

Distributed Navigational Alert Management

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ABSTRACT: The team of authors is engaged in the IMO corresponding group on INS / Alert Management and in national task groups primarily specialising in “Navigational Alert Management” matters. This presentation is based on the outcome of serious discussions carried out at different work group sessions in Germany and has been widely used as a guideline when details of an Alert Management concept are analysed (e.g. alert related communication and de-escalation strategies). A separate paragraph of definitions within this presentation describes “Function Alerts” which are not relevant for the navigational tasks carried out by the officer of the watch. Alerts appear to be nonrelevant because the subject under discussion whether their announcement should be automatically filtered out by a navigational module within an INS. This could be one effective method of resolution to minimise (the number of high priority) alerts.

1 PRESENTATION OF A CONCEPT OF A DISTRIBUTED ALERT MANAGEMENT
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Concept of a Distributed Navigational Alert Management

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and
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Fig. 2. Introduction of the authors

Fig. 1. Introduction of the authors

Introduction of

- a distributed alert management concept and
- the characteristic features of a strategy to minimise high priority alerts (i.e. **ALARM**)

⇒ The distributed approach is intentionally selected in order to identify:

- common requirements for the **alert related communication** and
- common requirements for the **re-evaluation of alert priorities**.

⇒ It seems feasible to apply this concept to centralised system structures in equal measure.

Alert management (introduction) 3

Fig. 3. Introduction of the subject-matter

Alerts on the bridge should be minimised

The purpose of an alert management

Alert management (introduction) 4

Fig. 4. The purpose of an alert management

The logical architecture of the alert management and the handling concept for alerts should provide the capability to minimise the number of alerts especially those on a high priority.

General requirement for an alert management

⇒ This can be achieved by generating and using "advanced knowledge" as a result of

- **information integration** and
- **functional integration**

Alert management (results of investigation I) 5

Fig. 5. Results of investigations

Examples of "advanced knowledge" from information integration:

- the present navigational situation
- the operational mode in use
- the navigational functions in use
- the essential navigational data required for each individual mode or function (in use)

open sea, confined waters ...

Heading Control, Track Control ...

target detection, collision avoidance, ...

Heading, Position, Speed Through Water, Speed Over Ground ...

Alert management (results of investigation II) 6

Fig. 6. Results of investigations

Examples of "advanced knowledge" from functional integration:

- concepts for integration of functions inside operation mode modules
- redundancy concepts inside INS

Module "Steering"

multi-sensor evaluation, ... e.g. module "Positioning"

Alert management (results of investigation III) 7

Fig. 7. Results of investigations

This "advanced knowledge" is naturally "distributed" within a navigational system structure.

Examples:

- operational mode e.g.: "Track Control" and
- navigational situation e.g.: "Open Sea" and
- the availability of redundant and activated sensors connected to an intelligent sensor data management module

⇒ Co-ordinated alert administration and alert related communication is required

e.g. multi-sensor evaluation, ... e.g. module "Positioning"

Additional information:

- The administration of the navigational situation could be done inside a different system-module than the Track Control function is implemented in.
- The criteria for alerts and weighting criteria for alert priorities are naturally implemented inside individual functions or system modules.
- Consequently relevant alert management functions are not necessarily to be implemented inside one alert management module.
- Requirements for alert related functions and for alert related communication depends on system design. Both should be co-ordinated.

Alert management (results of investigation IV) 8

Fig. 8. Results of investigations

⇒ Co-ordinated alert administration and

⇒ Co-ordinated alert related communication

Main tasks of the Alert Management

Alert management (results of investigation VI) 9

Fig. 9. Main tasks of the Alert Management

The following (4) slides present:

1. Examples of functional integration together with
2. Different characteristic features of alert related communication

Key words:

- function level module
- function alert
- system level module
- system alert

Functional integration 10

Fig. 10. Functional integration

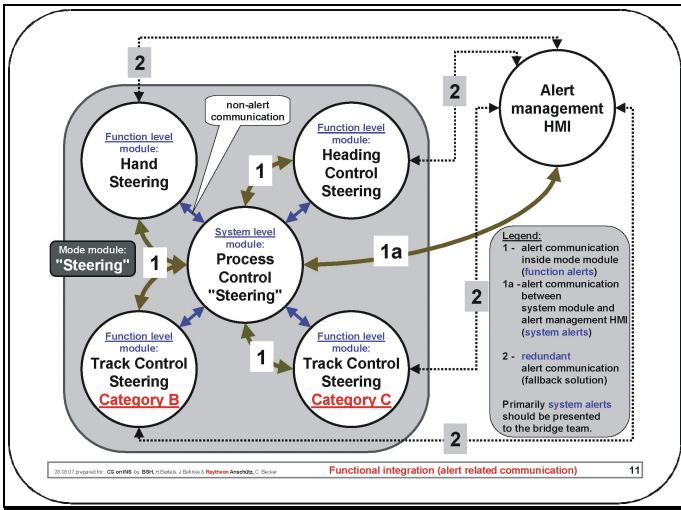


Fig. 11. Functional integration

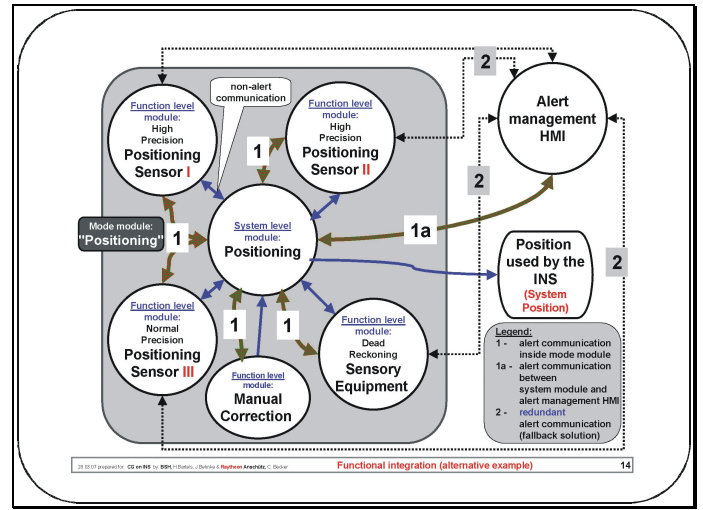


Fig. 14. Functional integration

Definitions:

- Function alert** A navigational function level module generates the function alert based on its internal knowledge. The release of this alert together with its function-dependent priority shall take place with no respect to a navigational system it is connected to or is part of. I.e. the function alert is evaluated as if the navigational function is operating stand-alone.

Navigational function level modules within the alert management structure should be featured with the ability to receive acknowledge commands from other navigational modules particularly with regard to the advanced knowledge of these modules.

Summary:
Function alerts which are **not relevant for:**

- the present operating status of the navigational system (INS) and
- the navigational tasks carried out by the watch keeping officer, are not required to be acknowledged by the bridge team.

Function alerts shall be presented on demand.

Fig. 12. Functional integration

The following (4) slides present:
An outlook to future

- distributed alert management concept based on:
 - a generic navigational module structure and
 - a generic alert communication concept with redundancies included

Key words:

- system level
- function level
- dynamic logical allocation

Fig. 15. Distributed concept

Definitions:

- System alert** A navigational system level module qualified for the evaluation of the system architecture and of system operational states, generates the system alert based on its advanced (system) knowledge. A system alert usually but not exclusively is the result of a re-evaluation process of one or more function alerts using the advanced knowledge.

Navigational system level modules within the alert management structure should be featured with the ability to re-evaluate and to acknowledge alert announcement requests they have received from navigational function level modules.

Summary:
System alerts are relevant for:

- the present operating status of the navigational system (INS) and
- the navigational tasks carried out by the watch keeping officer. System alerts shall be presented to the bridge team.

Fig. 13. Functional integration

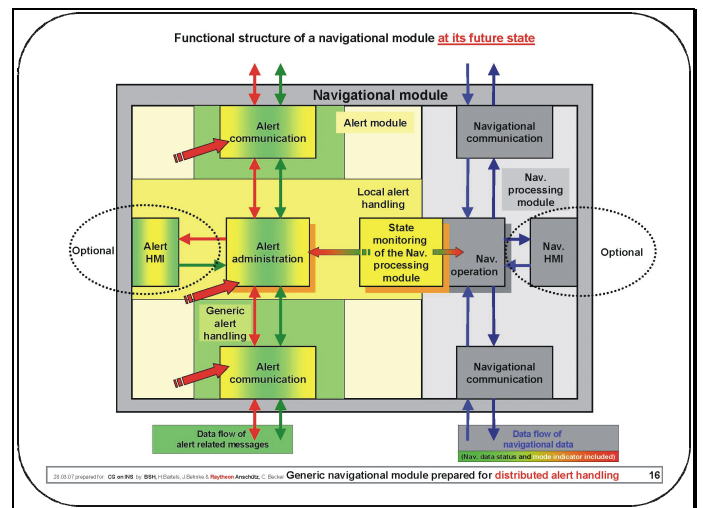


Fig. 16. Distributed concept

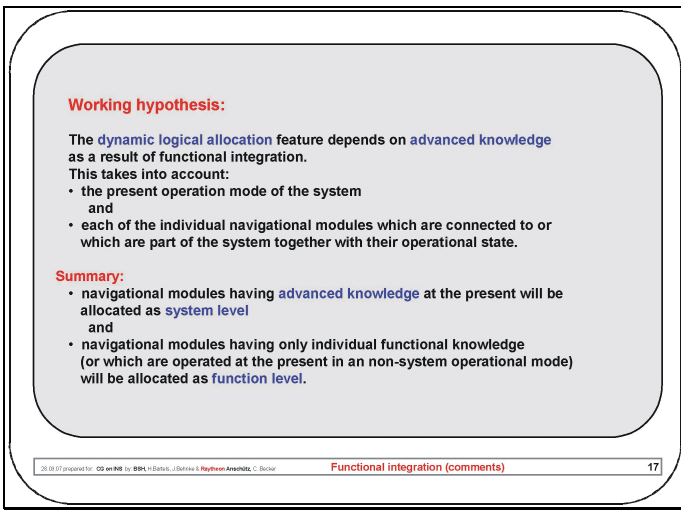


Fig. 17. Distributed concept

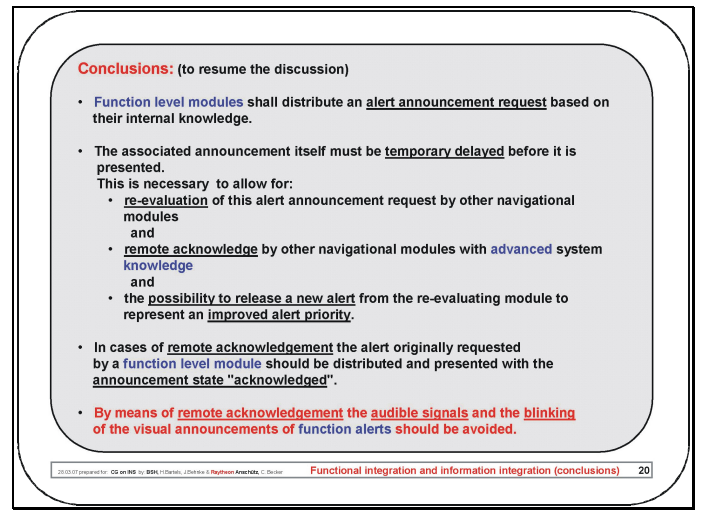


Fig. 20. Conclusions to resume the discussion

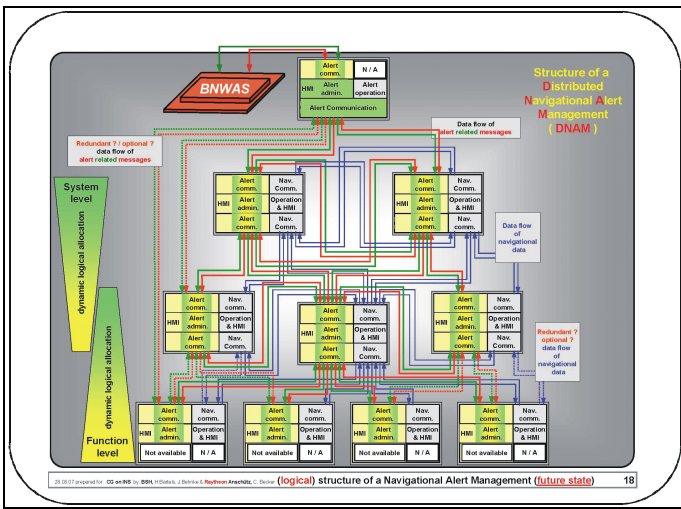


Fig. 18. Distributed concept

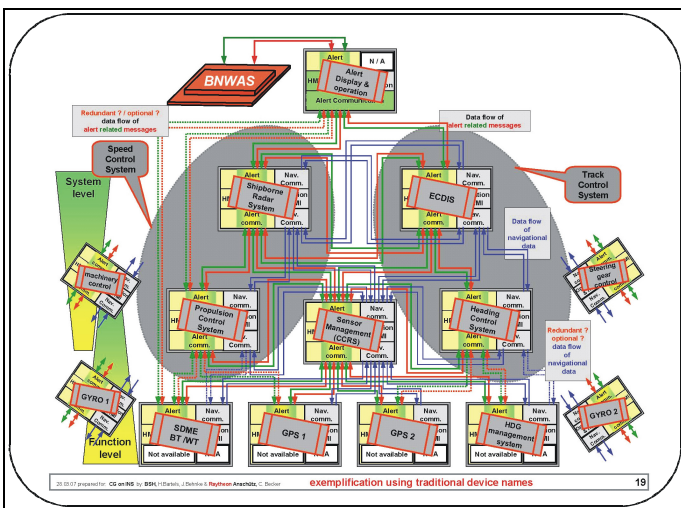


Fig. 19. Distributed concept

2 CONCLUSIONS

It appears feasible to minimise the number of alerts especially those on a high priority.

The conceptual design supports the implementation of “Function Alerts” and “System Alerts” and the capability of navigational system level modules to acknowledge “Function Alerts”.

Easily manageable alert related communication will be supported by this concept.

This presentation is a condensed version of an Alert Management concept based as a full version on different series of slides dealing with topics like “State Monitoring”, “Alert State Transitions”, “Alert Announcement State Transitions”, “Escalation Strategy” (to handle unacknowledged alerts), “Deescalation Strategy” (to minimise the number of high priority alerts) and “Consistency of Alert Presentation within a Navigational System”.

German workgroups deal successfully with these series of slides as a “starting point” whenever they plan to recommence discussions on related matters.

Additionally the slides are applied as a “toolbox” useful to align the picture of an Alert Management Structure in the mind’s eye of each member of a working group during discussions.

These series of slides are especially suited to mediate between the generic requirements laid down in the Performance Standards and the “Operational and Performance Requirements” to be implemented in IEC’s International Standards.