


# NAVAL TOPSIDE EM MODELING AND VALIDATION

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Naval Topside EM Modeling and Validation



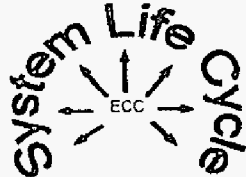
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Content

- Past, Present, Future:  
Modeling and Validation  
Engineering and Verification



ECC: Environmental  
Competence Center

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Past experience

- Many EMI activities:
  - 1960's (Sixties)
    - Basic EMI fixes
    - Towards installation guides
  - 70's
    - More equipment testing
    - Radarbox hazards
    - More precision, scale model testing
  - 80's
    - Design for operational environment
    - Topside design on ad-hoc basis, often dedicated to blocking, reflections, antenna efficiency and coupling
  - 90's
    - Equipment designed for integration in environment
    - More interference which cannot be solved on a case-by-case basis
    - Topside design becomes an important issue
  - Now
    - Integrated Mast Modules

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Now

- EMI: key topic in the design of a naval vessel; (with Stealth and limited space)
- Topside design: balancing act between contradictory requirements



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Now, 2

- More and more Computational Electro-Magnetics (CEM) in naval topside design
- We need confidence in simulation tools and to replace scale model and full-scale measurements in the optimisation process during the design
- Full-scale verification of the design will remain important

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Cad, meshing, example ('90s)

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Scale model testing ('90s)

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Simulation and validation

- Accuracy: ok
- Difficulties:
  - definition of the problem
  - importing geometry from CAD files
  - Mesh generation

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Simulation tools

- A box with many more or less integrated tools:
  - Completely integrated
  - Off the shelf (some very good), asymptotic: (UTD, PO, GTD) & full wave (MoM), with interface via DXF, IGES etc.
  - Engineering models in mathematical tools such as MatLab and MathCAD

But always: common sense! (and not: when everything fails then...)

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Structure of Integrated Toolset

Emerg. Query

Database: geometry, EM data, equipment data etc.

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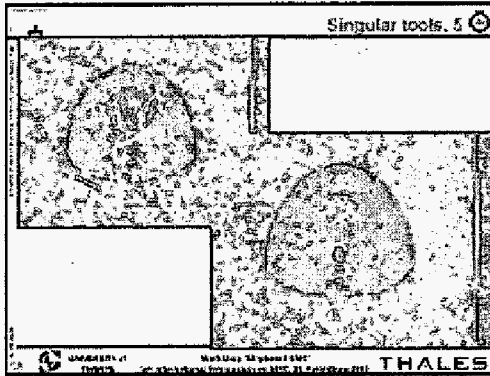
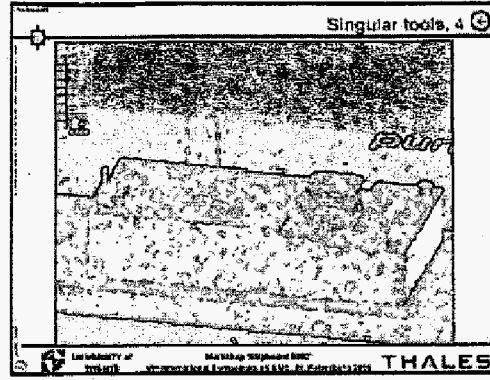
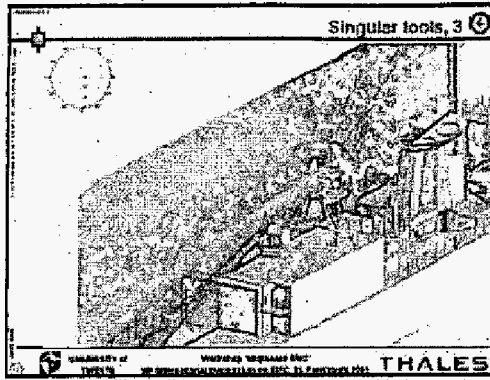
Singular tools, 1

Rafano: Interactive and fast source-current matrix (Thales Nederland proprietary)

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Singular tools, 2

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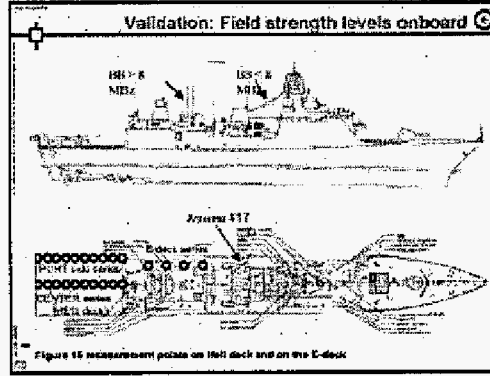
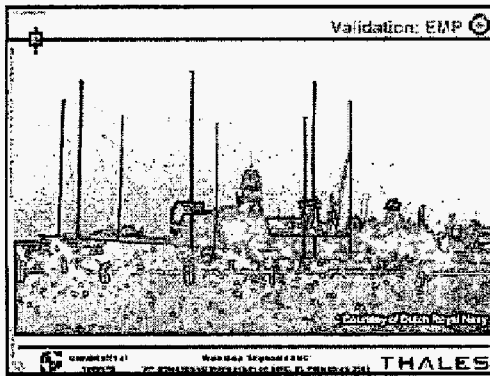
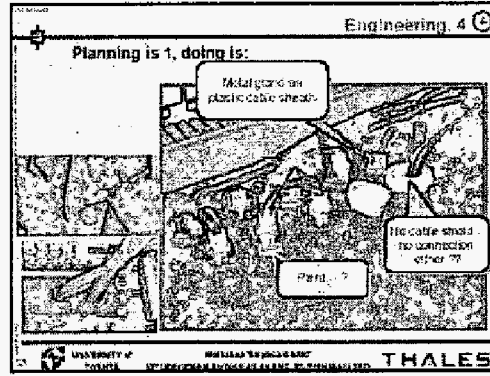
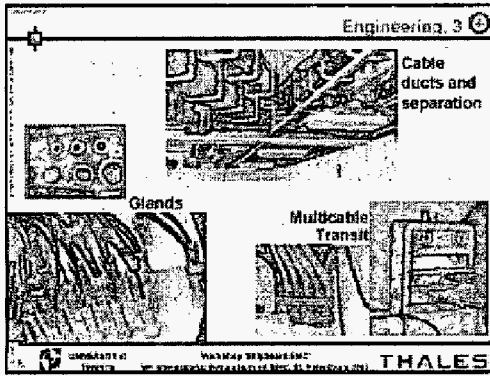


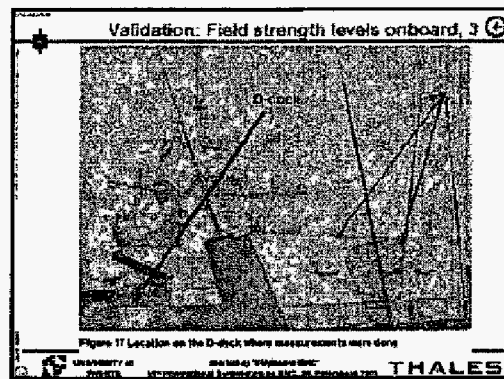
Engineering

Topside engineering: whole system life cycle

Phase	Statement of needs	System specification	System design	Development	Production and deployment	Operational support
Type						
Activity	Requirements analysis Customer needs analysis	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration
Output	Requirements analysis Customer needs analysis	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration	System architecture Functional decomposition System analysis System integration

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Topside engineering: Future

- Modern ships: many sensors/high data throughput, hostile environment, limited bandwidth
- One trend: combine all systems in one sensor
- Our approach: Integrated Mast Module (IMM)
- Scalability: assembly per platform application
- Modularity: easy servicing and upgrading during life cycle
- Interfacing: standard interfaces between modules and at footprint
- IMM makes use of a mix of new and existing systems.

Note: all studies are towards integration of functions. This concept is using existing or new systems, but integrates them in a smart way.

Key element: EM Engineering

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