IBS)*

- Draft revised performance standards for INS were finalised for adoption by MSC 83. According to the performance standards, the purpose of an INS is to enhance the safety of navigation by providing integrated and augmented functions to avoid geographic, traffic and environmental hazards.
- An INS comprises navigational tasks such as route planning, route monitoring and collision avoidance, including the respective sources, data and displays which are integrated into one navigation system.

- An INS is defined as such in the performance standards if it covers at least two of the following navigational tasks/functions: route monitoring, collision avoidance and track control.
- Other navigational tasks may also be integrated into the INS. The scope of the INS may differ, depending on the number and kind of tasks and functions integrated into the INS.
- The performance standards allow for a differentiated application of the requirements depending on integrated tasks and functionality.

➔ **MSC 83** (10/07) adopted **Resolution MSC.252(83)** - the Revised performance standards for Integrated Navigation Systems (INS)

* NAV 53(07/07)

INS – a modular system

- The INS performance standards are structured in four major modules:
  - Module A - Integration of information
  - Module B - Task related requirements for INS
  - Module C - Alert management
  - Module D - Documentation requirements

- NAV 53 agreed that, for the successful implementation of INS and IBS it is essential that all sensors and equipment adopt a standard serial communication protocol to support compatibility and allow interconnection and integration.

- In addition, the Sub-Committee re-established the correspondence group to develop guidelines for Integrated Bridge Systems (IBS), including performance standards for Bridge Alert Management.

- It also agreed to amend the title of the agenda item to "Develop guidelines for IBS, including performance standards for Bridge Alert Management" and to seek an extension of the target completion date for another two sessions.

- SOLAS regulation V/15 requires that the design and arrangement of navigation systems and equipment on the bridge should facilitate the tasks to be performed by the bridge team and the pilot and promote safe and effective Bridge Resource Management (BRM).
- The Sub-Committee agreed guidelines on the application of SOLAS regulation V/15 to INS, IBS and bridge design for adoption by MSC 83.

- The guidelines are designed to be taken into account by designers and system integrators designing and installing INS and IBS systems.
- They recommend that the physical arrangement of the systems on the bridge and presentation of information should permit observation or monitoring by all members of the bridge team and pilot, the system should avoid the potential for a single-person failure during operation and should minimise the risk of human error by facilitating monitoring and cross checks between members of the bridge team and pilot.

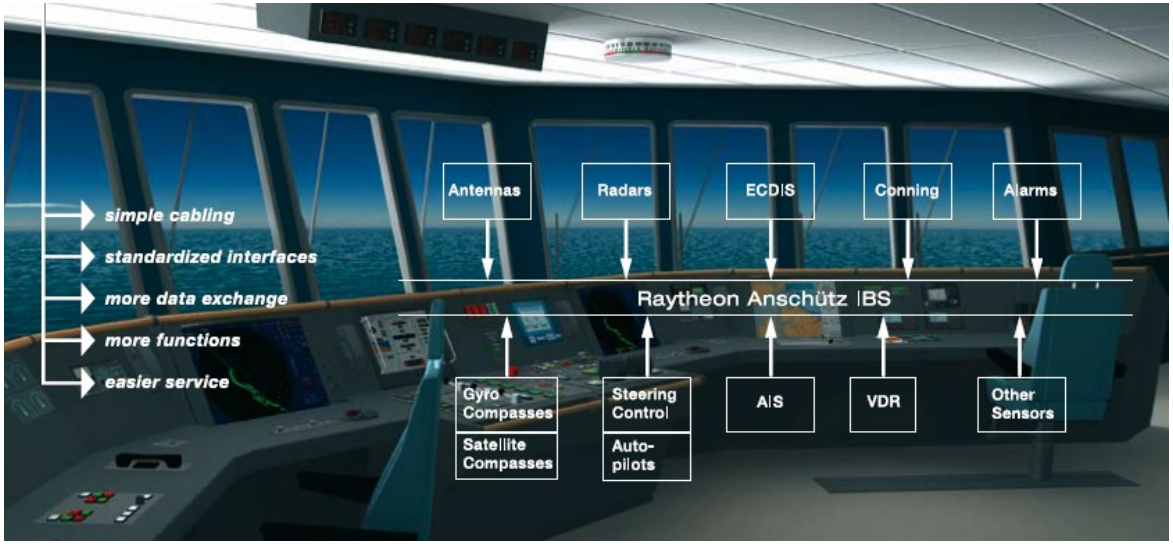
➔ **MSC83** approved **SN.1/Circ.265** – 'Guidelines on the application of SOLAS regulation V/15 to INS, IBS and bridge design'

Guidelines for Integrated Bridge Systems (IBS)*

- Draft guidelines for IBS and draft performance standards for bridge alert management were reviewed and the Sub-Committee agreed to broaden the scope of the proposed guidelines to Guidelines for bridge equipment and systems, their arrangement and integration.
- A correspondence group was re-established to finalise the draft guidelines and draft performance standards for submission to the next session, and to liaise with the Sub-Committee on Ship Design and Equipment (DE) to ensure consistent treatment of alerts, including alarms and indicators.
- Meanwhile, the Sub-committee agreed a draft SN/Circular on guidelines for the application of the modular concept to performance standards, which are intended to assist in the consistent and logically structured drafting of new and revised performance standards for systems and equipment according to the modular concept.
- With the modular concept, operational/functional and sensor/source modules are specified, allowing clear separation between operational requirements for the task orientated use and presentation of information on equipment and systems, and between the sensor specific technical performance requirements.

* NAV 54(06/08)

Raytheon-Anschutz*



* http://www.raytheon-anschuetz.com

INS/IBS – State of the Art Applications

Sperry Marine IBS

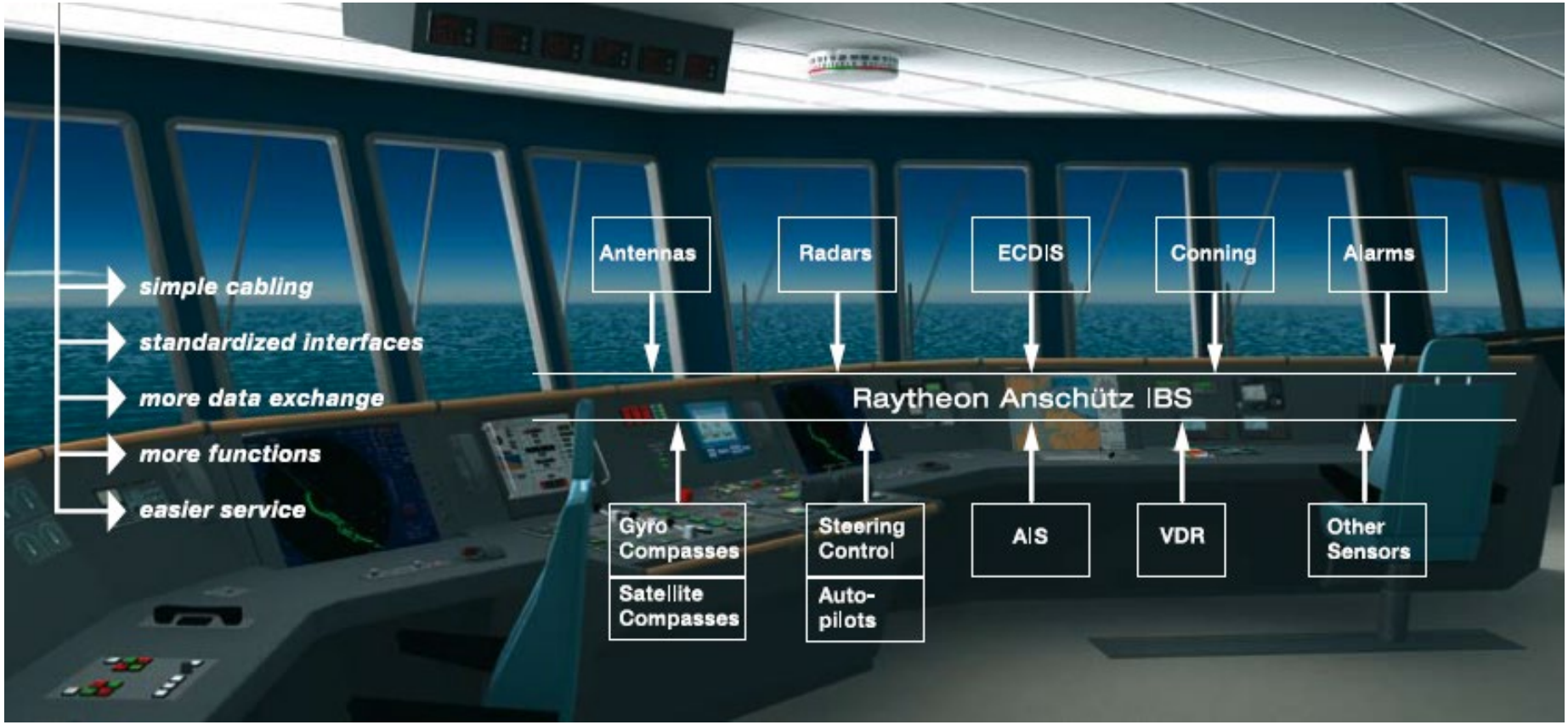
Raytheon-Anschutz*

- Full multifunctional workstations combine functions of RADARs, ECDIS and central navigation data display on one dedicated position, providing maximum flexibility for navigation data access at any location on the integrated bridge. The workstations provide all information for safe, precise navigation.
- In conjunction with an autopilot, the system allows qualified track control while the RADAR or ECDIS screen is being watched, thus achieving a higher level of integration.
- Reliable sensors support the core system with all relevant data, which is distributed and monitored by a fully redundant data and alarm management system. Radio communication systems according to GMDSS can be added to the IBS.

* http://www.raytheon-anschuetz.com

Integration offers clear benefits:

- Improved precision, performance and efficiency
- Full navigational data access at any workstation
- Maximum safety with respect to collision avoidance and anti-grounding
- Centralised alarm handling and monitoring
- Common operation philosophy with respect to ergonomical system design
- **Optimised system functionality**, e.g. integrated autopilot operation in RADAR and ECDIS, track monitoring and overlay of RADAR, ECDIS and AIS representations
- Standardised interfaces and reduced costs of wiring
- Reduced operation cost

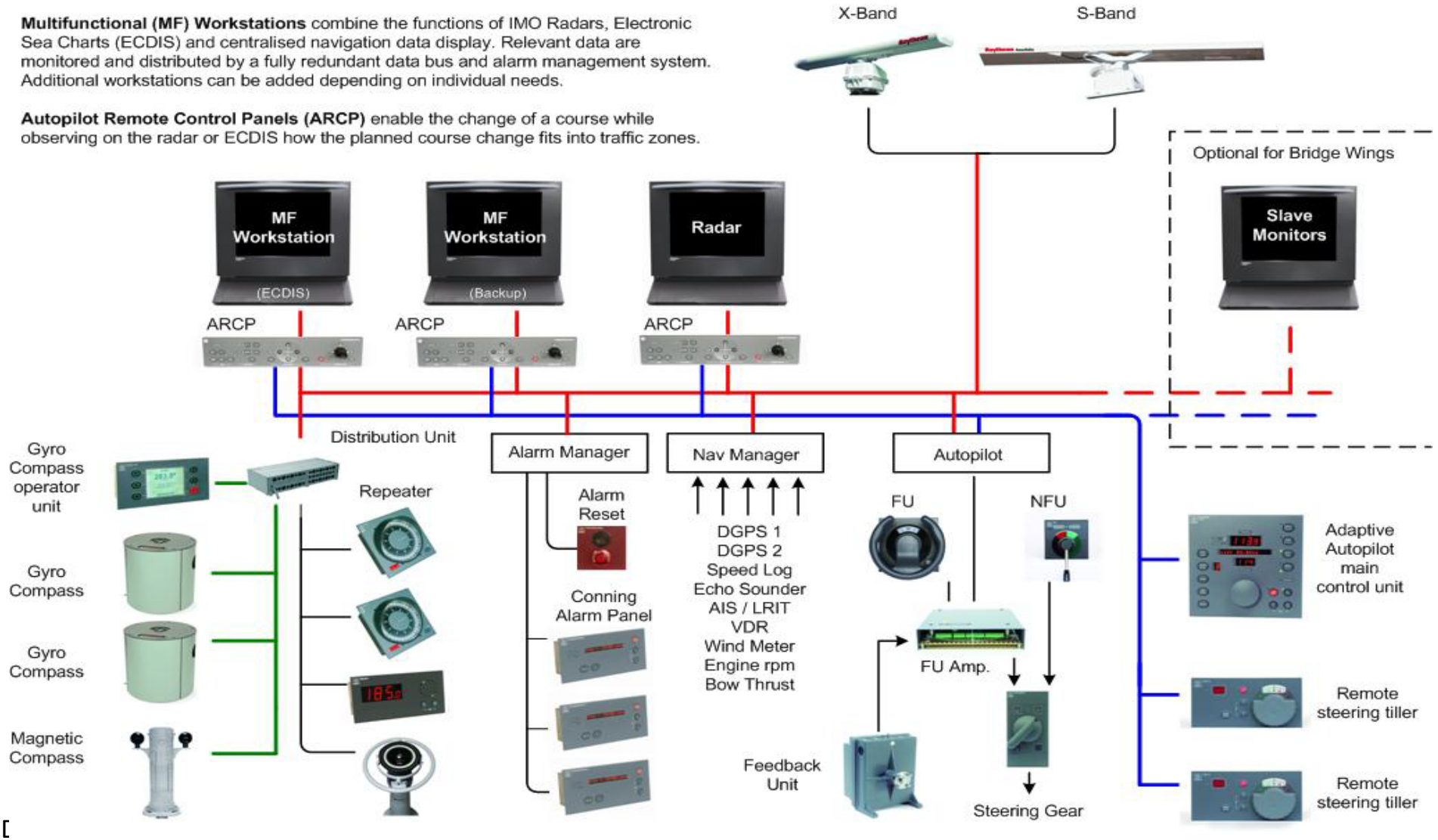

simple cabling
standardized interfaces
more data exchange
more functions
easier service
Antennas
Radars
ECDIS
Conning
Alarms
Raytheon Anschütz IBS
Gyro Compasses
Satellite Compasses
Steering Control
Auto-pilots
AIS
VDR
Other Sensors

Raytheon Anschütz Integrated Bridge System

Example of a System Configuration

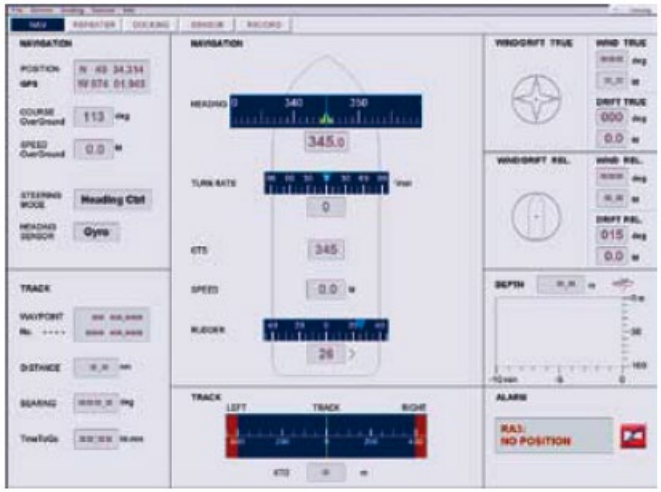
Multifunctional (MF) Workstations combine the functions of IMO Radars, Electronic Sea Charts (ECDIS) and centralised navigation data display. Relevant data are monitored and distributed by a fully redundant data bus and alarm management system. Additional workstations can be added depending on individual needs.

Autopilot Remote Control Panels (ARCP) enable the change of a course while observing on the radar or ECDIS how the planned course change fits into traffic zones.



Conning and Data Management

Docking display



Nav display

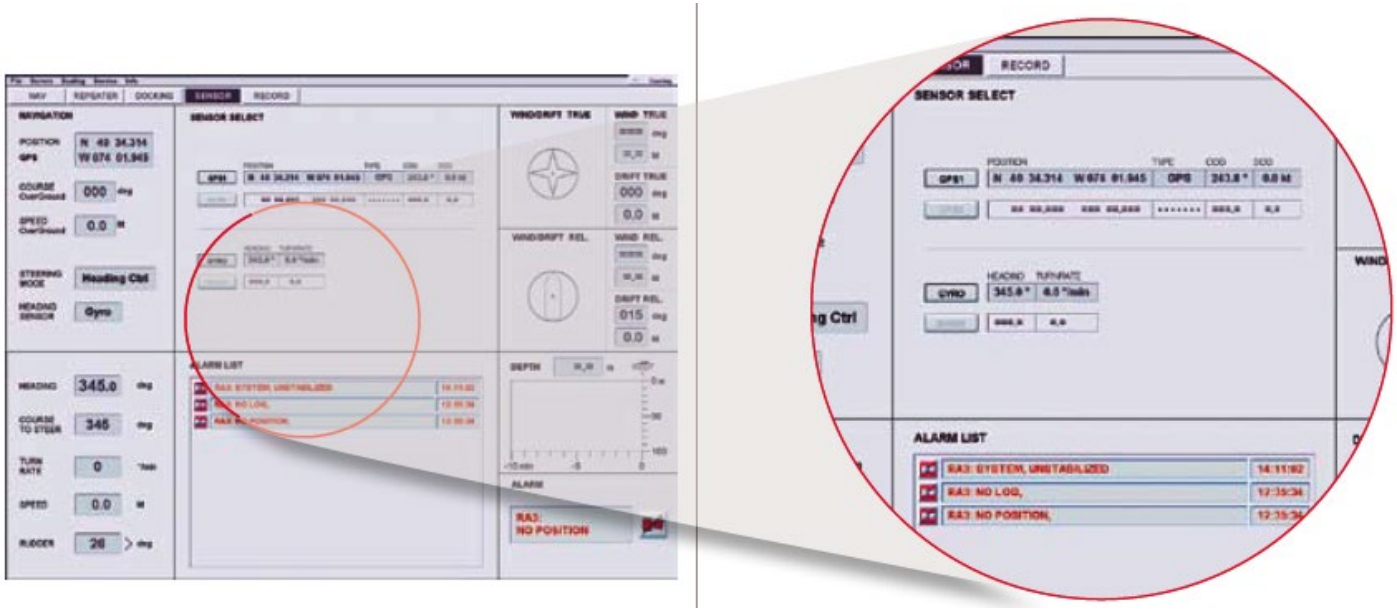
Conning

NautoConning® is the centralised navigation data display for the ship's command. It offers the comfort of having all relevant navigational data at a glance and hence contributes to safe navigation in accordance with operator philosophy. Various functions can be activated and configured by the operator as needed, depending on the situation and type of equipment.

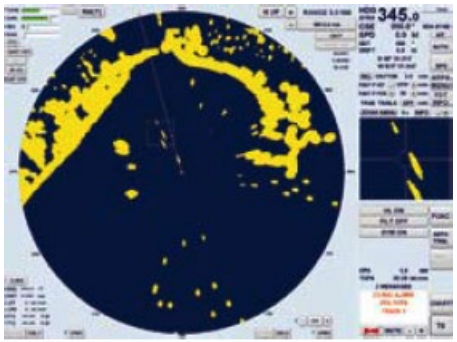
- Central display of navigation data
- Central selection of sensors
- Different display modes with respect to different manoeuvring situations
  (e.g. trackcontrol, docking, navigation)
- Recorder (heading, rudder angle, rate-of-turn, depth)
- Status indication for all devices and functions
- Ethernet connection
- Central printer
- Remote displays in bridge wings

Sensor selection and alarm management

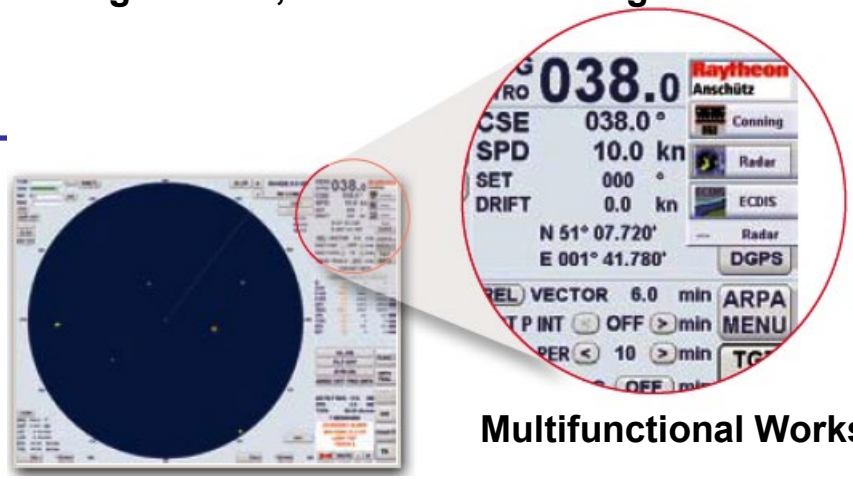
Alarm management within the bridge system comprises the handling, distribution and presentation of alarms and supports the bridge team in its tasks to identify situations and to take appropriate action.

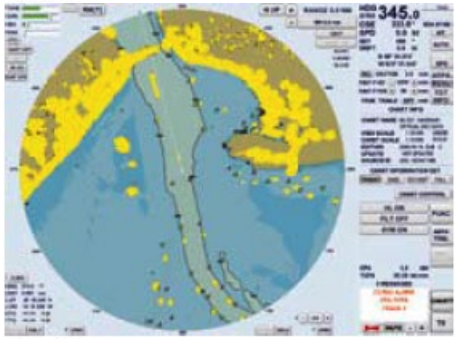


Multifunctional Systems including RADAR, ECDIS and Conning

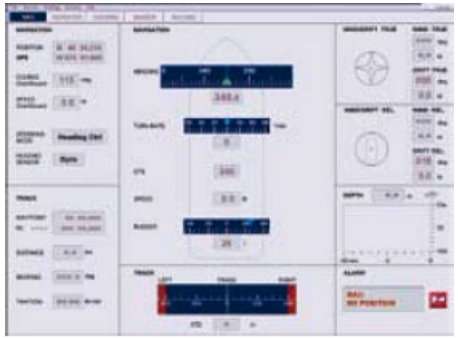


Radar

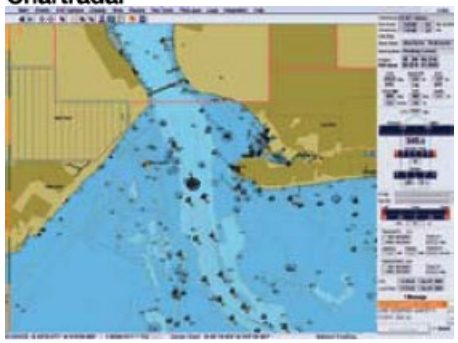




Chartradar



Conning



ECDIS

Multifunctional Workstations

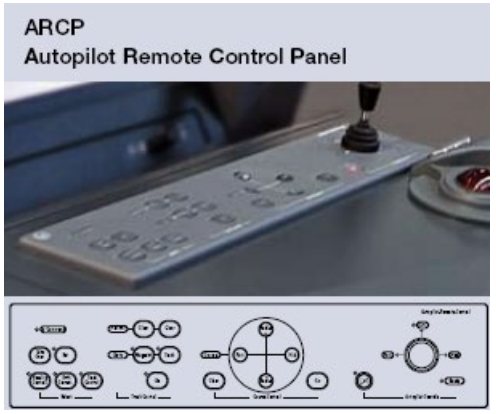
- For precise, safe and easy operation
- They combine and integrate the functions of RADAR, ECDIS and customised centralised navigation data display **<u>at one dedicated position</u>**. -> This enables full navigation data access at any place on the bridge.
- Easier watchkeeping increases safety at sea
- Redundancy of equipment leads to additional safety

Chartradar

- It presents ECDIS information to indicate where the ship is located with respect to shore lines, shallow water areas and traffic separation zones. -> This increases the efficiency during watchkeeping.

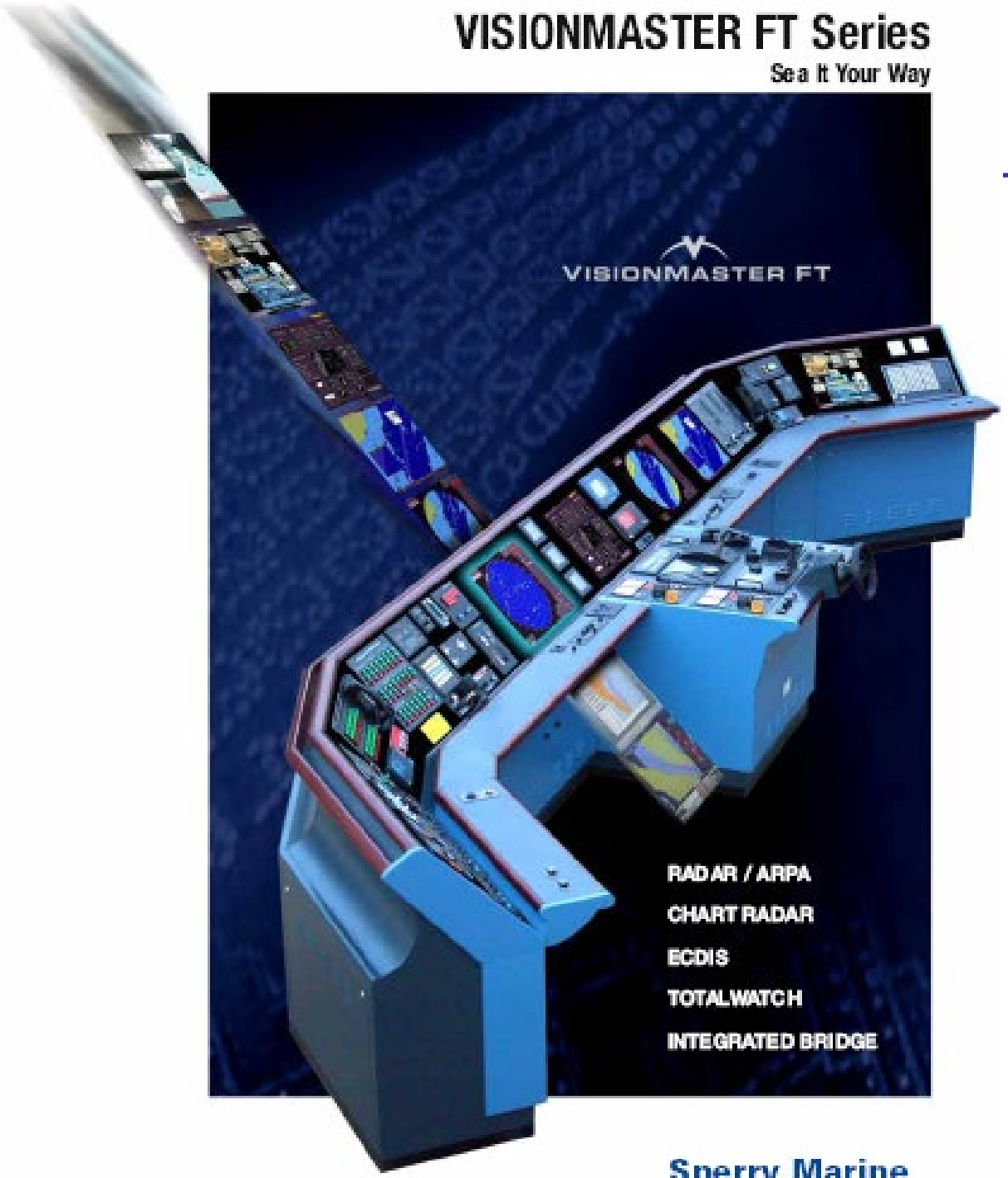
ARCP and Trackcontrol

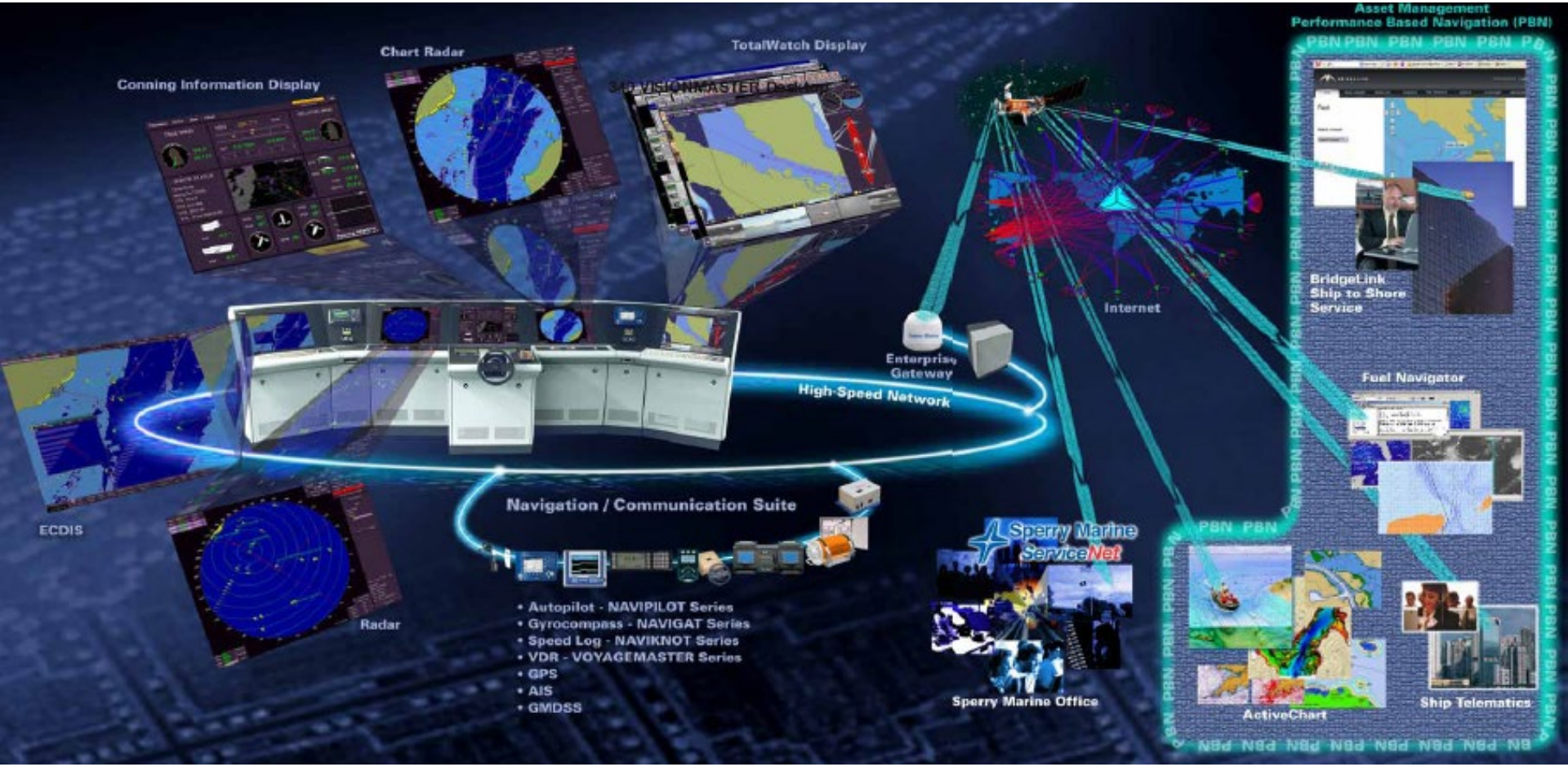
- Within the IBS the Autopilot Remote Control Panel (ARCP) enables Autopilot operation in front of Radar or ECDIS.
- This unique function enables the change of a course while observing on the radar or ECDIS how the planned course change fits into traffic zones.



Sperry Marine IBS


BridgeMaster E
Radar #1
BridgeMaster E
Radar #2
VMS/ECDIS
Navigation Station
Central Control Station
• NaviPilot 4000 Autopilot • Conning Display
• Main Engine & Thruster Controls
• Steering Controls • Communications
VMS/ECDIS
Planning
Station
Steering Stand
• NaviPilot 4000 Autopilot
• Helm
• Mode Switch
• System Switch
• NFU Override
SeaNET VT
GPS/AIS
Positioning System
Chart Table
Machinery
Monitoring &
Alarm Station
Voyage Data Recorder
Nav Sensors
• NaviGat X MK1
• NaviGat 2100
• SRD 500
• NaviKnot 400
• GPS/DGPS
• Depth Sounder
• Weather Station
Vessel Optimization &
Safety System (VOSS)
• Weather Workstation
• Route Optimization
• Sea-Keeping
• Hull Monitoring
GMDSS Communication
Console
Engine Room Gateway
Bridge Wing Console
• Docking Display
• Main Eng. & Thruster Controls
• Steering Controls


VISIONMASTER FT Series
See It Your Way
VISIONMASTER FT
RADAR / ARPA
CHART RADAR
ECDIS
TOTALWATCH
INTEGRATED BRIDGE
Sperry Marine


Asset Management
Performance Based Navigation (PBN)
Conning Information Display
Chart Radar
TotalWatch Display
Internet
BridgeLink
Ship to Shore
Service
Enterprise
Gateway
High-Speed Network
Fuel Navigator
ECDIS
Radar
Navigation / Communication Suite
• Autopilot - NAVIPILOT Series
• Gyrocompass - NAVIGAT Series
• Speed Log - NAVIKNOT Series
• VDR - VOYAGEMASTER Series
• GPS
• AIS
• GMDSS
Sperry Marine
ServiceNet
Sperry Marine Office
ActiveChart
Ship Telematics

Samsung NARU-2000 Navigation System

- Samsung Digital Control Systems, a division of Samsung Heavy Industries of Korea, is Korea's leading manufacturer of integrated automation and navigation systems.
- These totally integrated systems include: power management systems, machinery plant automation and control and integrated bridge systems.
- As the North American service agent of Samsung, Mackay's Service Engineers are factory trained to provide quality service and product support for Samsung equipment.

FEATURES

- Microsoft NT based operating systems
- Expert design team
- Worldwide service network
- Quality Components
- Reliable Products

Raytheon Integrated Bridge System (IBS)

- The synergistic design teams from Raytheon and Anschütz, two worldwide leading manufacturers of shipboard navigational equipment, has resulted in an advanced Integrated Bridge System.
- The modern, flexible design can satisfy all ship's bridge navigation and operating requirements. The user-friendly technology, designed for one-man-bridge operation, reduces workload and stress. The Raytheon “bridge concept” promotes the goal of improving safety, efficiency and operational economy through functional integration of Radar, ECDIS and Track Controller.

  TARGET MARKETS: Deep Sea Commercial and Naval Vessels

FEATURES

- Pathfinder®/ST MK2 Radar/ARPA Systems & ECDIS
- GMDSS Station & Radio Consoles
- NautoPilot® 2000, NautoConning® & NautoSteer® Standard 20 Digital GyroCompass
- Wind Meters & Weather Facsimile
- Speed Logs, Alarm Units & Echo Sounders

JRC Ocean Explorer – Integrated Bridge System (IBS)

JRC's Integrated Bridge System, the Ocean Explorer, is comprised of JRC's high performance navigation and communication products, resulting in optimum navigation programming and automatic navigation for each type of ship, thus ensuring economic and safe sailing, while supporting the One-Man-Bridge operation.

- TARGET MARKETS: Deep Sea Commercial and Naval Vessels

FEATURES

- ECDIS and Auto-Pilot system interfaced to provide intelligent and efficient maneuvering performance, meeting requirements of ANTS.
- Radar/ARPA communicate course position, speeds and other numerical/symbolized data of local ship and other vessels in proximity; overlaid on easy-to-read color radar screen.
- Conning Display provides a comprehensive overview of the ship's position, course, speed, rudder angle, rate-of-turn, propeller revolution, wind and drift.
- High definition ECDIS enabled with same page Raster & Vector charts, automatic Navtex markings and ENC (Electronic Navigational Chart) updates via Inmarsat-B communications.
- IRCS (Integrated Radio Communication System) allows centralized control of all radio communication equipment from a single station.
- HSD (High Speed Data) multi-media technology via Inmarsat-B benefits ship owners and crew with high speed file transfer, real time medical diagnostics, video conference, image file exchange and ISDN I
- Fleet Management System Software

Furuno Voyager – Integrated Bridge System

- FURUNO has invented a new way of integrating the bridge for the modern sea-going vessel. The Voyager is an Integrated Bridge System (IBS) that networks proven reliable Furuno bridge components including ANTS, ECDIS, Radar/ARPA's, automatic steering and communications equipment in accordance with One Man Bridge Operation.
- Combining these innovative communications and navigation technologies in a modular console design, tailored to each vessels wheelhouse, provide navigation efficiencies, better system integration, route planning, collision avoidance features and economics of operation.
- TARGET MARKETS: Deep Sea Commercial and Naval Vessels – modular design eases installation on new builds or existing vessels.

FEATURES

- Route planning and monitoring via integrated “check & balance” between ECDIS, ARPA/radar overlay display, grounding prevention, weather systems, etc., according to “Waypoint-based” navigation
- ANTS integrated adaptive steering control for economic “planned-route” point-to-point navigation, interfacing dual gyros, rate-of turn inputs, speed logs, navaids, radius & track steering.
- Navigational data displayed on 21" high resolution color centralized conning display.
- Communications equipment for safe ship-handling and transmission of pertinent operations data including VHF/DSC radios, Inmarsat connection for routine and distress communications, Navtex receiver, EG
- Fully interswitched X- and S-band system provide optimum target detection using video signal processing technology, with data link to ECDIS; exceeding IMO standards

TRANSAS Integrated Navigation System*

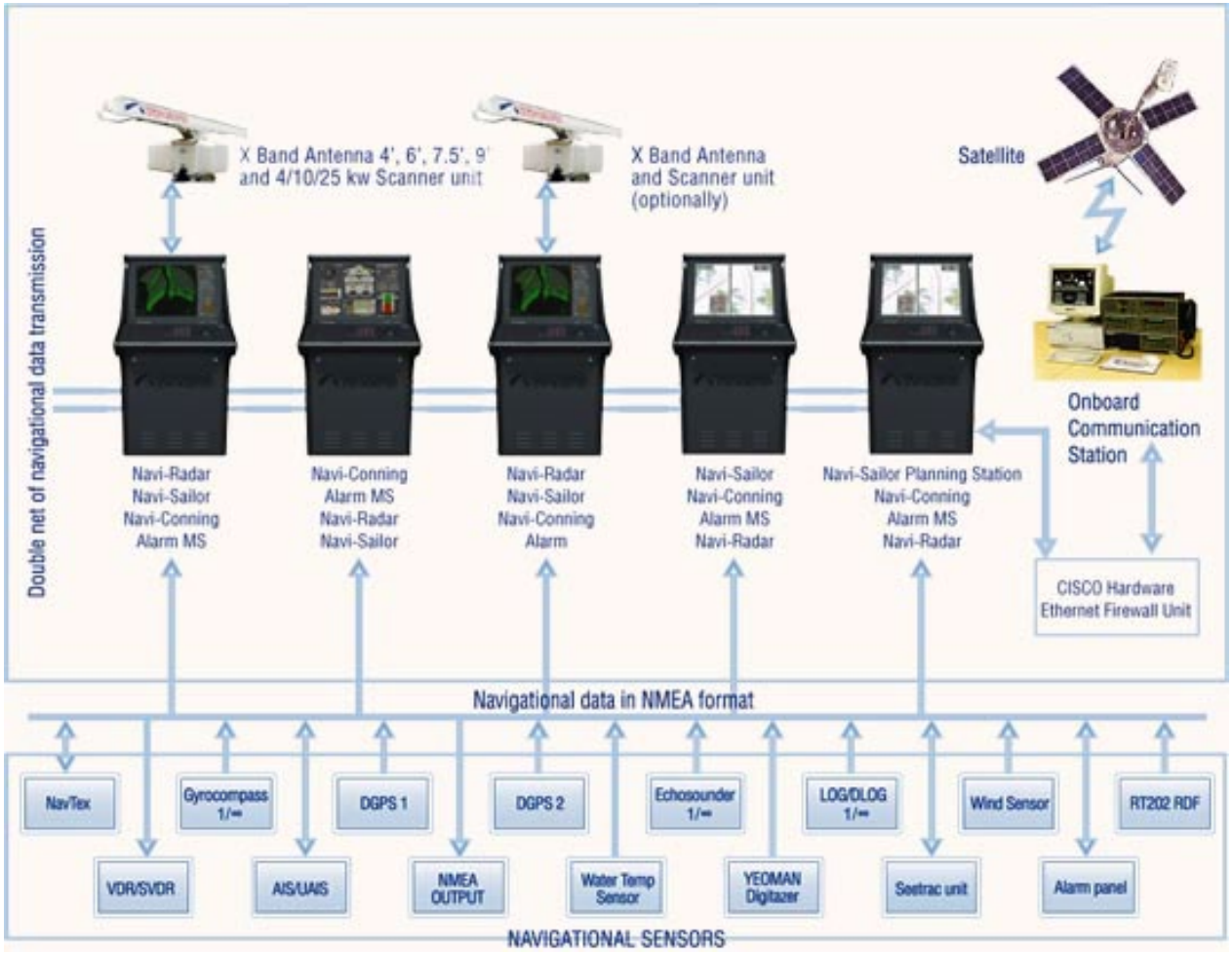
Integration benefits

- Navigator-friendly environment for One Man Bridge operation reduces workload and stress
- Enhanced functional integration of navigational data
- Master Station status changeover to any INS station
- X-Band or S-Band Scanner control takeover to any INS station with Radar Application
- Sensor redundancy and double network ensuring data integrity and reliability
- Integral monitoring of essential navigational data quality
- Intelligent and efficient alarm management
- Chart correction, route and user database synchronization at all workstations and applications
- Distribution of radar pictures from all available radars within INS
- Configuration Display utility for real-time presentation of system hardware and software component status
- Online ordering of charts, charts corrections and weather forecasts via ship communication

* www.transas.com

Transas Integration System gives...

Multifunctional display



- Every Transas INS Workstation (WS) can be equipped with a standard set of software such as ECDIS, Radar, Conning, Chart Assistant utility, SPOS weather module and Alarm Monitoring System (Alarm MS) with simultaneous execution
- Ability to execute all aforementioned tasks simultaneously as part of the Multifunction Display

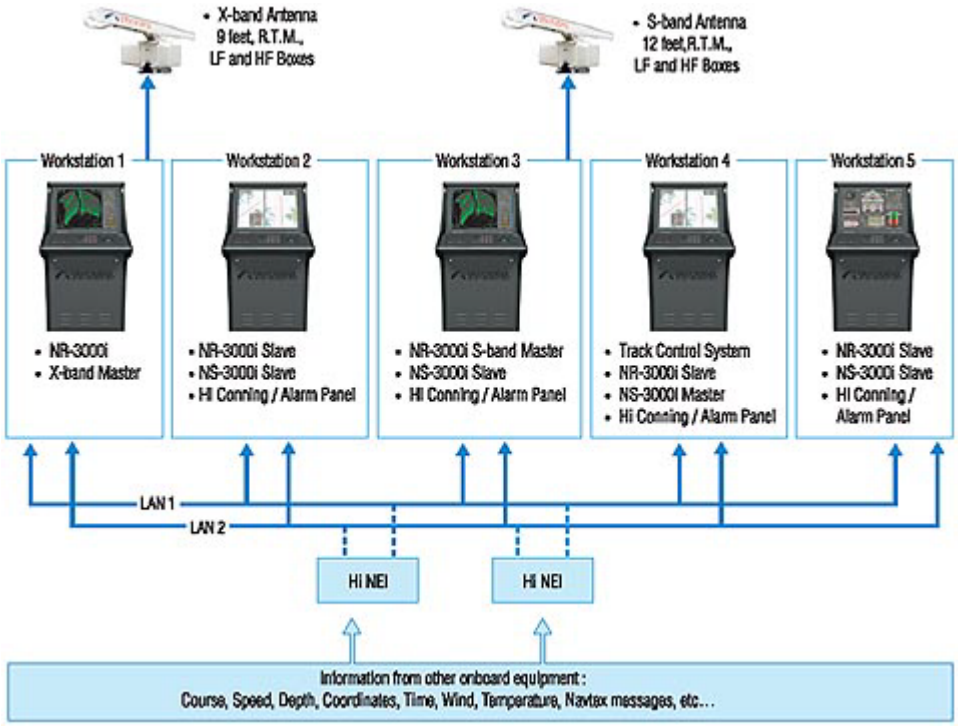
Hyundai Transas intelligent Bridge System (INS Class C)

- Hyundai and Transas developed an efficient and cost effective intelligent bridge system, the use of which brings a number of essential benefits to navigating personnel and has a positive impact on improving ships' overall operation and safety of navigation.
- The purpose of an integrated navigation system (INS) is to provide an "added value" to the functions and information needed by the OOW to plan, monitor or control the progress of the ship. The achievement of the following high-level requirements was the leading force for HTiBS product introduction and this is seen as "added value" of the INS.

HTiBS Principally New Features

- Enhanced level of functional integration of navigational data, databases and ship's particulars. All the data on the bridge is equalized.
- Simultaneous execution of applications on one workstation with easy switching between them.
- Flexibility of configuration and an extensive ability to connect/integrate with the external hardware and software.
- Use of synchronized double network for "Hot Backup" in the case of hardware failure.
- Close control of received data quality. Time and position synchronization at all the workstations.
- Intelligent and efficient alarm management aiming to support a safe level of situation awareness for the navigator and to reduce workload and stress resulting from non-synchronized alarm generation by equipment.

Structure Description



- HTiBS design is based on 3 levels of components or systems connected:
- sensors;
- connectivity, processing and human-machine interface;
- control systems.
- Sensors and control systems are not normally part of INS but just connected equipment with the minimum or no modification in order to ensure proper integration.

e-Navigation – the current way ahead

e-Navigation – Definition:

… is the harmonised

- collection,
- integration,
- exchange,
- presentation and
- analysis

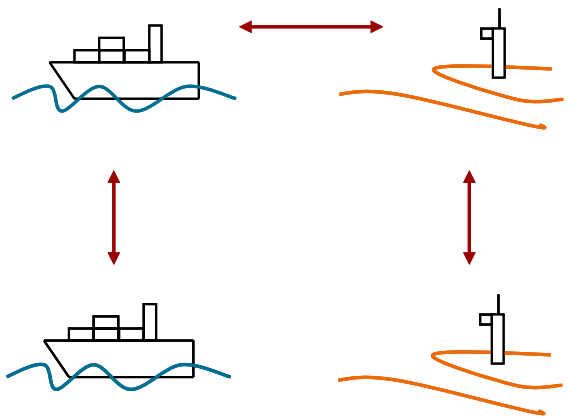
of maritime information **onboard** and **ashore** by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment. (NAV 53, 2007)

e-Navigation – the way ahead

- Today, the concept is living and known as **e-Navigation**.
- The title a misnomer in many ways, as it is not specifically about electronic technology, nor just about navigation. But the term is being used by the IMO, IALA and other organisations to refer to a link up of the range of marine monitoring and communication tools made available by technology development over recent decades, but keeping a focus on the requirements of the users, both on vessels and ashore.

Onboard-based

Modules and systems for the support of the officer of the watch and are integrated with own ship sensors, supporting information and standard user interfaces



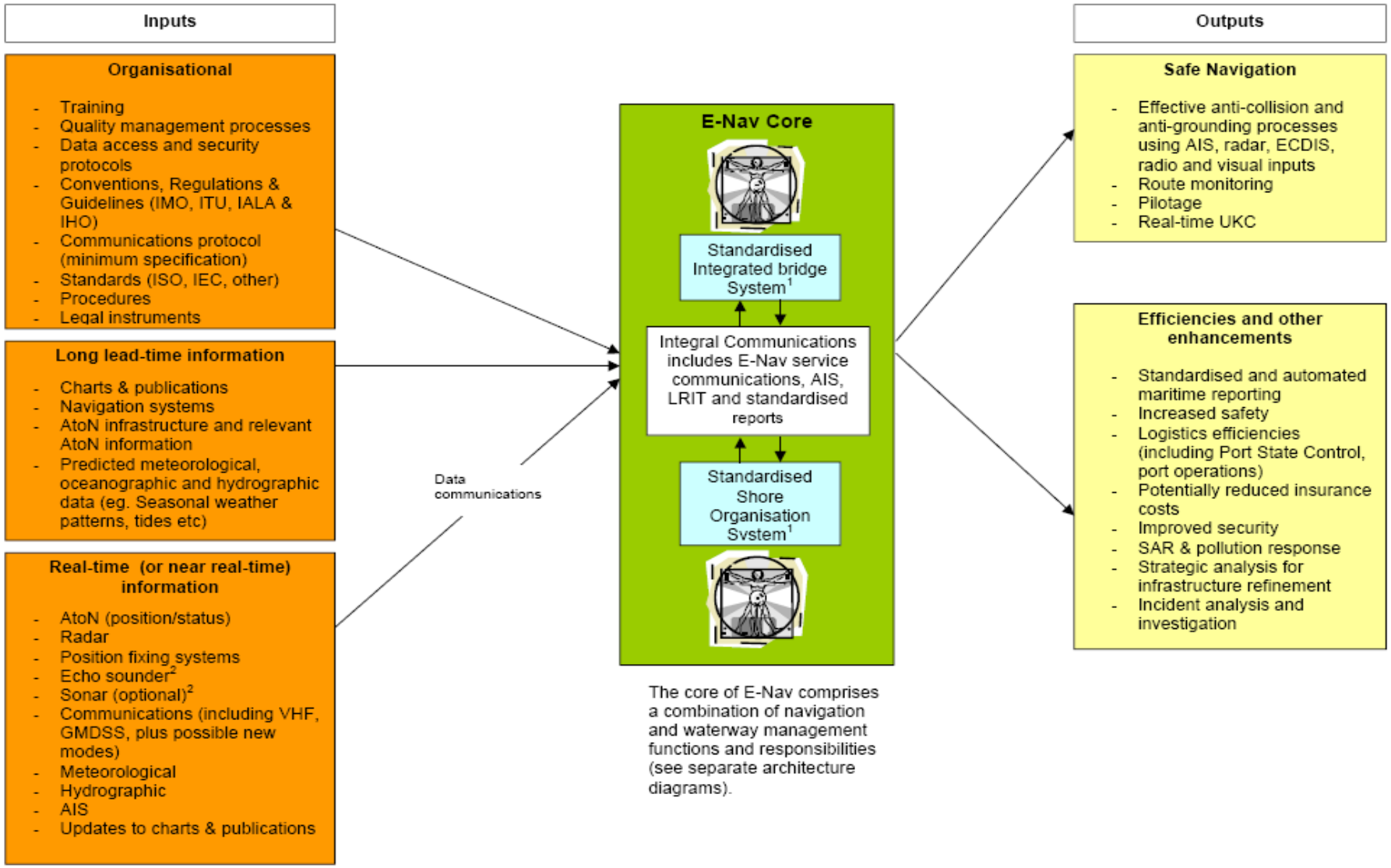
Shore-based

Systems to support enhanced vessel traffic management and other related services e.g. through better provision, coordination and exchange of comprehensive data

Communication

infrastructure providing authorized seamless information transfer

A Descriptive Model for E-Navigation



1. Systems to have appropriate redundancy, backup and individual integrity
2. Ship specific

e-Navigation – and INS

e-Navigation Underway - Conclusions

Bridge solutions

12. An e-Navigation bridge environment should provide for value added applications guided by design principles rather than regulations to encourage innovation.

13. INS is a possible basis for the future development of on board e-Navigation. Use could be made of the IMO modular approach used in the INS performance standards.

14. INS could be a core platform on the bridge enabling the addition of specialized applications that may be required by specific users and in particular regions.

15. There is a need to start the process for INS carriage requirement. This should be a part of the e-Navigation strategy implementation plan.

e-Navigation – and INS

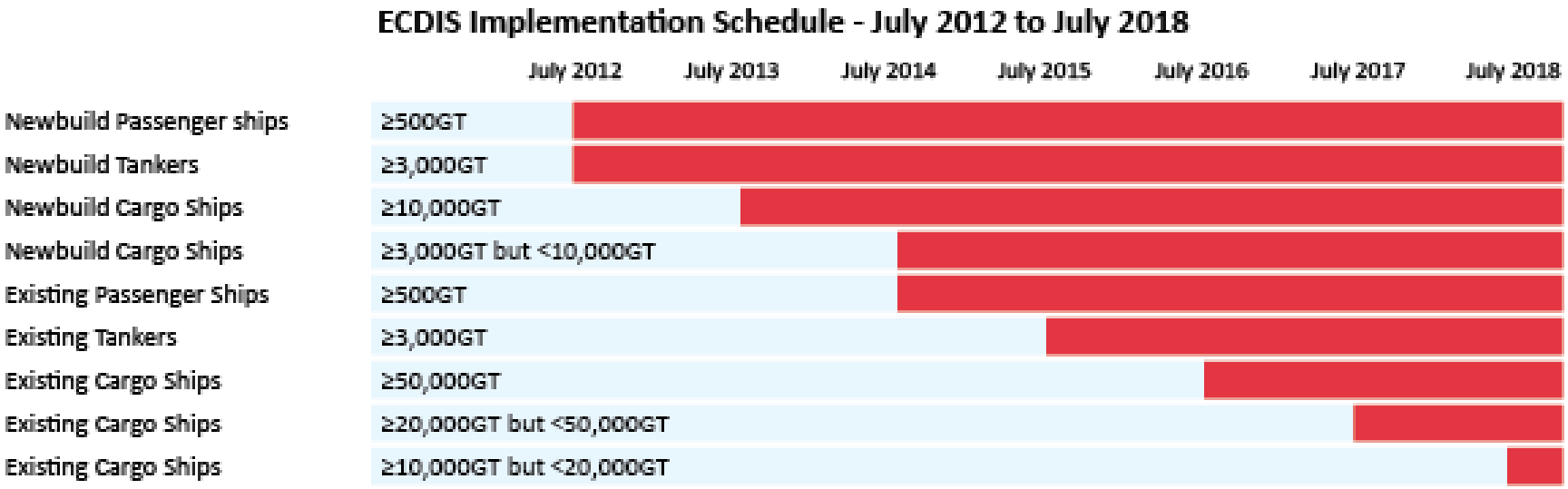
- e-Navigation key elements onboard:
  - ECDIS (Display)
  - INS/IBS
  - AIS (Communication & Navigation support)

- When **automatic identification system (AIS)** technology was made mandatory by the IMO, the legislation was rushed in, with little thought to how it would actually be used by the bridge team. The industry even began to talk of AIS-assisted collisions, as navigators took to relying all too heavily on a technology they did not fully understand.

ECDIS – A few basic facts

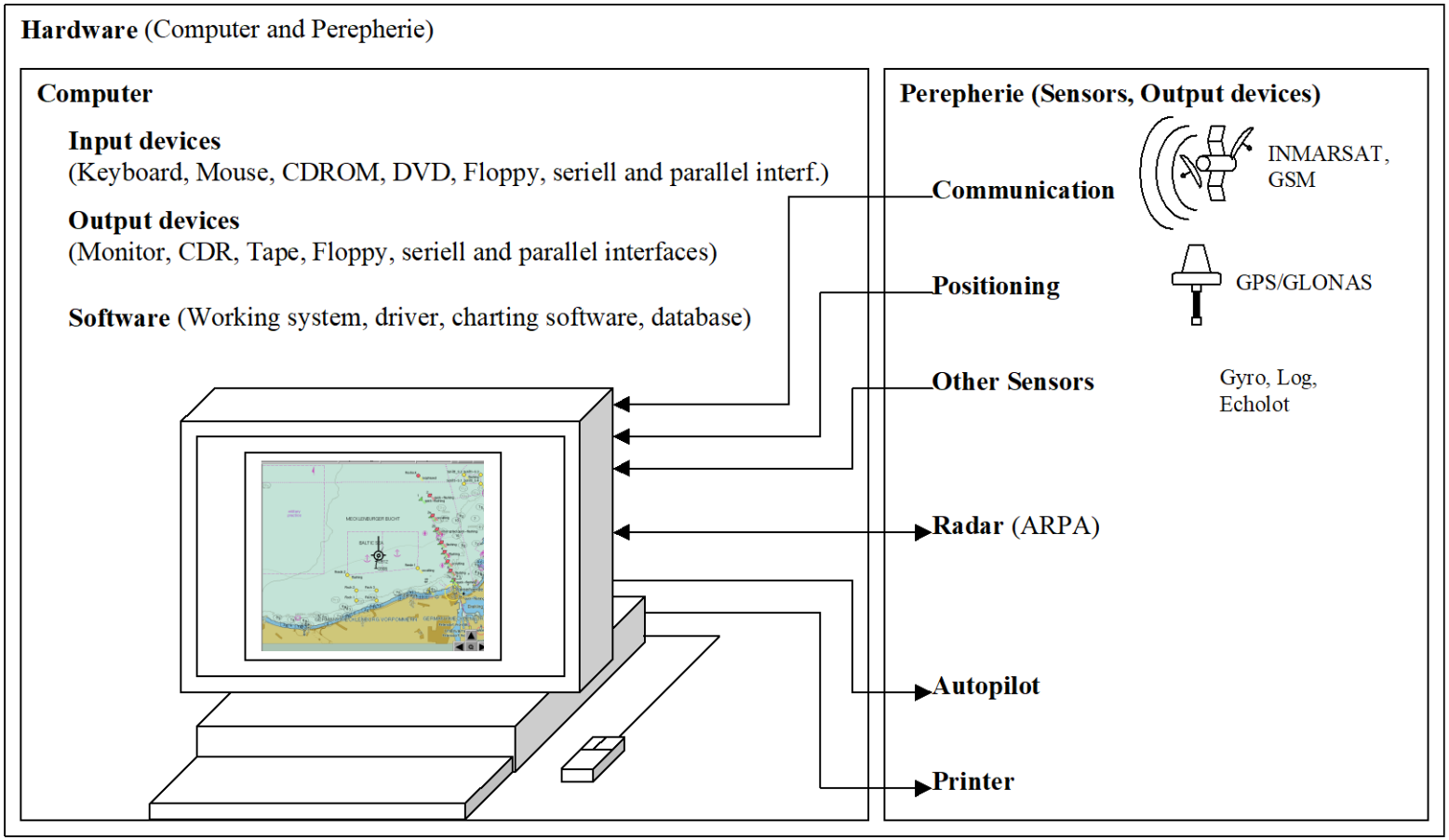
IMO - Solas Chapter V Regulation 19.2

The amendment requires ships engaged on international voyages to be fitted with ECDIS according to the following schedule:



ECDIS – A few basic facts

ECDIS consists of Hard- and Software



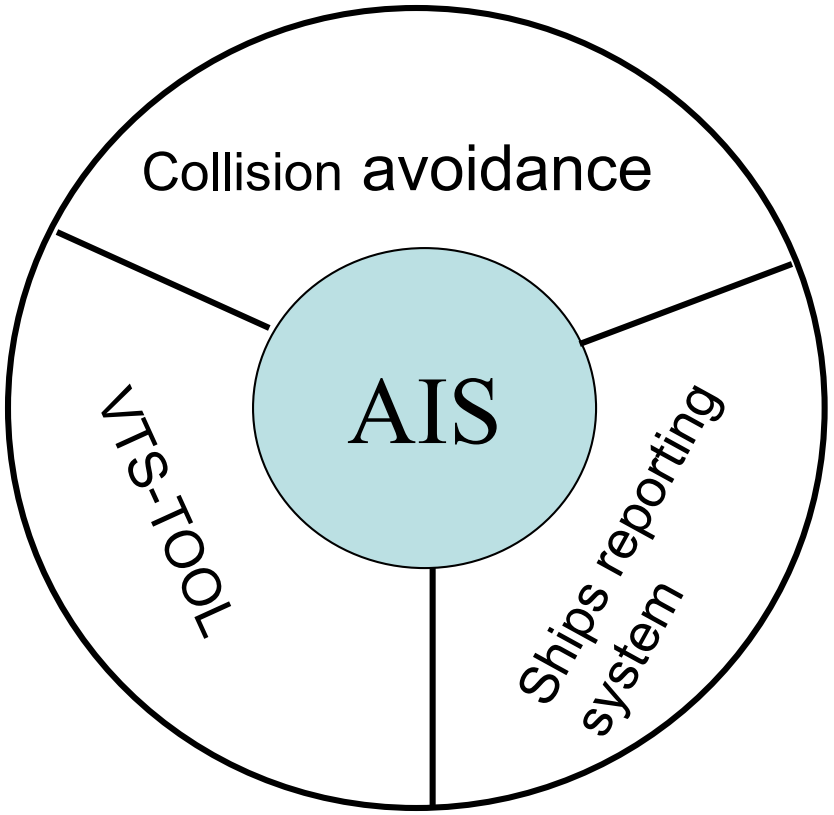
AIS – A few basic facts

According to SOLAS chapter V, Regulation 19

- AIS shall:

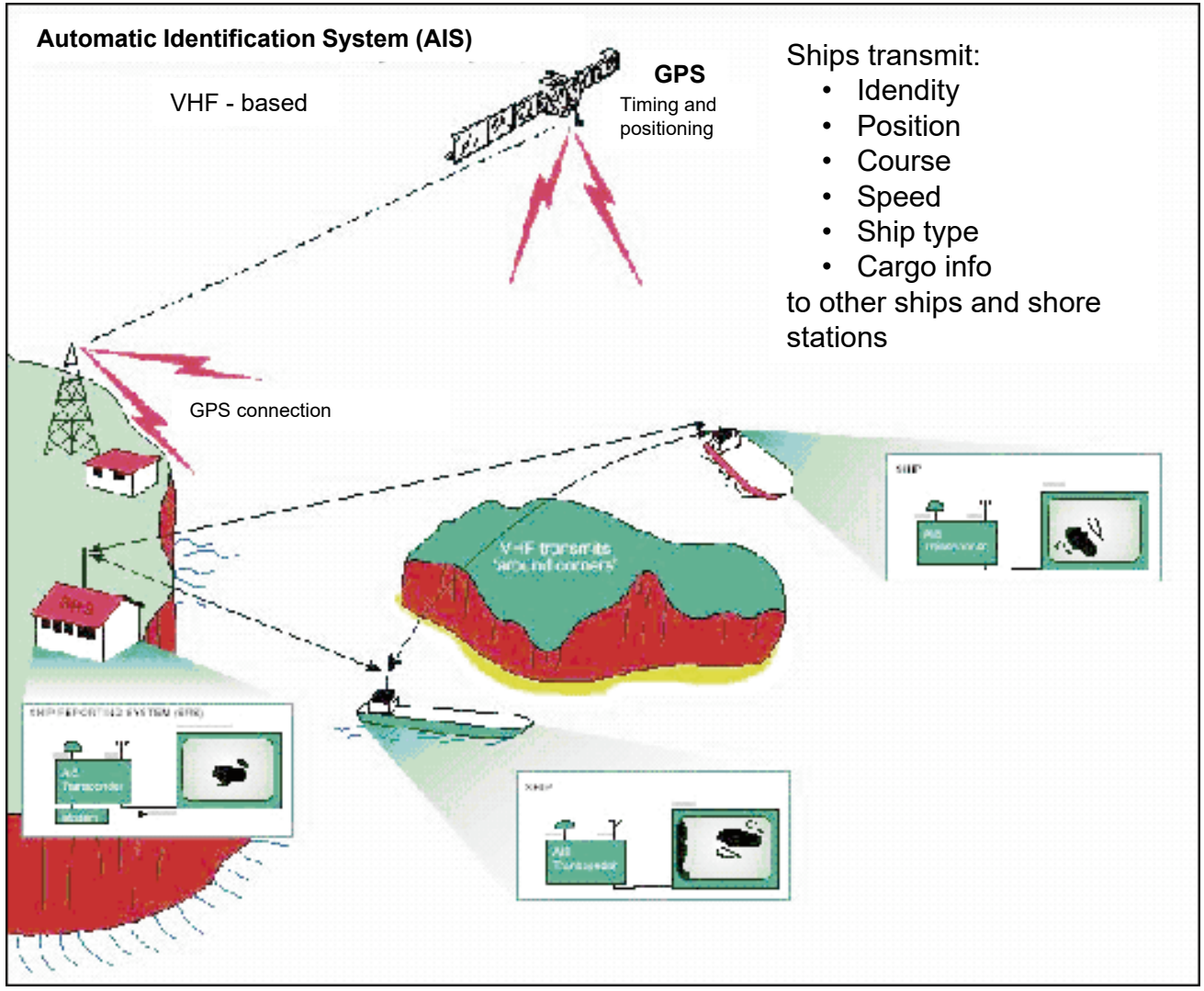
  - provide automatically to appropriately equipped shore stations, other ships and aircraft information, including the ship's identity, type, position, course, speed, navigational status and other safety-related information;
  - receive automatically such information from similarly fitted ships;
  - monitor and track ships; and
  - exchange data with shore-based facilities.

AIS – A few basic facts



1. AIS as an autonomous mean to enhance on board collision avoidance
2. AIS as a supporting tool independent from RADAR, to gain on board and in VTS centres ashore the traffic image
3. AIS as a tool for the Ship reporting systems, SAR-centres aso.

AIS – A few basic facts



Ships transmit:

- Idendity
- Position
- Course
- Speed
- Ship type
- Cargo info

to other ships and shore stations

On the Horizon:

MASS and Shore-based Services

IMO's e-Navigation initiative and the Future of VTS

Core elements - technology

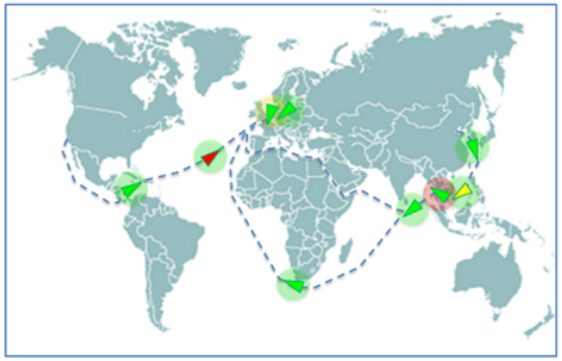
- Monitoring
- Guidance and Control
- Routeing

Shore-based monitoring from a FOC … RCC

Source: www.interschalt.com

Shore-based monitoring from a FOC … RCC

Draft Operational Concept – RCC



All ships overview projection

Top flags for all ships

Ship 5

ECDIS

Ship 5

Timeline

Ship 5

Switch board

Ship 5

Conning screen

Ship 5

Video/Radar/
CCTV/Weather
/Ship status

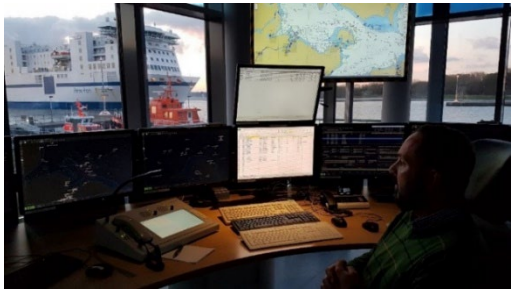
Aux. screen

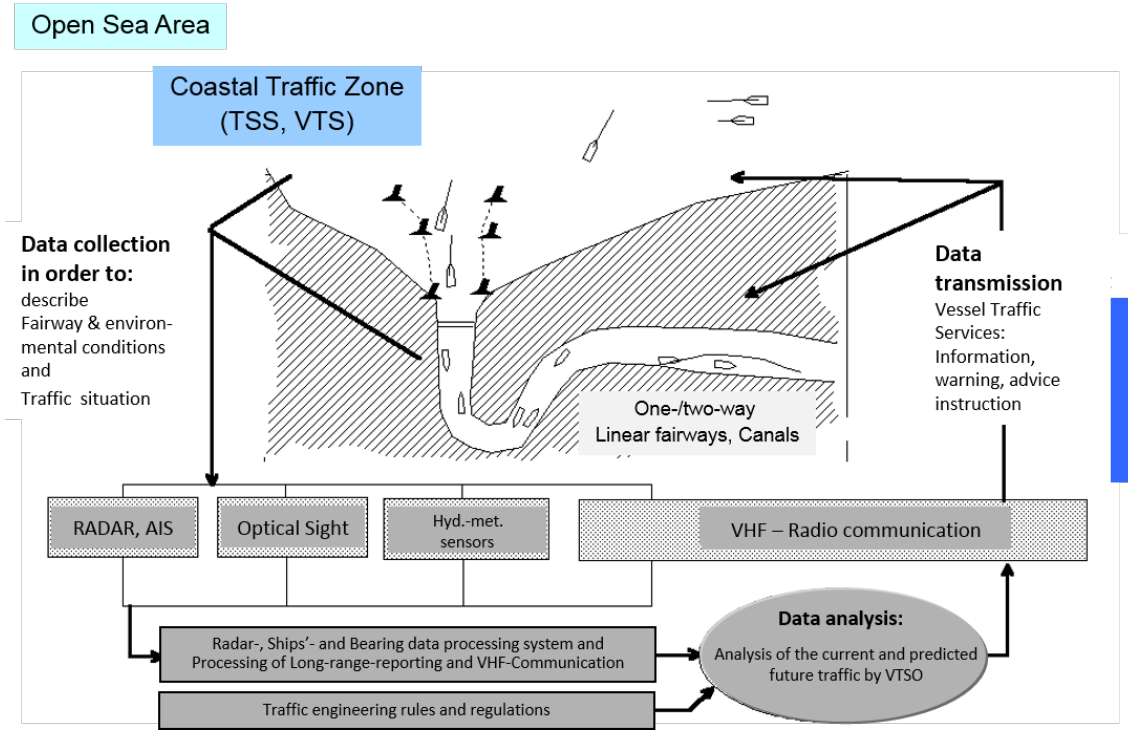
Operator

On the Horizon – MASS and Shore-based Services

Safe and Efficient Maritime Transport

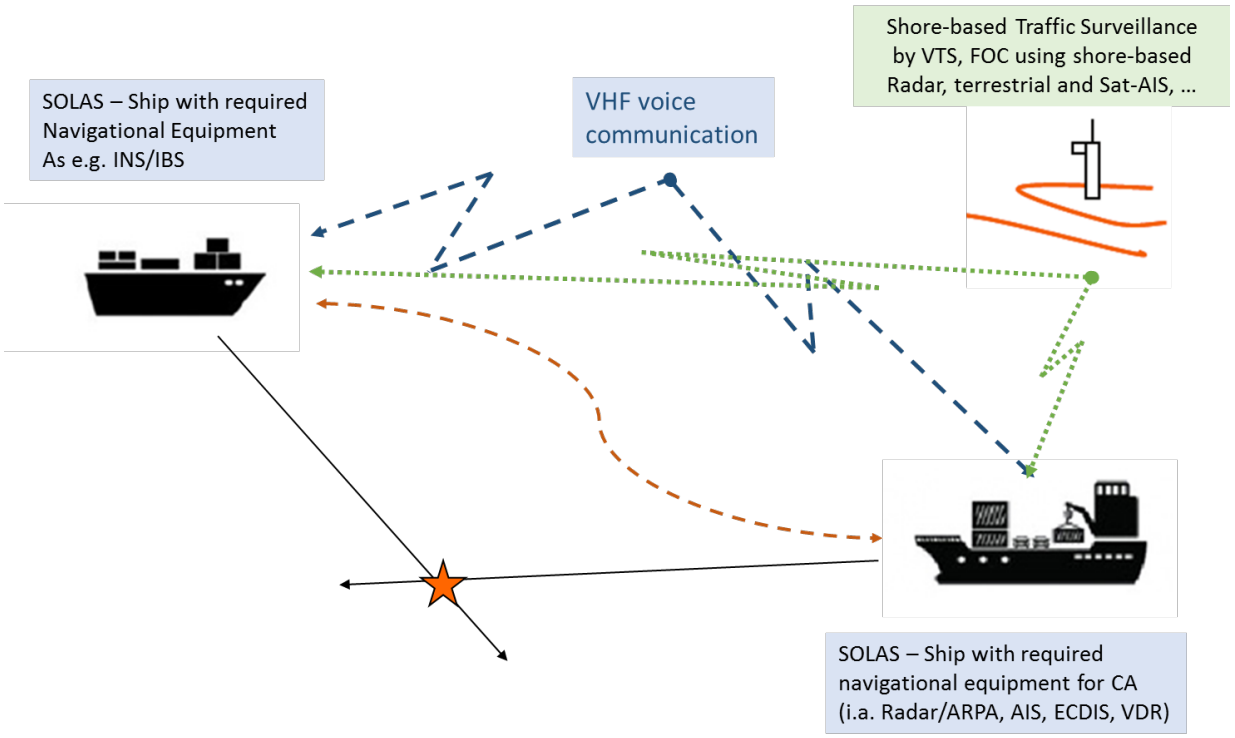
- Vessel Traffic Services (VTS) -





On the Horizon – MASS and Shore-based Services

A potential future scenario (2) including shore-based monitoring
e.g. in Coastal Areas with VTS coverage – current situation



1 Data acquisition for Target detection
- Observation of sea area around the ship (visual and acoustic)
- Supported by i.a Radar-ARPA, AIS
- …

2 Target identification
- AIS and VHF voice communication
- Assessment of RoC according to COLREG, situation dependent parameter and criteria (constant compass bearing, safe passing distance, target range, …)

3 Decision making
- Action according to COLREGS

That’s all folks ;-)

Thank you for your attention!