Intelligent – Shipping – Technology

Increasing Automation and ‘Autonomous’ Ships




The Shipbuilder’s Perspective

Rauma, August 2018
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Content

Rauma Marine Constructions, NB6001

Introduction

Courtesy of Baltic Yachts

Objectives and Purpose of the ‘Autonomous Ship’ R&D programmes

- Autonomous
  - performed by a device capable of operating without direct human control
  - moral philosophy; acting in accordance with one's moral duty rather than one's desires.

- Apollo programme by NASA
  - Nasa scientists have pioneered more than ***6,300 technologies*** during their bid to understand space that are now routinely used in day-to-day living.
  - CAT scanner: this cancer-detecting technology was first used to find imperfections in space components.
  - Computer microchip: modern microchips descend from integrated circuits used in the Apollo Guidance Computer.
  - Cordless tools: power drills and vacuum cleaners use technology designed to drill for moon samples.
  - Ear thermometer: a camera-like lens that detects infrared energy we feel as heat was originally used to monitor the birth of stars.
  - Freeze-dried food: this reduces food weight and increases shelf life without sacrificing nutritional value.

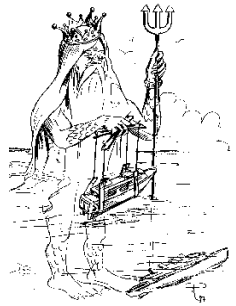
Introduction – Design Approach

TECHNOLOGY AND INNOVATION INTERACTION

- Mission based design – task for innovative functionality solutions
- Solve Customers' problems and challenges
- Mathematic modelling of complex physical phenomena
- Decisions based on understanding, which comes only through experience
- Cutting-edge technology in combination with a broad polytechnic understanding

FUNCTIONALITY
Offshore Support
Environm. Observations
Oil/Chemical Recovery
Research Facilities
Logistics
Accommodation

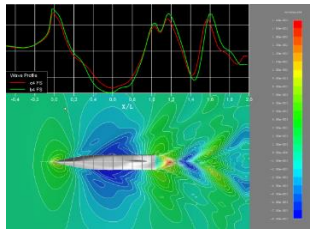
SAFETY
Crew Safety
Special Purpose Ship
Personnel Safety
SRtP
Comfort
(Noise/Vibration)



RMC – Finland CONCEPT

Requirement Specification

PERFORMANCE
Ice Navigation/
Breaking – Assistance
Seakeeping
DP and Track-keeping
Environment Footprint
Energy Efficiency



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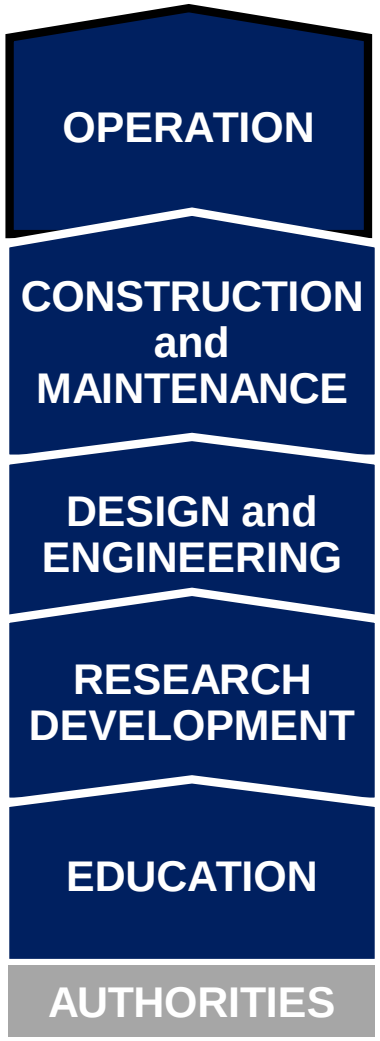
Technology Development – The Shipbuilder's Challenges

Sustainability and recruitment – Transfer of tacit knowledge

Knowledge Sustainability

- Challenges the co-operation between industry, science and education
- Maritime Network must comprise the whole vertical value chain
- Requires feedback between all steps in the value chain
- Each component in the chain to be structured into a multi-level activity
  - professors and doctors in science
  - masters and engineers
  - vocational and technicians
  - theoretical and applied science
- Trainees with an ability to integrate into the tacit knowledge in industry

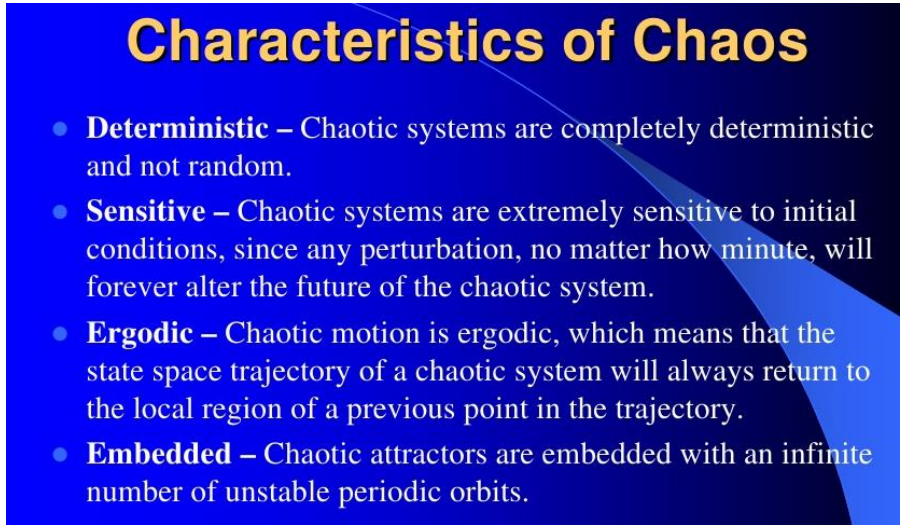


Reliability – Knowledge Level Requirements

- Reliability of sensors and processor technology as well as data collecting devices
  - doubling – tripling – five-fold systems for reaching “enough” redundancy
  - can reliability be solved with multiplied control units and software??

- Cyber reliability
  - not to mention cyber security

- Understanding is not enough
  - to perceive the facts and see the consequences → make the correct decisions
  - decision support through sensors and processed data – Yes !
  - human as part of the system and preferably with physical presence
  - changing operational boundaries? – in a chaotic surrounding or system



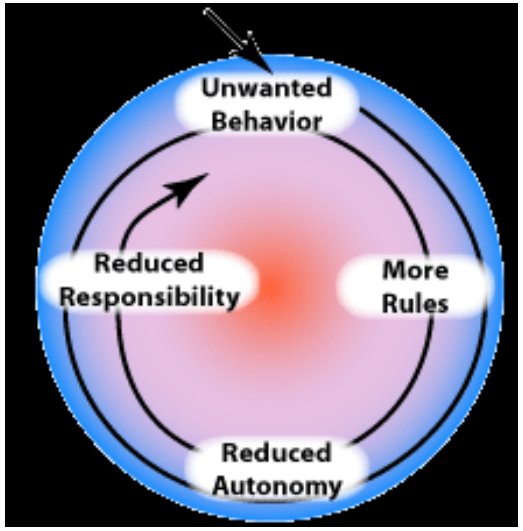
/CHAOS, Lorenz Attractor [Gleick, 1987]

Responsibilities – Does the Industry understand and can the Authorities regulate

- Ships' technical performance and functionality
  - system responsibility – enough challenging for the supplier
  - trends are poly-industrial
  - the Yard, i.e. shipbuilder, will carry the ultimate responsibility

- Operational and maintainability
  - operation versus traffic control – part of the integration?
  - component condition monitoring – obeying "indications"

- Legal aspect of technology potential
  - how will the Authorities guide and guard the development
  - harmonised legislation
  - ethical aspects of technology and autonomous ships
    - artificial intelligence



/Dr. Paul Ekman: Responsibility

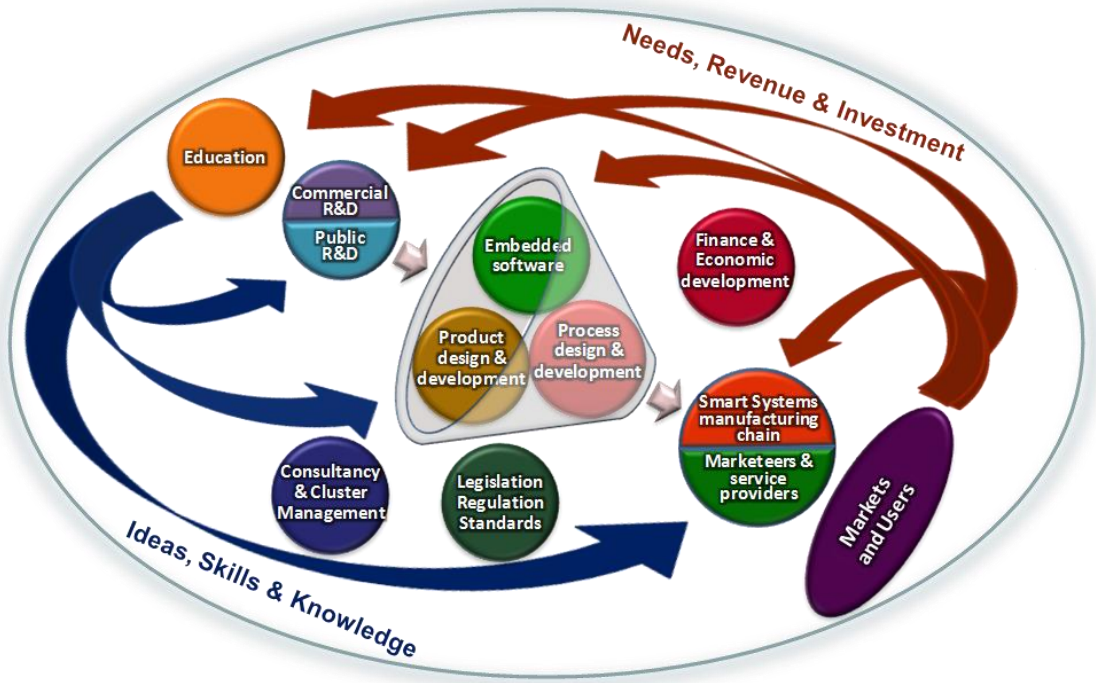
Human System Integration

- Human systems integration (HSI) considers areas such as: manpower, personnel, training, human factors engineering, system safety, personnel survivability, and health hazards.

- In simple terms, HSI focuses on human beings and their interaction with everything in the environment associated with systems.

- HSI is a comprehensive management and technical strategy for human systems integration that is initiated early in the acquisition process to ensure that the design and ultimate development ***meet human performance capability***.

- EXPRESS – Expert Resources in the European Smart Systems Integration Ecosystem



/EXPRESS - Mobilising Expert Resources in the European Smart Systems Integration Ecosystem

/Håkan Enlund

Conclusions

Objectives and Considerations

- Increased automation in modern ships have created new weak points in the overall performance of the ships
  - increased instability in integration due to software mal functions
- Autonomous ships' R&D-efforts will give a higher reliability of components and sub systems
  - by extension an increased safety
- Mission based development of future ships will ensure deeper technology understanding
  - theoretical knowledge supported with experience and deep understanding
- Talent and well educated people will contribute to keep continuity in the shipping value chain
  - a guarantee for the sustainability, - education – research – development – shipbuilding – operation
- Legal constraints and guidance integrates the Authorities into the business development