

**8th ICCRTS 2003, Washington, DC**

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**Design and Evaluation of an  
Image Analysis Tool supporting  
Naval Reconnaissance**

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# **Design and Evaluation of an Image Analysis Tool supporting Naval Reconnaissance**

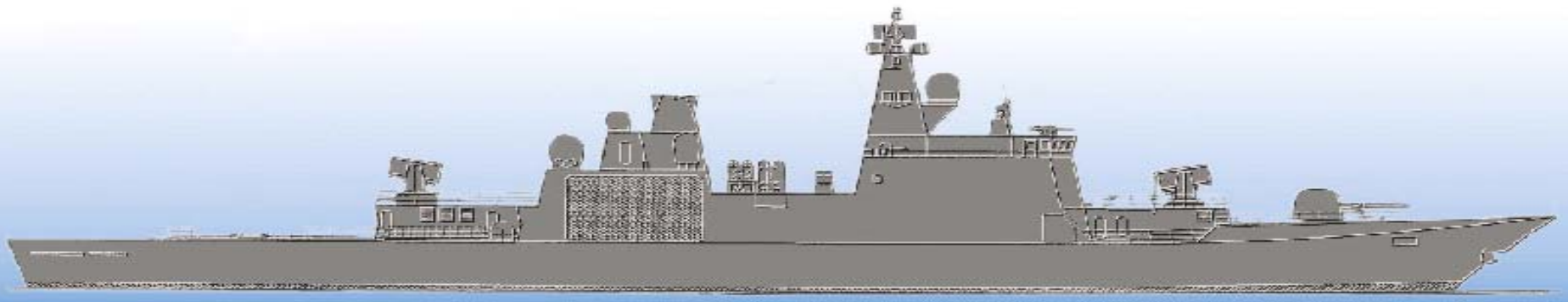
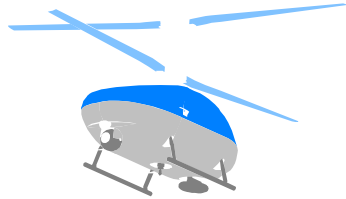
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- **Introduction**
- **Concept, Design, Realization**
- **Evaluation & Optimization**
- **Conclusions**

# Introduction

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**The new german Corvette Class K 130  
with Navy Drone**



# Introduction

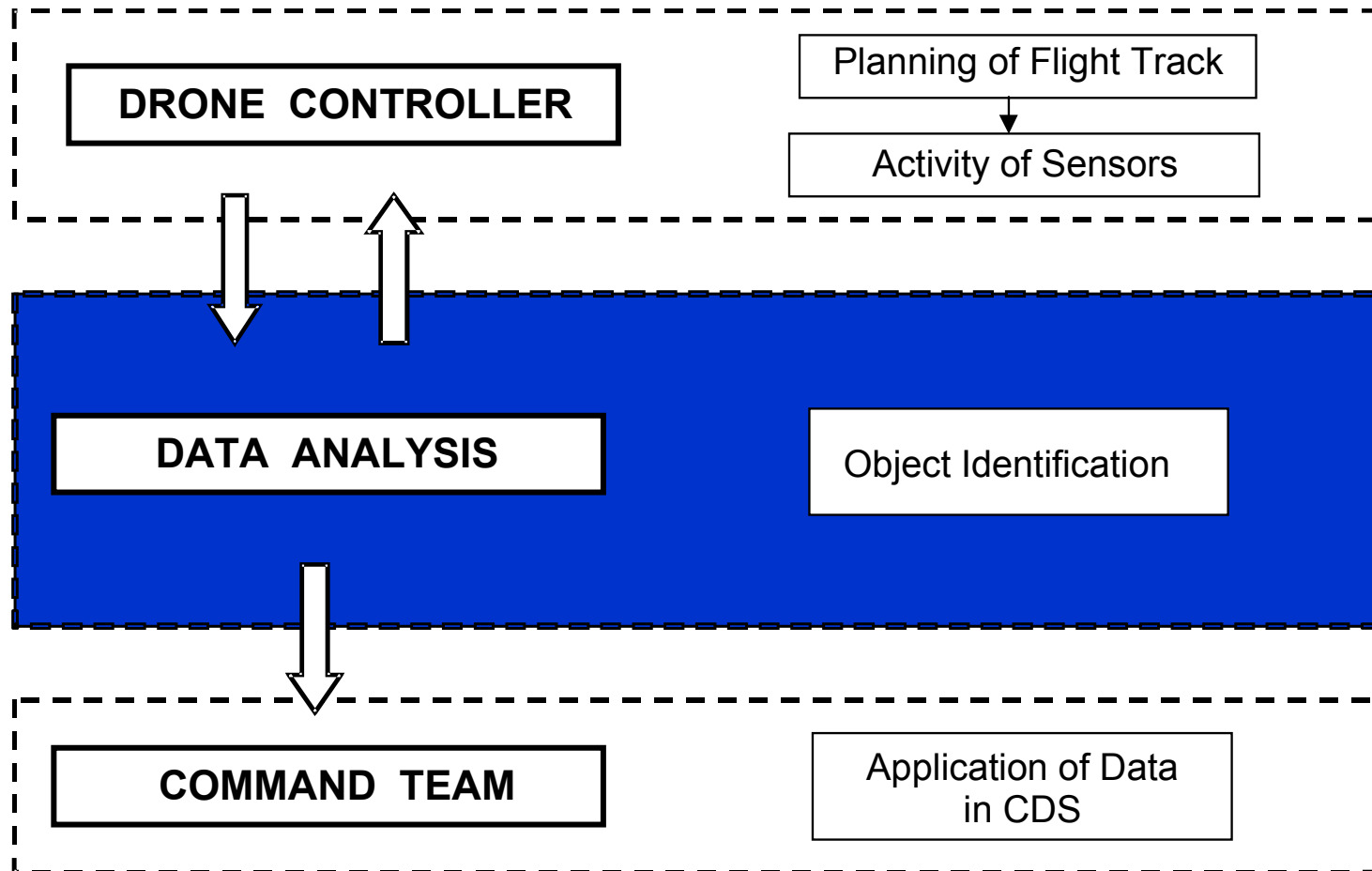
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## Basic conditions:

- increasing needs for reconnaissance
- why surface reconnaissance with „Marinedrohne“ ?
  - > discontinuous sight in coastal areas
  - > high density of civil and military targets
  - > usage of maximum weapon range
  - > camouflage of own position while reconnoiter
- „Marinedrohne“ with 2 sensors (EO and ISAR)
- reconnaissance results as graphical material
- supporting interpretation and implementation

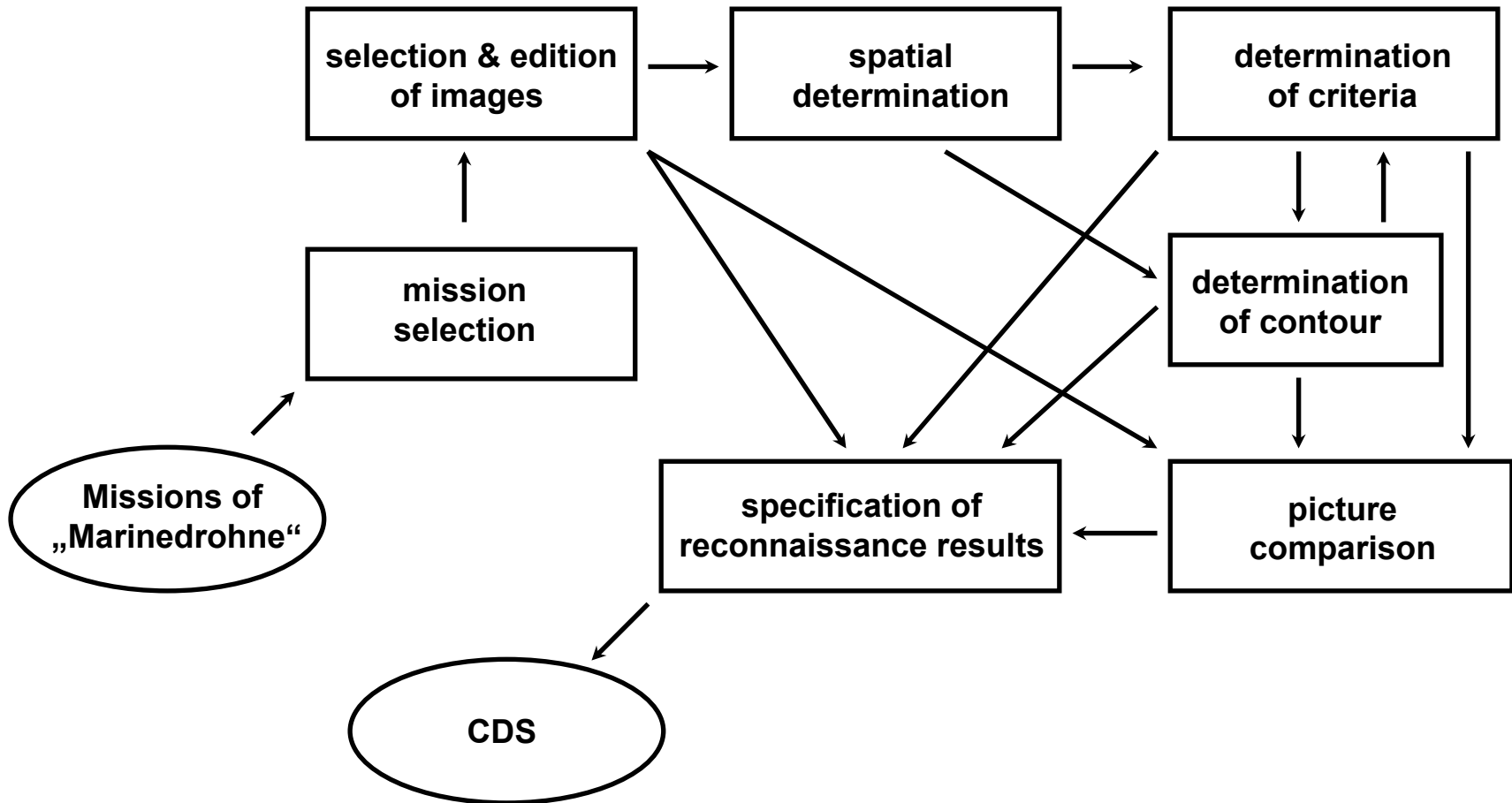
# Concept, Design, Realization

## Process Environment



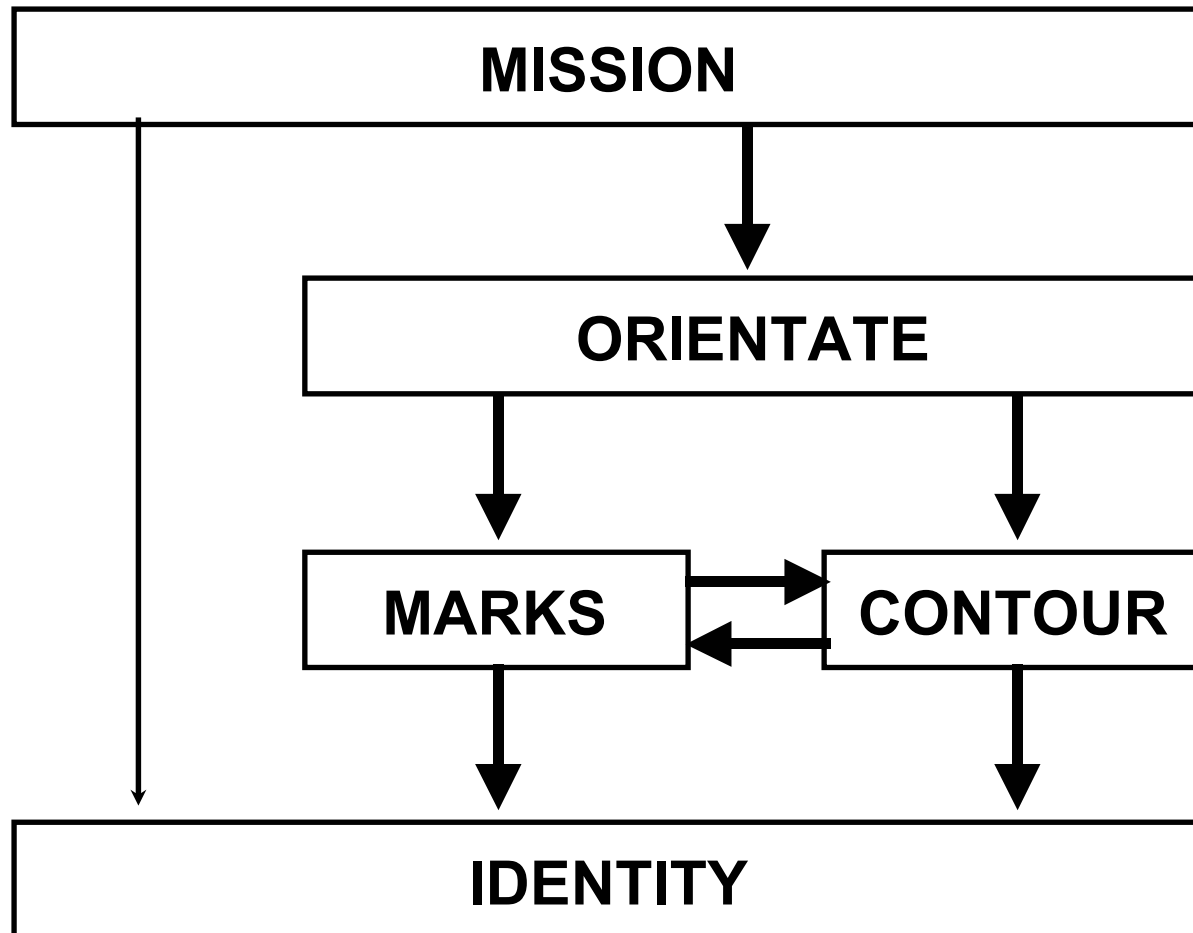
# Concept, Design, Realization

## Process Structure

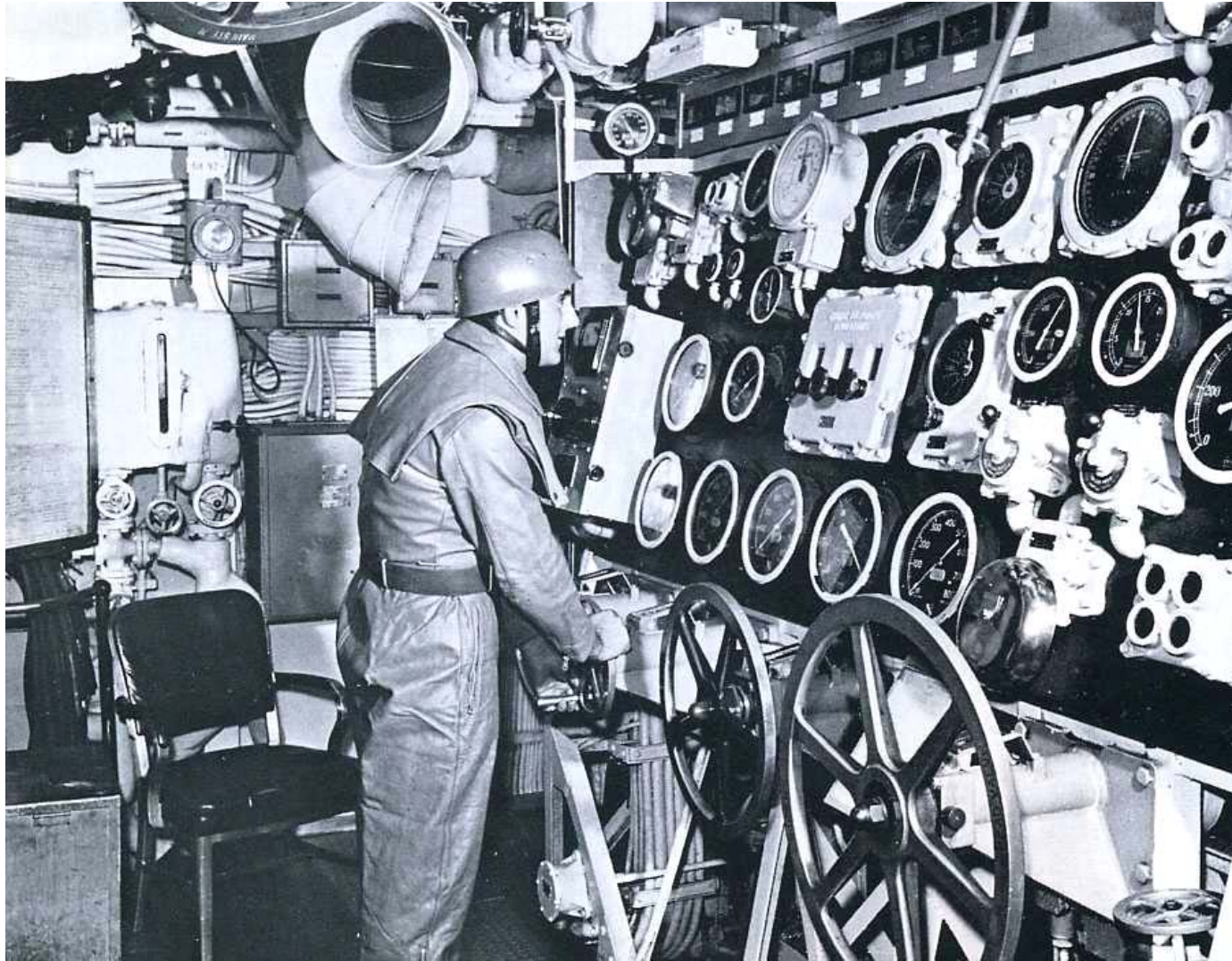


# Concept, Design, Realization

## Realization Process States



# Version 0.1





# GUI Process State „Mission“

database area

control/ status area

The screenshot displays the RDA (Remote Data Acquisition) GUI interface. The window title is "RDA". On the left, there is a "database area" with a tree view containing "AIR", "LAND", and "SEA". The main display area is divided into two sections: a "picture area" at the top showing a grayscale image of a ship, and a "disposal area" at the bottom showing a grayscale image of a ship's silhouette. A blue arrow points from the "disposal area" label to the bottom image. At the bottom, there is a "control/ status area" with a table of mission data, a "SAVE" button, a "DELETE" button, and a timeline. The table data is as follows:

MIS	9902 270845 Z FEB	
BRG	123 DG	ORIENTATE
DST	80 NM	CONTOUR
CRS	247 DG	MARKS
SPD	80 KN	IDENTITY
HGHT	340 FT	
LAT	23 45.6N	
LNG	123 45.6W	

Below the table are buttons for "EO" and "ISAR". A timeline at the bottom shows a duration from 08:45 to 12:32, with a current time of 09:39:20 indicated by a vertical orange line.

picture area

disposal area

# GUI Process State „Orientate“

database area

The screenshot displays the RDA (Remote Data Acquisition) GUI interface. It is divided into several functional areas:

- Database Area:** A hierarchical tree on the left lists categories such as AIR, LAND, and SEA, with sub-items like AIRCRAFT-CARRIER, AUXILIARIES, COAST-GUARD/CUSTOM/POLICE/SAR, CORVETTE, CRUISER, DESTROYER, FRIGATE, ICEBREAKER, LANDING/AMPHIBIOUS, MINE-WARFARE, PATROL, RESEARCH-SHIP, SUBMARINE, and TRAINING-SHIP.
- Picture Area:** The top right shows a grayscale image of a ship on the sea. Below it, a 3D model of the same ship is displayed in a perspective view.
- Control/Status Area:** The bottom section contains a table of parameters, a set of navigation buttons (X, Y, Z, RESET), and a timeline for EO and ISAR data.

MIS	9902 270845 Z FEB	
BRG	123 DG	ORIENTATE
DST	10 NM	
CRS	247 DG	MARKS
SPD	80 KN	
HGHT	12340 FT	CONTOUR
LAT	23 45,6N	
LNG	123 45,6W	IDENTITY

Buttons: SAVE, 09:34:35\_EO, DELETE, EO, ISAR, 08:45, 12:32

picture area

control/ status area

# GUI Process State „Marks“

database area

The screenshot displays the RDA (Remote Data Acquisition) GUI interface. It is divided into several functional areas:

- Database Area (Top Left):** A hierarchical tree structure for selecting data sources. The 'SEA' category is expanded, showing sub-categories like AIRCRAFT-CARRIER, AUXILIARIES, COAST-GUARD/CUSTOM/POLICE/SAR, CORVETTE, CRUISER, DESTROYER, FRIGATE, ICEBREAKER, LANDING/AMPHIBIOUS, MINE-WARFARE, PATROL, RESEARCH-SHIP, SUBMARINE, and TRAINING-SHIP.
- Marks List (Middle Left):** A list of detected features with their counts:
  - BOW: 1
  - TAIL: 1
  - GUN: 2
  - RADOME: 1
  - RADAR: -
  - MAST: 1
  - BRIDGE: -
  - FUNNEL: -
  - FLIGHT\_DECK: -
  - HANGAR\_GATE: -
  - AIRCRAFT: -
  - LAUNCHER: 1
  - CRANE: -
  - OTHER: -
- Picture Area (Right):** A grayscale video frame showing a ship's wake. Several 'x' marks are overlaid on the image, corresponding to the marks listed in the adjacent panel.
- Control/Status Area (Bottom):** A panel for system configuration and playback control. It includes:
  - MIS: 9902 270845 Z FEB
  - BRG: 123 DG
  - DST: 10 NM
  - CRS: 247 DG
  - SPD: 80 KN
  - HGHT: 12340 FT
  - LAT: 23 45.6N
  - LNG: 123 45.6W
  - Buttons: ORIENTATE, MARKS, CONTOUR, IDENTITY, SAVE, DELETE, RESET, ERASE, EO, ISAR.
  - Timeline: A horizontal bar with a playhead at 09:34:35, ranging from 08:45 to 12:32.

picture area

control/ status area

# GUI Process State „Contour“

database area

The screenshot shows the RDA GUI interface. On the left is a tree view for the database area. On the right is a picture area showing a grayscale image of a ship with an orange contour overlaid. At the bottom is a control/status area with various parameters and buttons.

**database area**

- AIR
- LAND
- SEA
  - AIRCRAFT-CARRIER
  - AUXILIARIES
  - COAST-GUARD/CUSTOM/POLICE/SAR
  - CORVETTE
  - CRUISER
  - DESTROYER
  - FRIGATE
  - ICEBREAKER
  - LANDING/AMPHIBIOUS
  - MINE-WARFARE
  - PATROL
  - RESEARCH-SHIP
  - SUBMARINE
  - TRAINING-SHIP

**picture area**

**control/ status area**

MIS	9902 270845 Z FEB	
BRG	123 DG	ORIENTATE
DST	10 NM	
CRS	247 DG	MARKS
SPD	80 KN	
HGHT	12340 FT	CONTOUR
LAT	23 45.6N	
LNG	123 45.6W	IDENTITY

SAVE 09:34:35\_EO\_OM DELETE [Navigation icons] RESET UNDO FINISH

EO [Timeline bar] 09:34:35

ISAR 08:45 [Timeline bar] 12:32

picture area

control/ status area

# GUI Process State „Identity“

database area

identification results

control/ status area

picture area

disposal area

The screenshot shows a complex GUI interface for ship identification and tracking. It is divided into several functional areas:

- Database Area (Top Left):** A tree view showing a hierarchy of ship classes under the heading 'SEA'. The selected class is '143B-ALBATROS GER'.
- Identification Results (Middle Left):** A form displaying tracking data for the selected ship, including ID, TRACK, AREA, TYP, CLASS, NAT, NAME, HULL, BRG, DST, CRS, SPD, HGHT, LAT, and LNG. It also shows 'MARKS' (LAUNCHER, GUN) and 'NOTES' (LENGTH 57 M).
- Control/Status Area (Bottom Left):** A control panel with buttons for 'ORIENTATE', 'CONTOUR', 'MARKS', and 'IDENTITY', along with a 'SAVE' button and a dropdown menu.
- Picture Area (Top Right):** A grid of images showing different views of the selected ship, '143B-ALBATROS GER'.
- Disposal Area (Bottom Right):** A large video frame showing a ship at sea, with a blue arrow pointing to it from the 'picture area' label.
- Bottom Center:** A timeline or progress bar with a play button and a timestamp of '09:39:20'.

# Evaluation

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- **concept of test procedure (efficiency)**
  - homogeneous collective incl. high expert knowledge
  - similar test conditions
  - list of questions with ratingscales and text queries
- **experimental tests**
  - 10 test subjects (long served navy officers)
  - working on scenario (approx. 1h)
  - questionnaire

# Two-Level Sequential-Judgement Scale

**Rating of Controllability**

With the following scale you should rate the controllability of the system you just worked with. Please judge whether the controllability was low, adequate, or high and mark the correct box below with an X. Then follow the arrow below.

**LOW**                       **ADEQUATE**                       **GOOD**

Now rate carefully, exactly how you would rate the controllability of the system.

Record your rating by marking anywhere on the line, on or between the scale marks.

Now consider carefully, whether the controllability is exactly adequate or more in the direction towards low or high.

Record your rating by marking on the line, on or between the scale marks.

Now rate carefully, exactly how you would rate the controllability of the system.

Record your rating by marking anywhere on the line, on or between the scale marks.

very low    rather low    somewhat low    barely low    neither low nor high    barely high    somewhat high    rather high    very high

0            1            2            3            4            5            6            7            8            9            10

# Ratingscale Results

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<b>Suitability for the task:</b>	low: <b>0</b>	adequate: <b>0</b>	high: <b>10</b>
<b>Self-descriptiveness:</b>	low: <b>0</b>	adequate: <b>2</b>	high: <b>8</b>
<b>Controllability:</b>	low: <b>0</b>	adequate: <b>0</b>	high: <b>10</b>
<b>Conformity:</b>	low: <b>0</b>	adequate: <b>0</b>	high: <b>10</b>
<b>Error tolerance:</b>	low: <b>0</b>	adequate: <b>0</b>	high: <b>10</b>



# Results of Questionnaire

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- **comments on minor details only**
- **...**
- **no comments concerning system structure**
- **...**
- **„system very good and easy to handle“**
- **„system supports goal-oriented task processing“**
- **„usage of greyscales minimises distraction“**
- **„coloured timemarker supports orientation on timeline“**
- **„path-structure enables good orientation in database“**

# Optimization of Details

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- more clearly arrangement of filenames
- warning before deletion of files
- RESET function for brightness and contrast
- fast forward and rewind on timeline

# Conclusions

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- **support system highly required**
- **developed support system is efficient**
- **support system is independent from sensors**
- **support system is independent from platform**

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