Bundesministerium
für Verkehr, Bau
und Stadtentwicklung

Solution-orientated concepts:
the integration of information received via communication equipment with onboard navigational systems

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Agenda

1. Overview
2. Defining the problem and requirements
3. Overall concept for integration and presentation
4. Identifying and evaluating potential solutions
5. Selected example solutions

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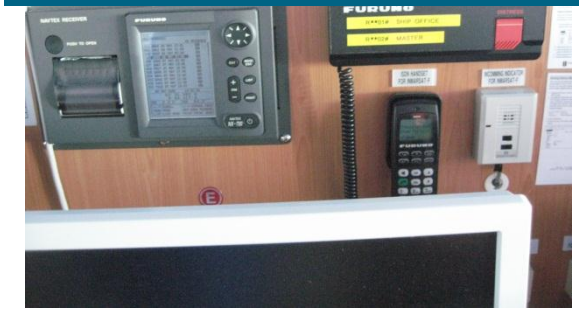
1. Overview - situation onboard

technical and legal conditions

The current separation of communication systems and navigational systems doesn't meet the requirements of safe navigation to include all means and information in the decision making.



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1. Overview- Solution

Integration and presentation of available information received via communication equipment in graphical displays
IMO (NAV 58/WP.6/Rev.1)

Core-elements:

Integrated Navigation System

&

Management of Information Received via Communication Equipment

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2. Defining the Problem and Requirements

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- Define the information, context, and problems
  - Literature review, mariner interviews
  - Equipment review considering GMDSS, MSI, radio watch, distress communications, chargable services, etc.
  - Work domain analysis (by voyage phase with mariner validation)
  - Classification of information by categories, INS task supported, and presentation options
- Consider regulatory requirements and changes
  - SOLAS Chapter IV and V
  - Existing bridge design requirements

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2. Defining the Problem and Requirements

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- Define initial user requirements
  - Surveys, interviews, onboard observation, human factors review, participation in IMO e-Nav activities (gap analysis)
  - Global E-Navigation User needs survey
  - Task-orientated bridge design requirements (IMO, past INS research)
  - Communication management requirements and concept
  - Information requirements
  - HMI requirements (task analysis, ACWA, EID)
  - Data structure requirements and options (IHO, IALA, WIS, S-10x)
- Risk Analysis and Risk Control Options
  - External information presented via onboard navigation displays
  - Onboard navigation information transmitted to external parties

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3. Concept for integration and presentation

- Do not repeat old mistakes:
  - lack of standardization, inconsistent presentation of information, unnecessary level of complexity, information overload

- Need to consider:
  - content, timing, workflow, presentation format, and relationship to tasks and overall bridge resource management

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3. Concept for integration and presentation

- Task-oriented integration of information received via communication equipment in shipboard navigation systems
- User-selectable filtering and routing of information to prevent information overload
- Data evaluation (quality assurance) and storage
- Provision of source and channel management
  (selection of best connection according criteria, e.g., content, integrity, costs)
- Increased availability and reliability of information due to efficient use of different communication channels

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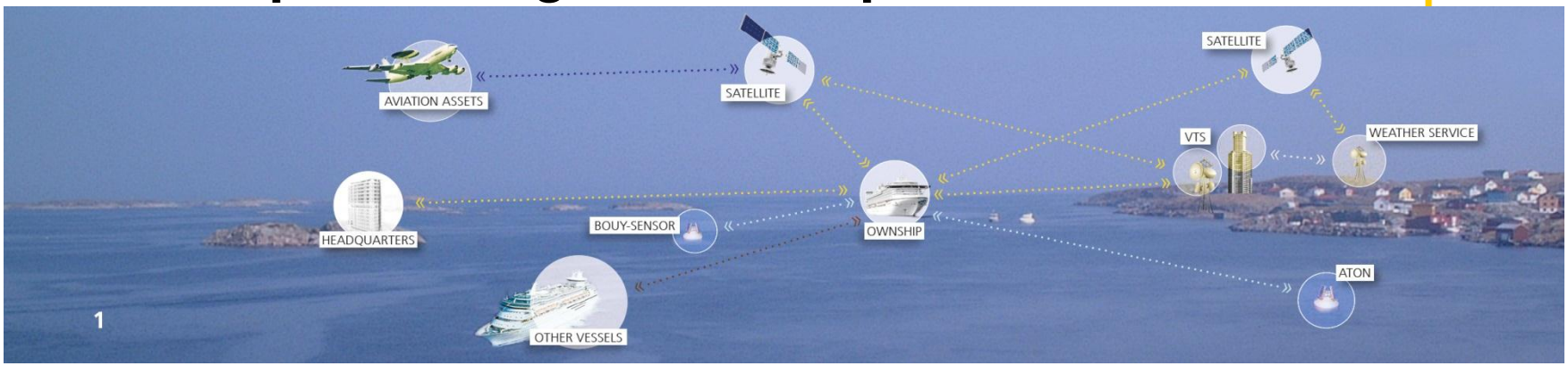
3. Concept for integration and presentation



Prioritized Focus Areas:

- Geo-referenced locations to avoid or with procedures/activities (MSI)
- Safe depth information, Air Gap information
- Alterations to ownship route
- Collision avoidance information
- Hydrographical, Weather data, Ice information
- Message/Information Handling Interface

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4. Evaluating Concepts and Solutions

- Identification of existing functionality, prototypes and testbeds to support evaluations
- Development of prototype Message/Information Handling Human Machine Interface (HMI)
- Route Exchange evaluation at Chalmers Technical University
- Focus-Group Discussion with Maritime Pilots
- Simulator Evaluation and Interviews at WMU
- Human Factors heuristic evaluation and comparison of identified solutions

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5. Example Solution 1

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Concept: Large amounts of information are, and will be available, but

Not all available information

- should be presented on INS
- is relevant to every INS display (task)
- is relevant to every voyage/situation
- will arrive appropriately formatted

An interface will be required to manage communicated information:

SOLUTION: Message/Information Handling Human Machine Interface (MIHI)

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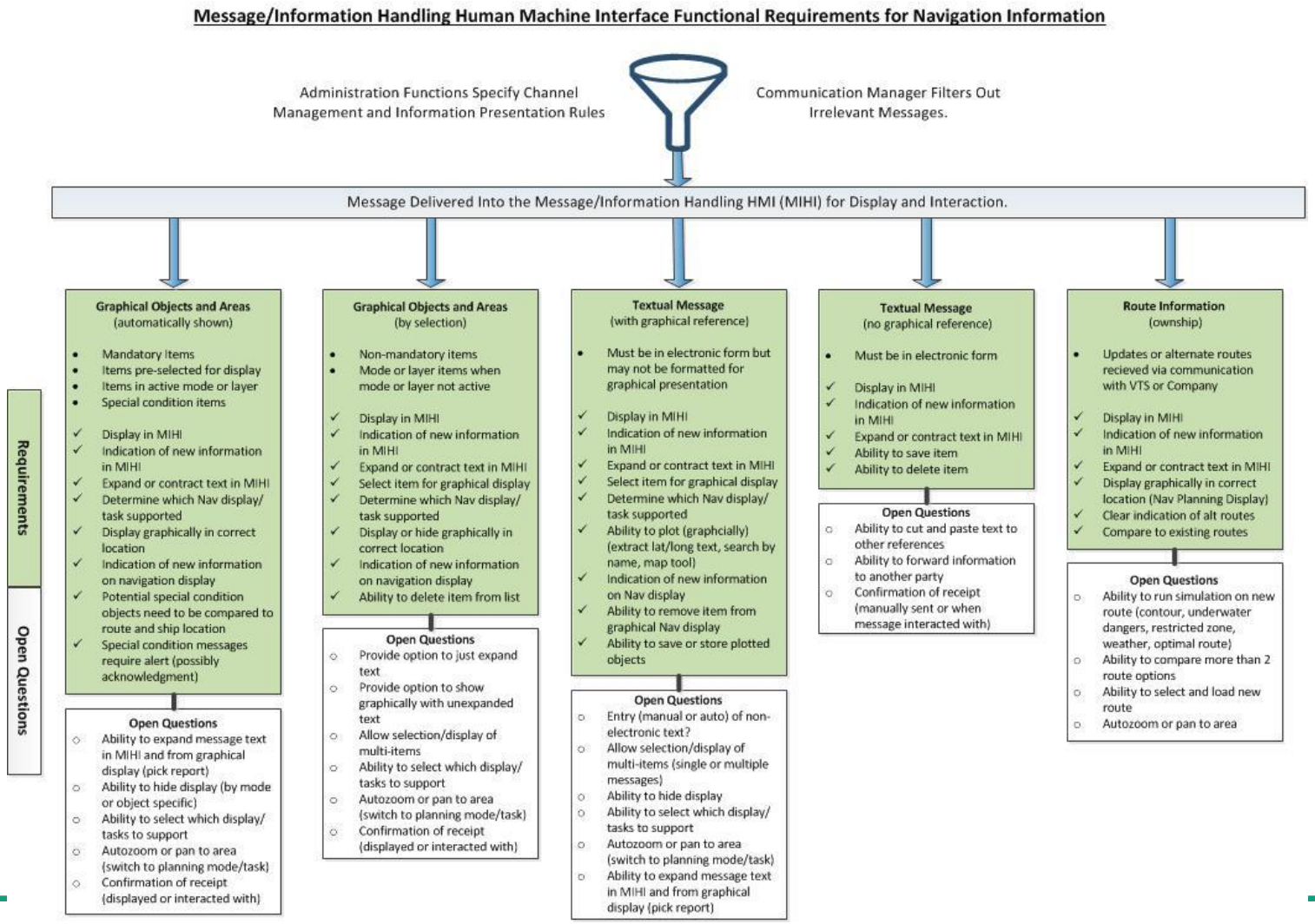
5. Example Solution 1—MIHI



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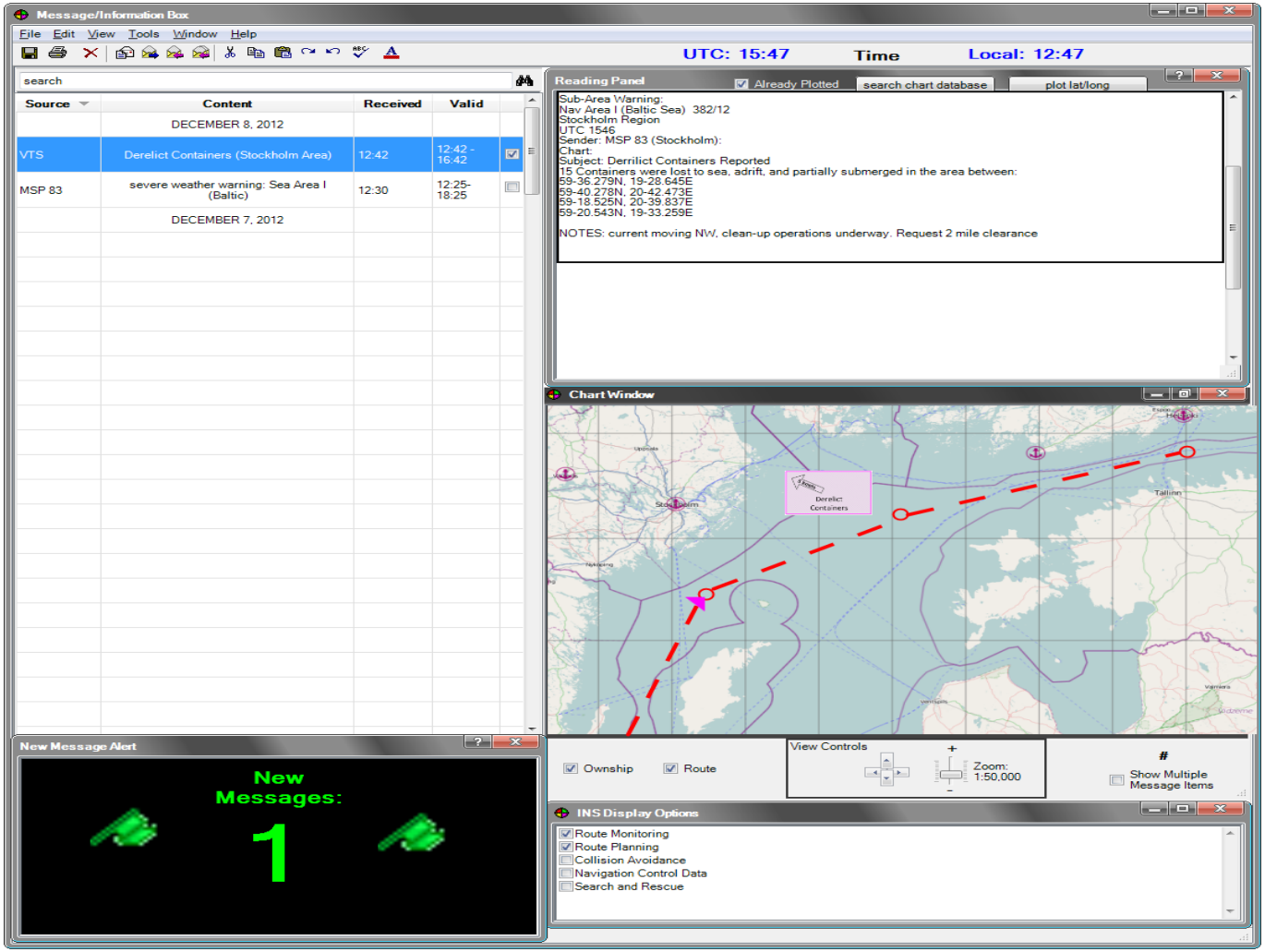

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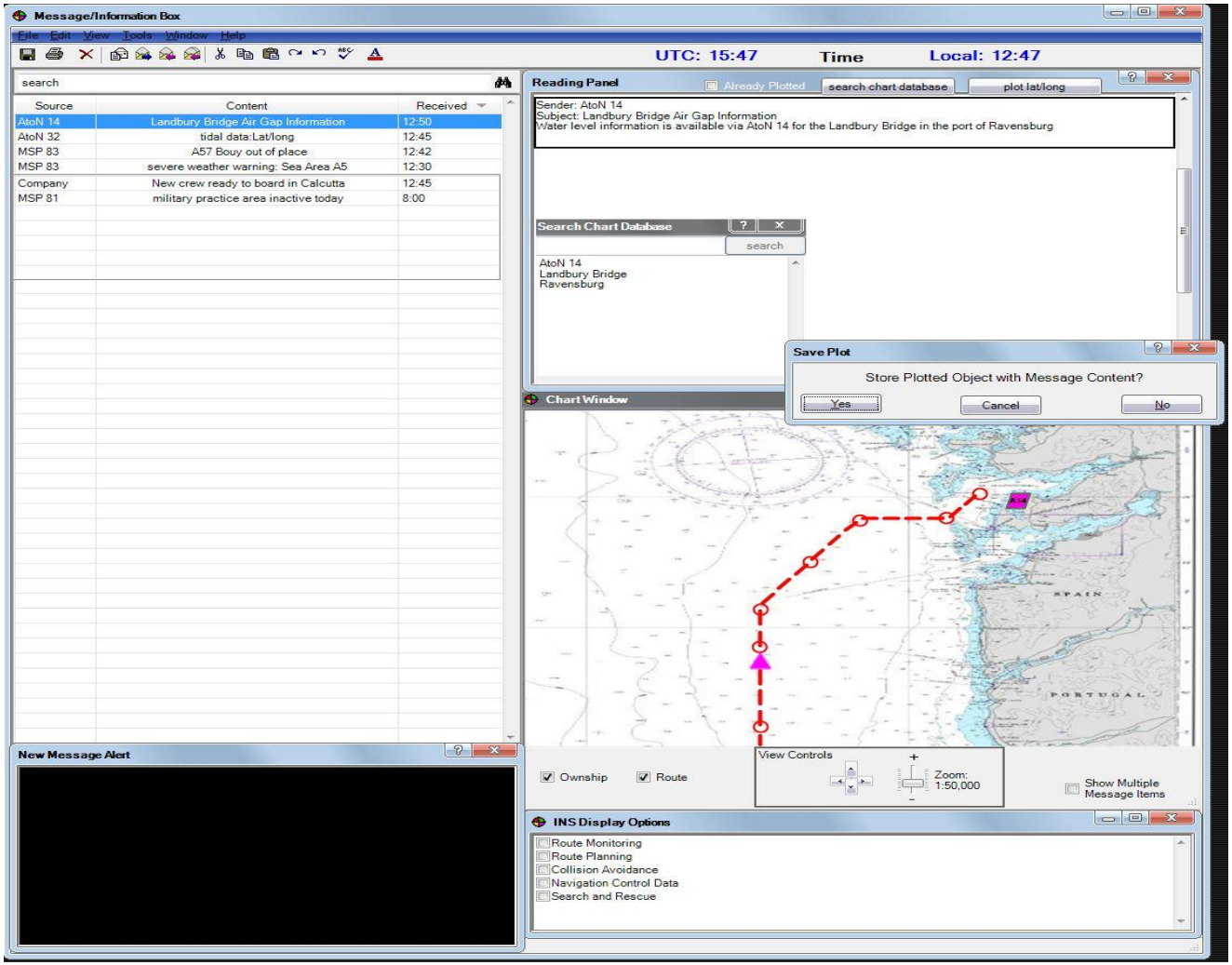

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5. Example Solution 1—MIHI

Further Considerations (examples):

- Allow for user-friendly follow-up communications to confirm receipt, agreement (non), and clarify content.
- For evolving situations (e.g., SAR, drifting hazards, etc.) provide option to select and monitor the situation
- Further research concerning automatic updating, deleting, and removing messages and message content as situation changes (resolved, terminated).
- Optimal indication of new information based on:
  - Message type and content
  - User preferences
  - Most effective
  - Least distracting (current audio overload)

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5. Example Solution 2—Maritime Safety Information

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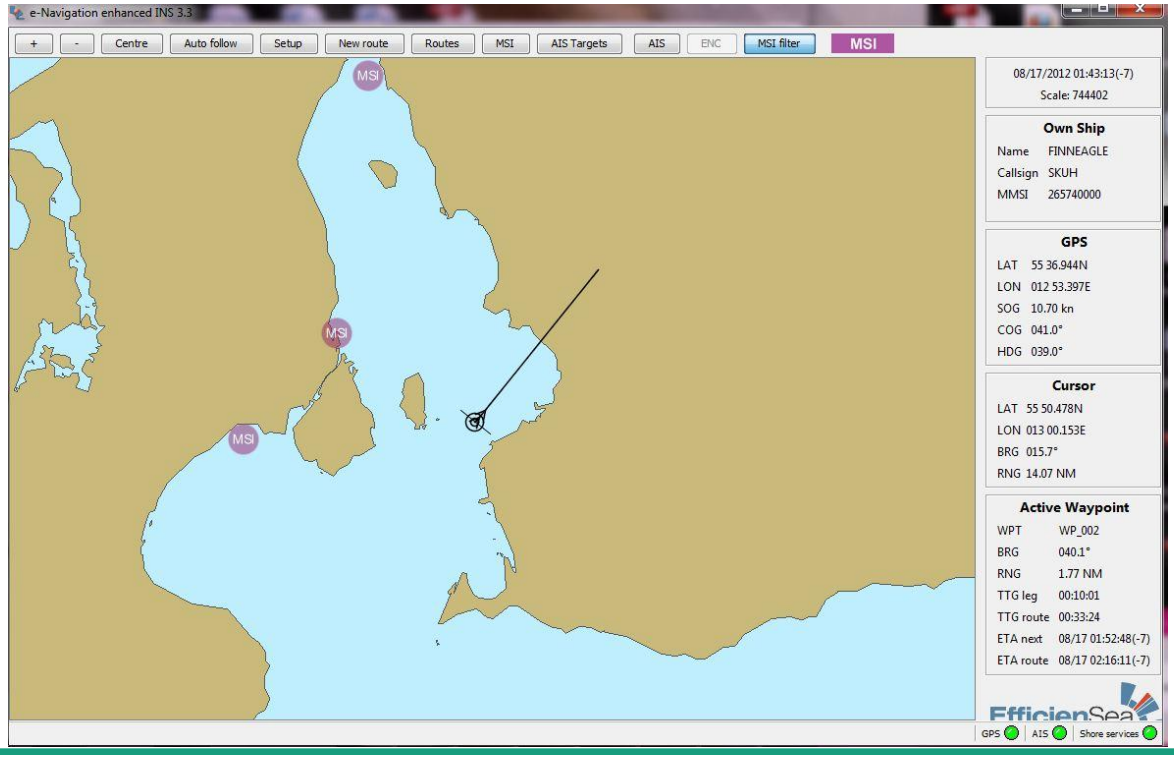
Concept: Communications received from sources not onboard containing updates with geo-referenced locations to avoid (hazards or regulations) or with special procedures (e.g., speed or fuel restrictions) or special activities underway (SAR, spill, etc.).



The ee-INS (e-Navigation Enhanced Integrated Navigation System) DMA

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5. Example Solution 2—Maritime Safety Information

Message Content/Presentation Requirements for INS:

- Format and transmit message content location electronically in reference to known reference system, allowing graphical display
- Show additional text-based information on selection via MIHI or pick report-like functionality
- When presented on navigation display provide clear indication that new content has been added.
- Provide contact information for source (name, affiliation, and position)
- Etc.

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5. Example Solution 2—Maritime Safety Information

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Features and Functionality Requirements (Examples):

- Ensure integration of new MSI content with existing content and functionality:
  - Route Planning (distance measuring, route check)
  - Route Monitoring
  - Chart Radar (EBL, VRM)
- Upon receipt system should automatically evaluate for applicability and potential hazards to planned route
  - Provide alert for imminent risks
- Provide ability to save the MSI and message content to the voyage record
- Etc.

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5. Example Solution 2—Maritime Safety Information

Further Investigation (Examples):

- Requirements for alert and warning functions based on content and situation.
  - Direct hazard, less direct threats, user preferences
  - Accident and incident prevention, reduce WL
  - Consider current alarm overload situation
- Use of existing chart symbols or one generic marker to identify location or combination
- Determine which stakeholders represent a competent authority
- Etc.

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Example Solution 2—Maritime Safety Information

Risks and Concerns (Examples):

- Clutter and information overload
  - Especially when directly plotted on INS
  - Implement and test intelligent filter
- Critical content not presented, perceived, or used
  - Filter rules, distraction, obscuring existing data
- Content misinterpreted or misunderstood
  - Meaning of content
  - Relationship to other content
- Available display options unclear or unknown
- Etc.

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Thank you for your attention.

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