

***The Ship:
System of Systems by definition***

CETENA's experience in the field

Aldo Zini

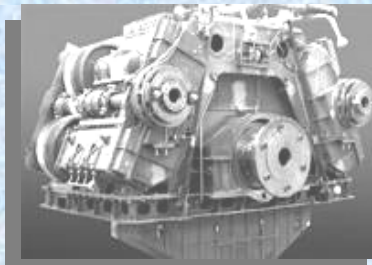


CETENA as part of FINCANTIERI Group

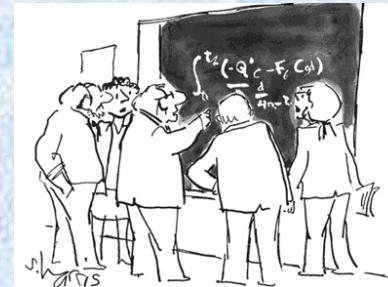
CETENA is part of the FINCANTIERI Group, one of the largest groups in the world in the design and construction of merchant and naval vessels.

Core business of FINCANTIERI is the development and construction of complex ships with high technological content.

The role of **CETENA** in the Group is to **develop applied research programs and provide high level consultancy, services and training.**



- ✓ **Applied Research**
- ✓ **Consultancy and Services**
- ✓ **Development of Tools and Methodologies** to help Ship Design and Ship Operations
- ✓ **Training, dissemination** (technical seminars, our conference NAV...)



BRIDGE
*between
the academic world
and the maritime industry*



Networking

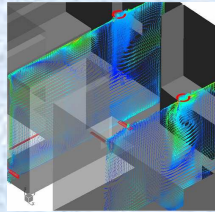
- Collaboration with National and International Research and Development Centres;
- Collaboration with Transport, Research & Development, Educational Ministries, Ministry of Transports, Development, Education, University and Research;
- Cooperation with University and Italian Navy.
- Participation to Districts: **IMAST** - Engineering of polymeric and composite materials and structures - Campania, **SIIT** - Intelligent Integrated Systems - Genoa; **DITENAVE** - Naval and Maritime Technologies - Friuli Venezia Giulia, **NAVTECH** - Transport, Naval, commercial and recreational transports - Sicily, et **DLTM** - Marine technology - La Spezia;
- Member of **ITTC** - International Towing Tank Conference, **ISSC** - International Ship and Offshore Structures Conference, **CRS** - Cooperative Research Ship, **ECMAR** - European Cooperation in Maritime Research and **AIRI** - Italian Association for Industry Research.

Activities:

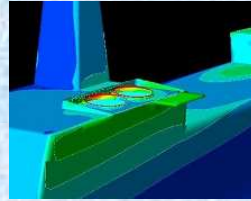
- Numerical simulations and studies (Fluid Dynamics, sea keeping, navigation and manoeuvring, FEM, etc.)
- Sea trials, monitoring and workshop tests (Noise & vibration, speed/power, IR, etc.)
- Products and integrated systems development
- Engineering consultancy (Ship design, Ergonomics and Human factor, etc.)
- Research and Development
- Transfer of Technology

Competence areas:





AIR CONDITIONING in public areas and cabins



ship superstructures

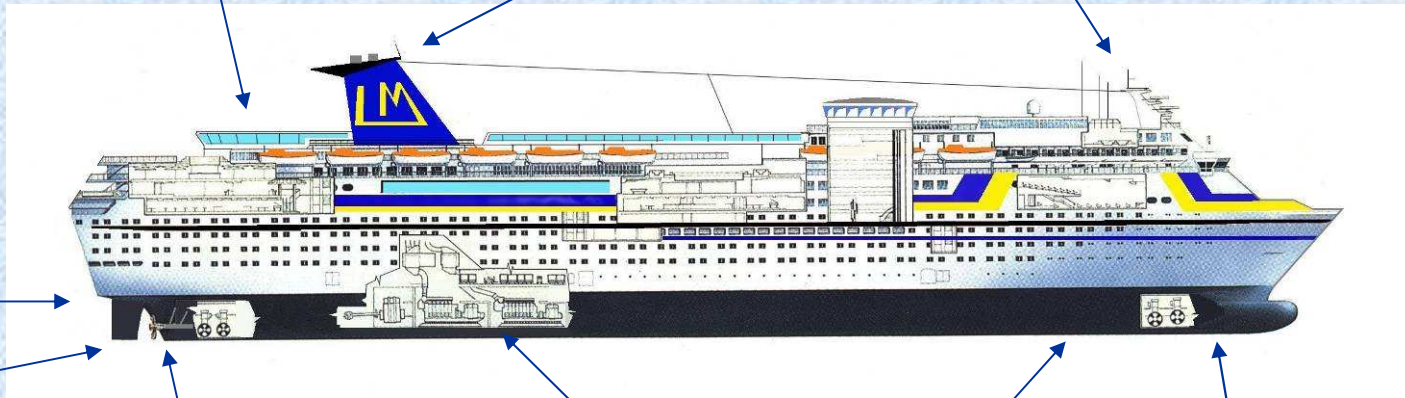


Bridge

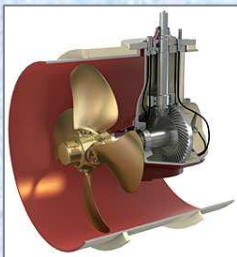
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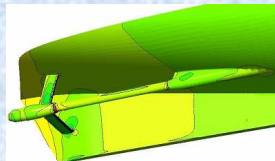
RUDDERS and other manoeuvring devices



PROPELLER



APPENDAGES



Engine room



Stabilizers



Anchor



...

The ship heavily interact with the environment

She is influenced by the environment



She influences the environment



The ship interact with other entities



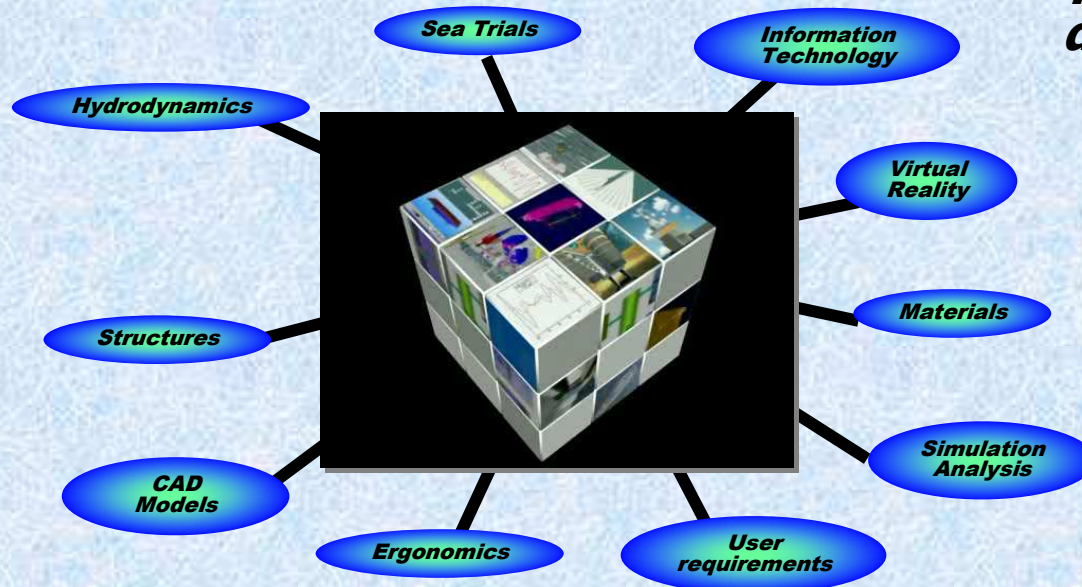
The actual ship usually is the only prototype of herself



Simulation of the behaviour of the different components and of the whole Ship is a mandatory



Virtual Prototyping

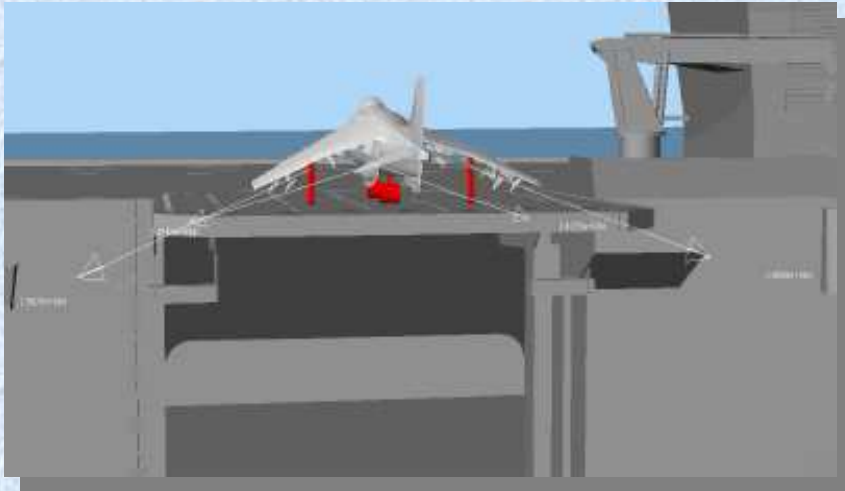


To demonstrate feasibility of design choices

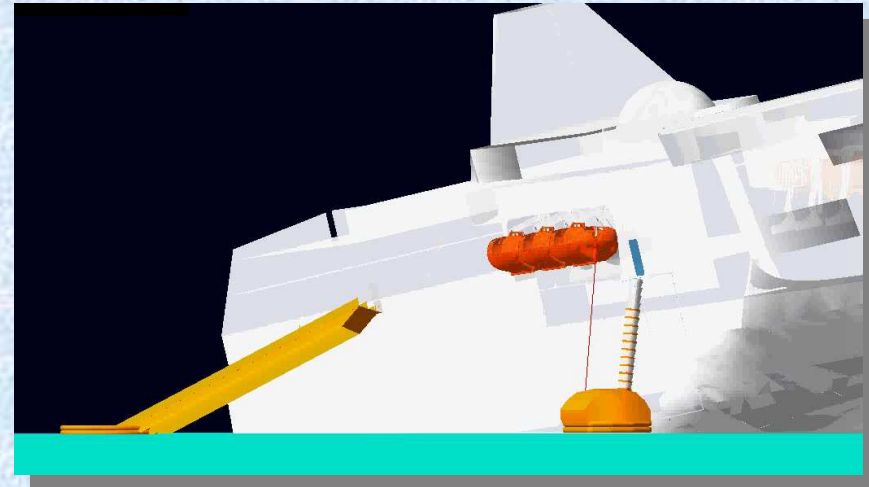
To verify operative requirements in dangerous/extreme situations

To assess the behaviour in operational scenarios

CONCEPT: Conceive, Design, Test, Train and Operate the Whole Ship on Computer before Cutting Metal



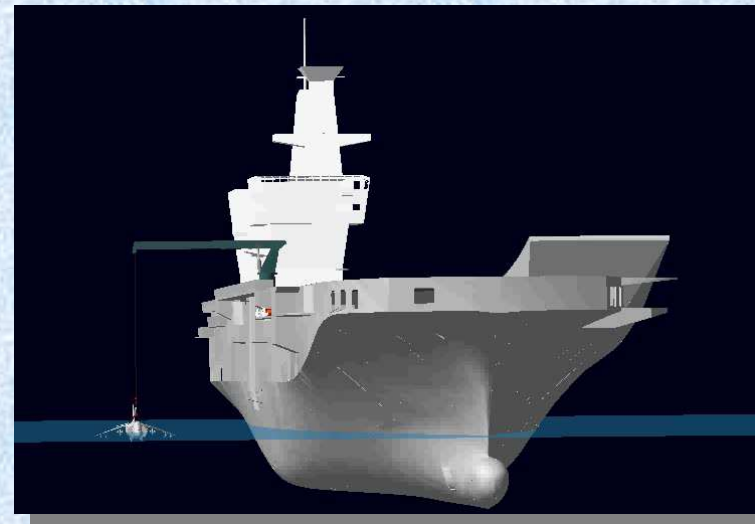
Evaluation of forces on the aircraft



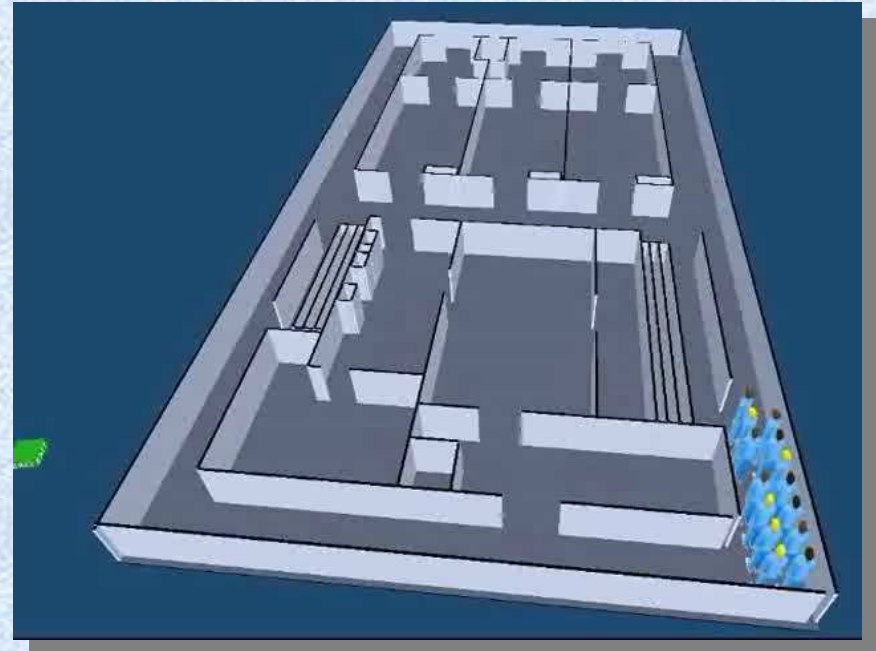
Lifeboats Release Operations



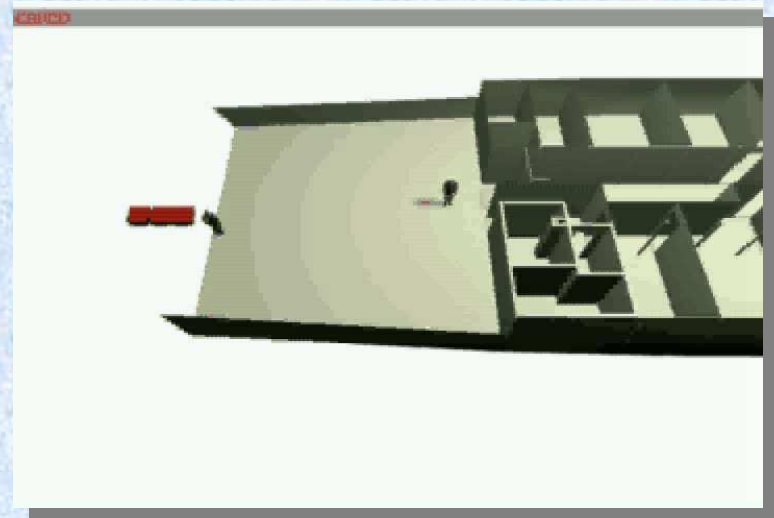
Loading/Unloading Operations

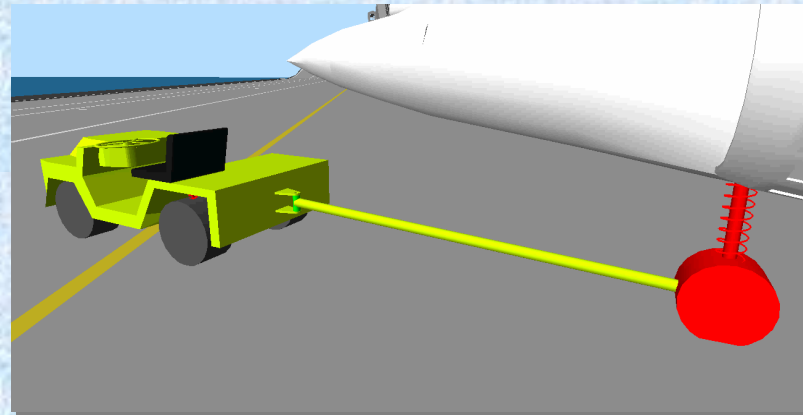
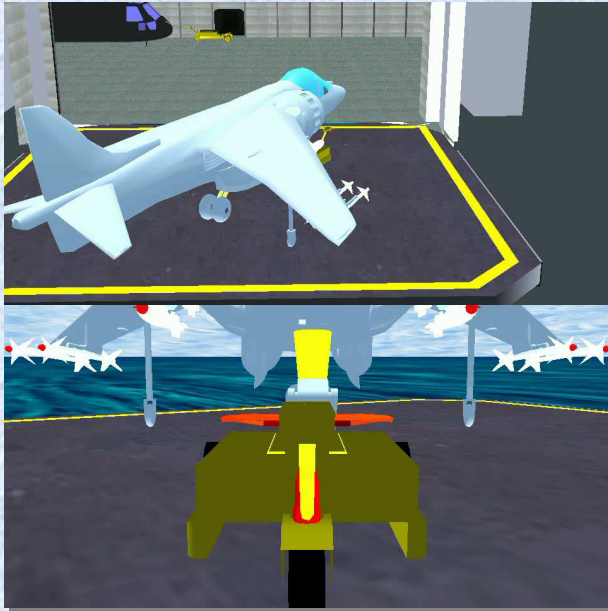


Rescue operations



Human behaviour on Board





Onboard Aircraft Manoeuvres



Loading/unloading operations

**More
complexity**

**Multiple
Entities**

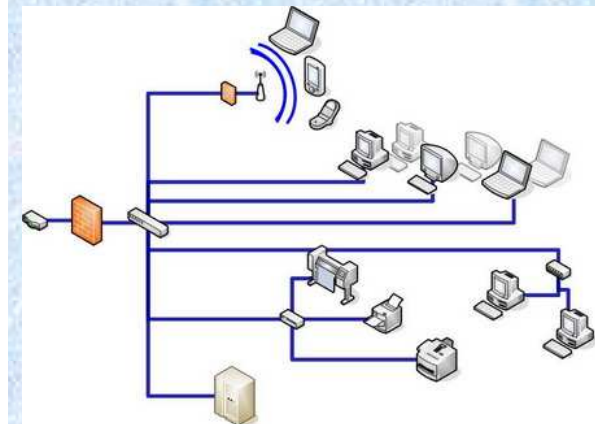
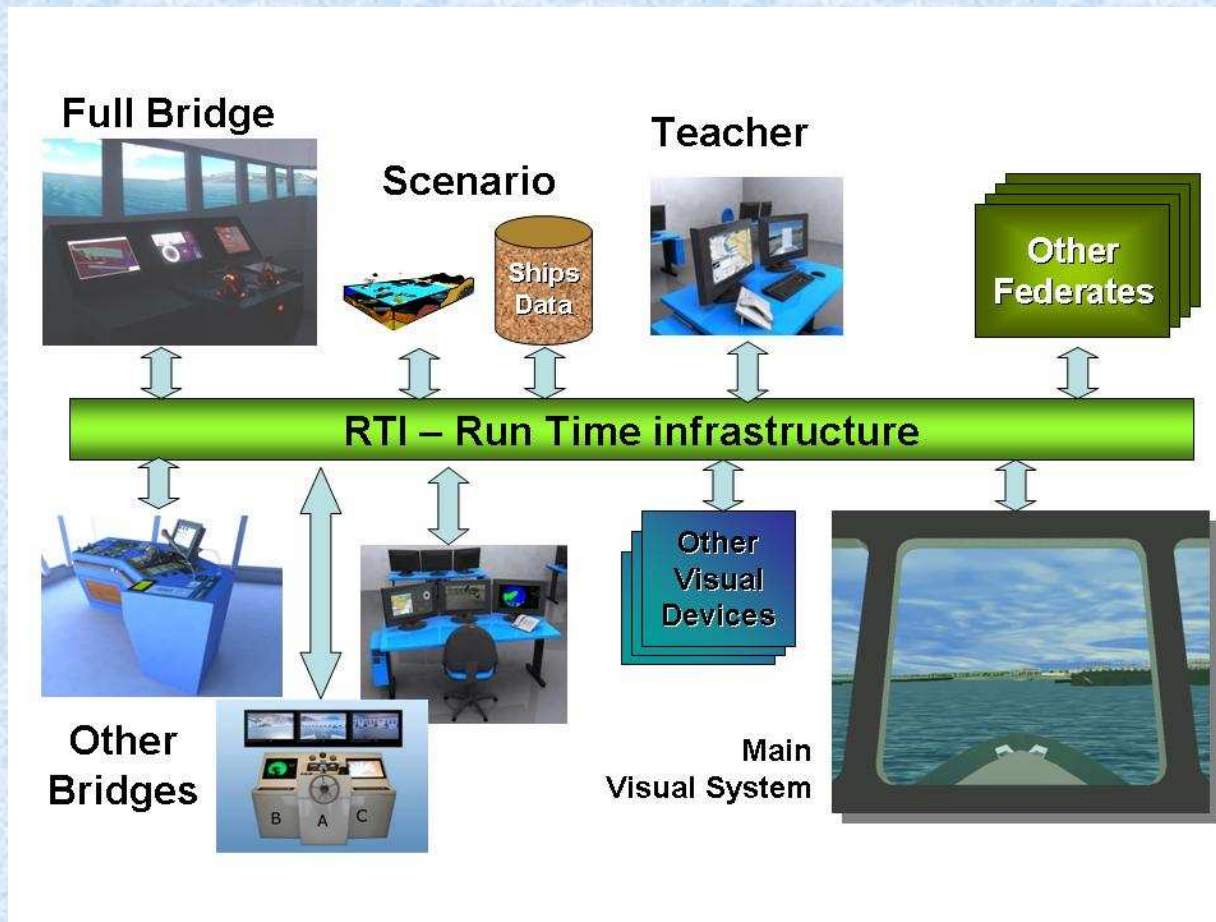
**Real-time
visualization**

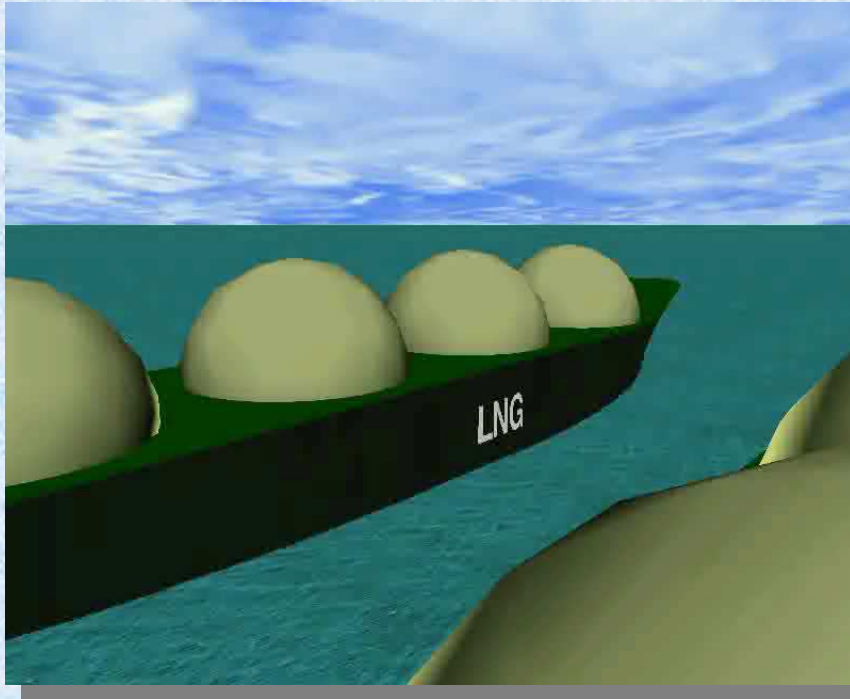


**Environment
interaction**

**Interactive
Behaviour
(man in the loop)**

- ✓ HLA Based Standard Architecture
- ✓ Connection with other simulators/simulations even WAN based





Two cooperating ships

Port traffic



ViSIR *Virtual Ship Integrated Architecture*



RAS



Italian Navy



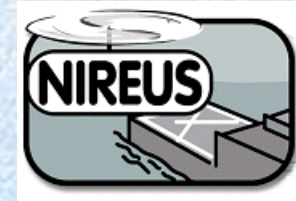
LPD

VTOL





-  LPA
-  BG96
-  HAMINA L
-  Lafayette
-  K130
-  NUMC
-  F-100
-  VISBY
-  CVSG
-  LHA



International HLA Federation Development



Geographically Distributed HLA Federations

Alenia (Turin) - Cetena (Genoa)



- **Integration of the actual systems in the federation**
- **Integration of other entities simulators / emulators**
- **Interaction among different experts /users**
- **Scalability: use in different design/operation steps**
- **Human in the loop and ergonomic assessment**

- **Simulation of complex interactive systems is becoming an important topic in ship design (*derisking*)**
- **The final users is not yet enough confident in the results as should be (*validation*)**
- **Interoperability and reuse of existing simulations can be achieved using HLA**
- **Further standardization needed for broader reuse and integration among different organizations (*international cooperation*)**
- **Reuse in different life cycle phases (training...) for maximizing Return of Investment**

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