Integrated Bridge Systems – Turnkey solutions from one supplier

RAYTHEON ANSCHÜTZ Every third new ship built today is outfitted with an Integrated Bridge System, tendency increasing. Although according to the rules of the IMO, the one-man bridge watch is still only permitted during the day and under good visibility conditions, more and more shipowners are specifying Integrated Bridge Systems for their newbuildings. Not so much reduction of personnel is in the foreground, but rather additional accident avoidance safety.

As early as the beginning of the 90's, DNV (Det Norske Veritas, Norway) was the first classification society to define how an „Integrated System" should look: Under the designation W1 a new classification was developed for vessels with one-man bridge systems, with detailed regulations for ergonomics, instrumentation, documentation and training. The one-man bridge according to DNV-NAUT-AW is viewed by shipowners today as being synonymous with a high standard of safetv.

Uniform operation for all Anschütz navigation devices

Under the name BridgeControl® Raytheon Marine in Kiel, in close co-operation with classification societies, shipowners and shipyards, has developed a new total concept for the one-man bridge which is based on five principles:

- Ergonomics
- Automation of navigation
- Monitoring
- Safety and redundancy
- System support.

Ergonomic considerations mainly affect three aspects: the arrangement of working places, the instrumentation and the operability of the equipment itself. The watch officer spends a large part of his bridge watch at one central place of work and needs an all-round view from this position, if possible without blind spots. This means: setting up the work place in a sort of bay window which minimizes the number of blind spots; furthermore there should be no additional rooms or stairwells in the rear area of the bridge. Nowadays a good number of shipyards decide upon the navigation system first and then construct the bridge to fit it. The proper arrangement of the instruments is determined in agreement with the shipowner and also conforms to detailed regulations which prescribe which equipment and information must be available at which work places. DNV requires, for example, the work stations for the NAUT-AW set-up. The installation place and maximum distance of the instrument from the watch officer's seat depends on the function of the equipment: Some devices must be operated from a sitting position; for others it is sufficient for the watch officer to stand up to operate them. In the planning phase for building a ship, the classification society already checks the arrangement of the desks, all-round view and arrangement of the instruments. For each vessel a special individual trial run of the bridge is carried out after the regular trial run. During this Det Norske Veritas (DNV), unique to a classification society, not only checks the function of the instruments but also the safety and convenience of all work processes of the bridge watch. Therefore each one-man bridge according to NAUT-AW is an individual tailor-made system. For the ergonomics of bridge systems, the uniform operating philosophy realized for the first time two years ago by Raytheon Anschütz brought the decisive breakthrough: From the gyro compass to the handwheel and autopilot on up to radar and ECDIS, all units have standardized key fields, displays and menus. All operating units are self-explanatory. The new operating concept was made possible by the fact that Raytheon Anschütz now develops and manufactures all major components itself in Kiel: gyro compasses, rate-of-turn indicators, autopilots, steering gears, rudder position indicators, RADAR's and ECDIS.

NautoConning: All navigation data and alarms at a glance

High-accuracy track control

Developing the concept as a whole results in a number of functional advantages, for example track control and the central alarm monitoring. Raytheon Anschütz now offers a track control system which is able to guide a ship fully automatically along a track with an accuracy of 20 meters (based on a position accuracy of six meters). Several years of experience with the track pilot NautoPilot 2035 on various types and sizes of vessels and under differing load conditions have shown that this accuracy is maintained not only on straight route sections but also during the track change. The track control system, also called „Au-

Anschütz Integrated Bridge System BridgeControl®

tomatic Navigation and Track Keeping System (ANTS)", comprises five elements:

- electronic sea chart,
- separate route planning station with digitiser,
- position receivers,
- autopilot and
- conning display.

As soon as track control is started, it proceeds independently and the watch officer can concentrate entirely on the traffic. Shortly before each heading change point is reached, the system delivers two messages: the „Approach Alarm", six minutes before the beginning of the heading change, checks the attentiveness of the watch officer. If this alarm is not acknowledged, the alarm transfer system alarms captain, officers, ship's office and mess hall. Immediately before beginning the turning manoeuvre, the „Wheel Over Alarm" is given. Here no acknowledgement is necessary; the turn begins and the ship is guided along the curved stretch of the route to the next track heading along the planned radius. The track control can be interrupted at any time with just one manipulation: An override tiller makes it possible for the operator to steer the ship by hand. If the track control is to be started again after such an intervention, two keys can be selected: „Return to Track" or „Steer to Waypoint". For the operator, RADAR's and ECDIS are supplied with an autopilot operator unit. Including override tiller. Thus interruption of track control and return to it are comfortably possible from every work place.

Monitoring of all processes

The conning display shows all navigation data from the track control process graphically at a central place in an easy-to-follow manner: track deviation, heading, rate-of-turn, speed ahead and lateral speed, rudder position, water depth, distance and course to next waypoint, wind and drift. A further important function of the conning displays is the alarm display. All system functions and satisfactory operation of all components of the navigation system are monitored. In addition, the conning display reports alarms and messages from the current navigation process: Off Course, Off Track, Dangerous Target, Shallow Water, Waypoint Approach, Wheel Over Point and Watch Alarm. If the watch officer does not acknowledge important alarms, the alarm transfer system forwards them to the captain and the living quarters. More alarms do not necessarily mean greater safety; it is well known that they can, under some circumstances, increase stress as well. In developing the system, therefore, special attention was paid to limiting the number of alarms to really important danger situations and to simplifying operation (acknowledgement). Raytheon Anschütz was the first manufacturer to create a truly integrated alarm monitoring system in which the alarms for the navigation equipment are not only centrally displayed but can also be centrally acknowledged. And the watch alarm is not only reset by pressing the reset key, but also through normal operation activities on all connected navigation devices.

Safety and redundancy

When we speak of integrated navigation systems nowadays, the question of redundancy pops up again and again. What happens if a component of an Integrated System fails? Here two points are to be considered:

- Are all important functions and devices doubly represented?

For one-man bridges it is now standard to have the following: 2 RADAR's, 2 gyro compasses,2 DGPS, 2 autopilots and 2 ECDIS. Sometimes the classification authorities require an automatic change-over in case of failure (gyro compass), sometimes manual selection (autopilot). Here the independently functioning individual components such as RADAR, ECDIS, gyro compass, autopilot can easily be doubled or even tripled and integrated into the whole system as modules.

- Does failure of one function lead to failure of other functions?

The Anschütz bridge system consists of autonomous devices which operate independently of each other. Disturbances or switching off of one device do not affect the other devices directly. Example: If the radar fails, the electronic sea chart is not disturbed and vice versa; if log or autopilot fails, conning and ECDIS of course continue working.

Documentation and system support

Besides ergonomics and equipment function, the classification societies put particular emphasis on documentation and operator training by the manufacturer. This is intended to ensure that the user can handle the system safely in any situation. Here the mere collection of individual operating handbooks is not enough; a true system guide is needed explaining how the devices work together and especially describing the operation of functions which affect the system as a whole. All effects of disturbances and failures are clearly depicted for an integrated system in the comprehensive „Failure Mode and Effect Analysis (FMEA)": Which system functions are affected in what form, if for example a DGPS antenna is damaged, the log is disturbed or a rudder angle feedback unit no longer moves? The detailed overview gives the user exact information about what the disturbance means for operation and what measures must be taken. A possible measure would be, for example, changing over to a second device. An Integrated Bridge System can help to save money every day. Because maintenance and repair is coordinated by one manufacturer. This guarantees speedy help and repair for the total system wherever a ship may be. Especially in the container trade, risk of downtime is a big problem for ship operators. If a large modern 12,000 TEU containership is three hours out of schedule, would require additional fuel worth 20,000 USD to get back into schedule. To have a competent partner for after sales service is the biggest driver for the current development towards more Integrated Bridge Systems.

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