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Prototype to product – the difficult transition

Case: K-Master

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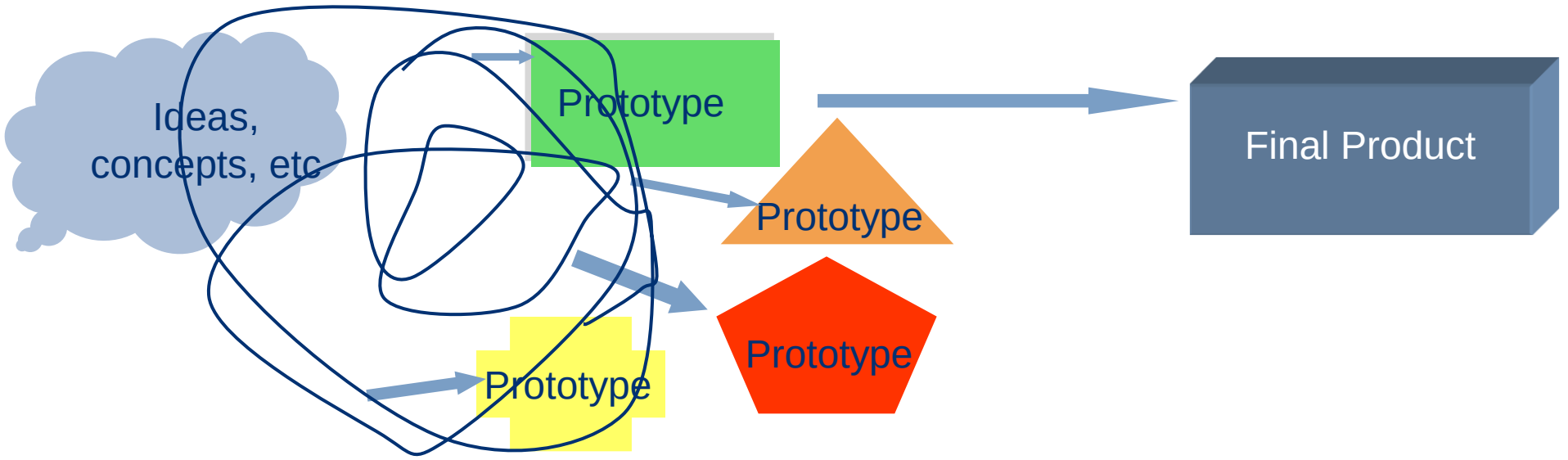
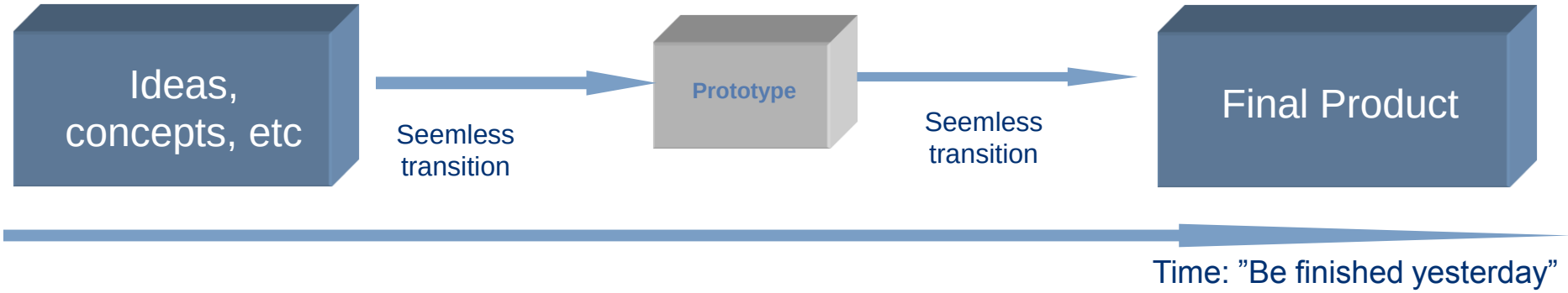
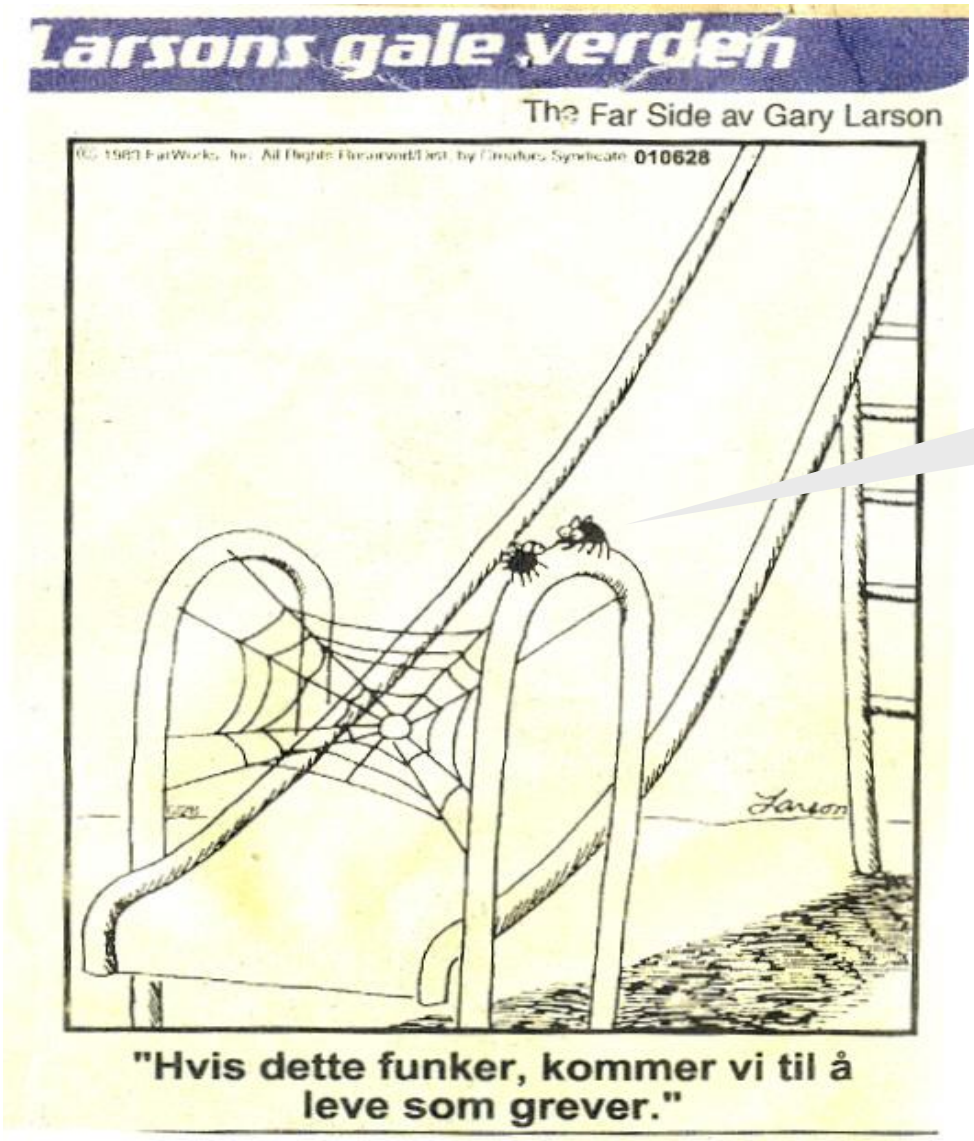
The ideal world (for innovators, developers etc.)



The real world (or how marketing dep sees it):



Ideas, concepts, experimentation



”If this works, we are going to live like kings for the rest of our lives”




The Presentation

- Short introduction of Kongsberg Maritime
- Why develop a new aft bridge workstation?
- The project: From idea to prototype to product
- The final product: K-Master
- Some lessons learned

Kongsberg Maritime

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Core business areas

Dynamic positioning systems

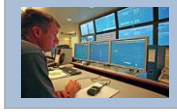
Automatic positioning of vessels, regardless of weather conditions

Navigation systems

Systems for navigation and the identification of vessels

Monitoring & control systems

Systems for monitoring and control of engines, cargo and propulsion



Process automation

Systems for control and coordination of different operations on oil platforms or production ships

Subsea

High-tech products using sound waves for seabed surveying, subsea communication, positioning and monitoring. Marine electronics for fisheries (SIMRAD)

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Offshore Support Vessels (OSV)

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- **Dynamic Positioning**
- **Thruster Control**
- **Navigation**
- **Machinery automation**
- **Sensors**

OSVs – a multitude of workstation arrangements

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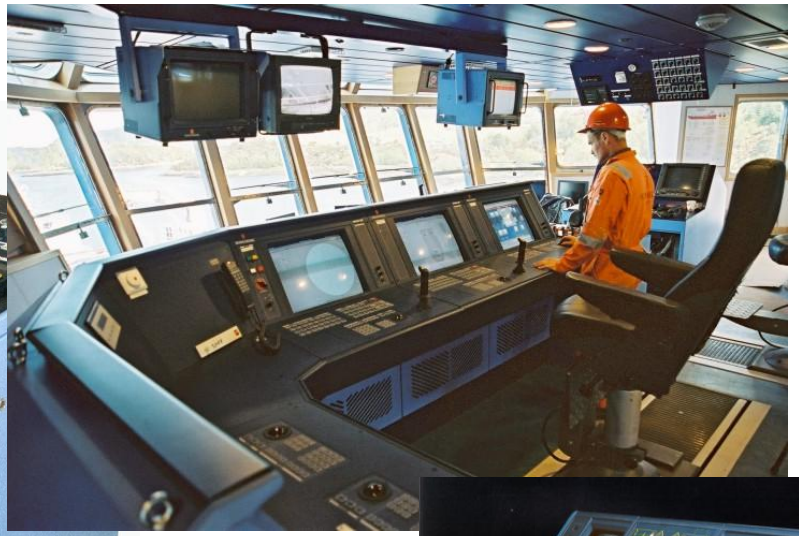
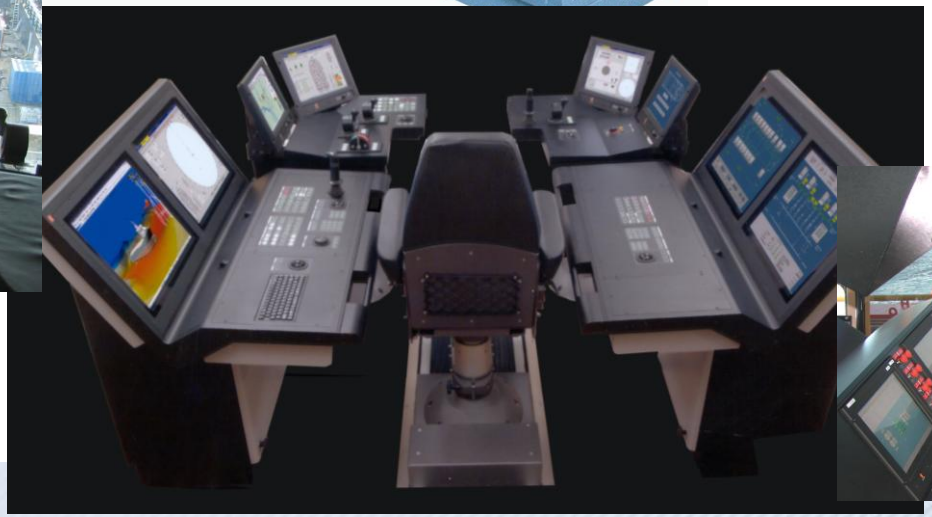
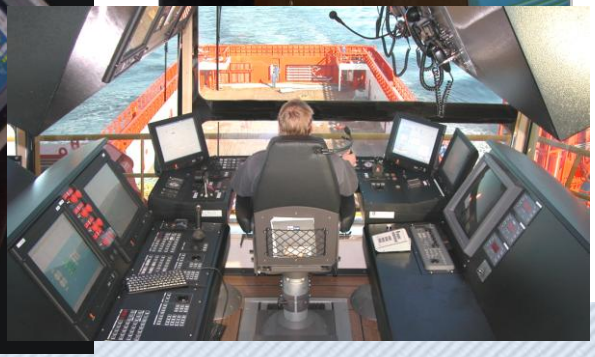
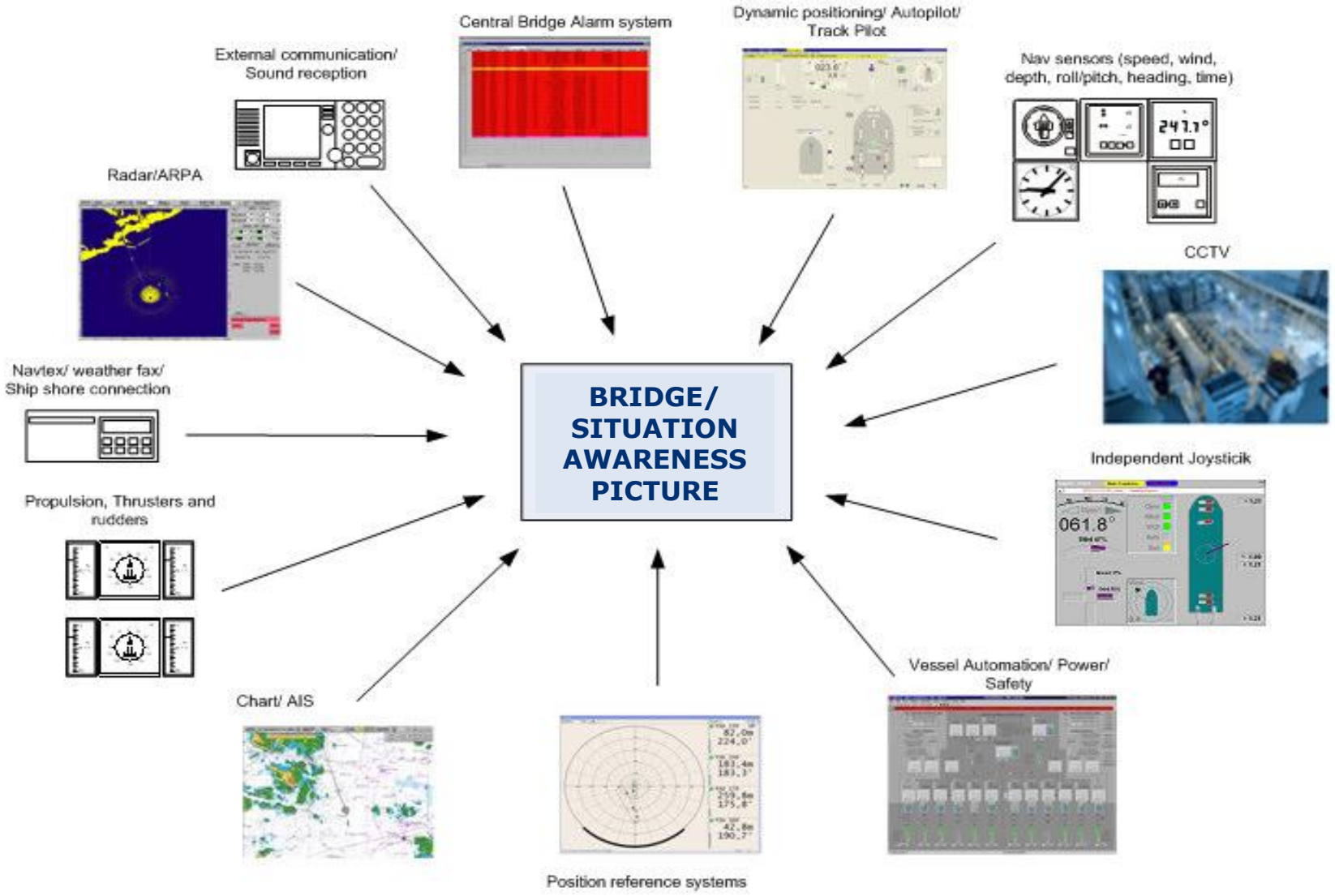






Our Vision
– Full Picture Integration of Kongsberg Scope of Supply



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Project ”Workplace Bridge”

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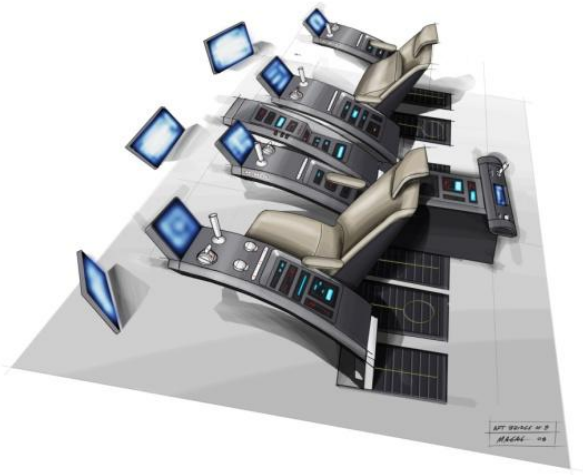
Mission statements from management:

”Make a product with a high ”WOW” factor”

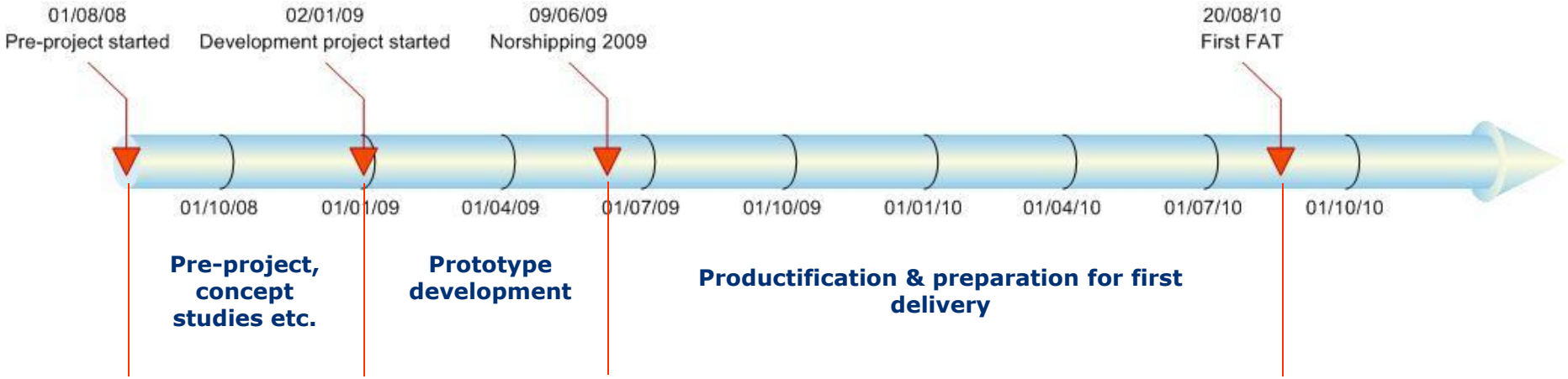
“We’ll give you all resources you need”

“KM’s #1 prioritized development project”



=> A System Engineers wet dream

Time schedule & Major milestones

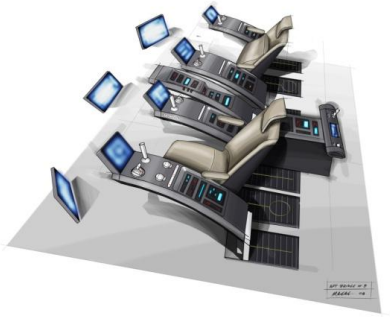


- Pre-project init Q3/2008
- Concept studies
- User questionnaires
- Design guidelines
- Recommendation in Dec 2008

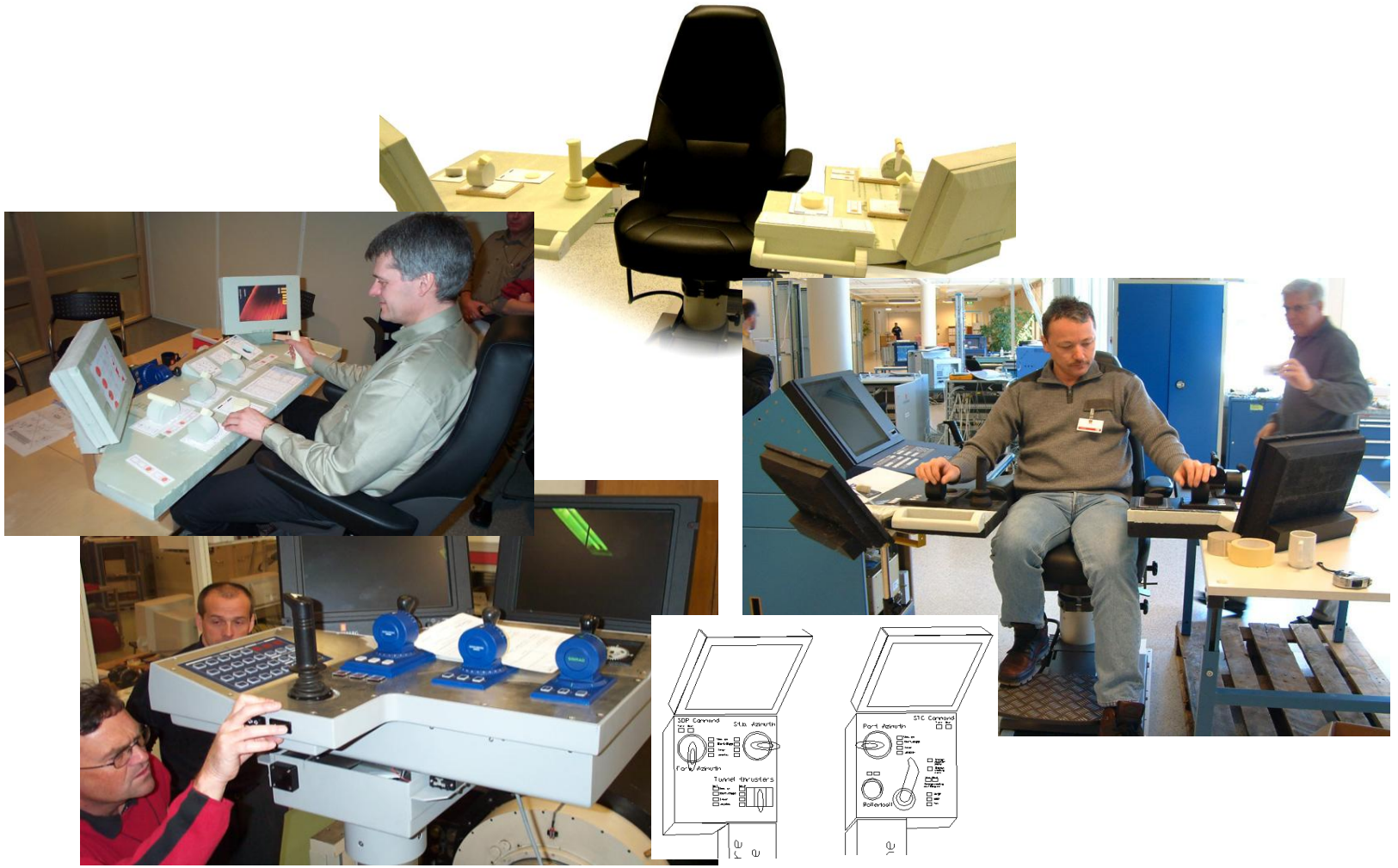
- Development started January 2009
- ”Adrenalin rush” prototype development
- Market launch at Norshipping 2009

- Building of 2 demo chairs
- Roadshow 2009
- Start of Productification phase

- Productification & operation adaptation
- Design Excellence award
- First sales contract signed
- Building of first aft bridge delivery



Pre-project , concepts, experimentation



Development project approach

- Common and intuitive operational philosophy
- Dramatic reduction of ”hard” panels and buttons
- Reduced number of displays
- Multi Functional Displays (MFD)
- Focus on Situation Awareness

Challenges

- Very tight time schedule: Norshipping June 2009
- ”Everything” new designs
- Multi-discipline project & Team building
- Manning with sufficient and competent personnel.

Prototyping & ”KM Skunkworks”

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- Lockheed Martin has trademarked the name Skunk Works
- A skunkworks is a small group of people who work on a project in an unconventional way. The group's purpose is to develop something quickly with minimal management constraints.
- Skunkworks are often used to initially roll out a product or service that thereafter will be developed according to usual business processes.
- Although people have speculated that the name was inspired by the poor hygiene habits of overworked employees, it was really taken from the moonshine factory in a cartoon series called "L'il Abner."

First milestone reached:

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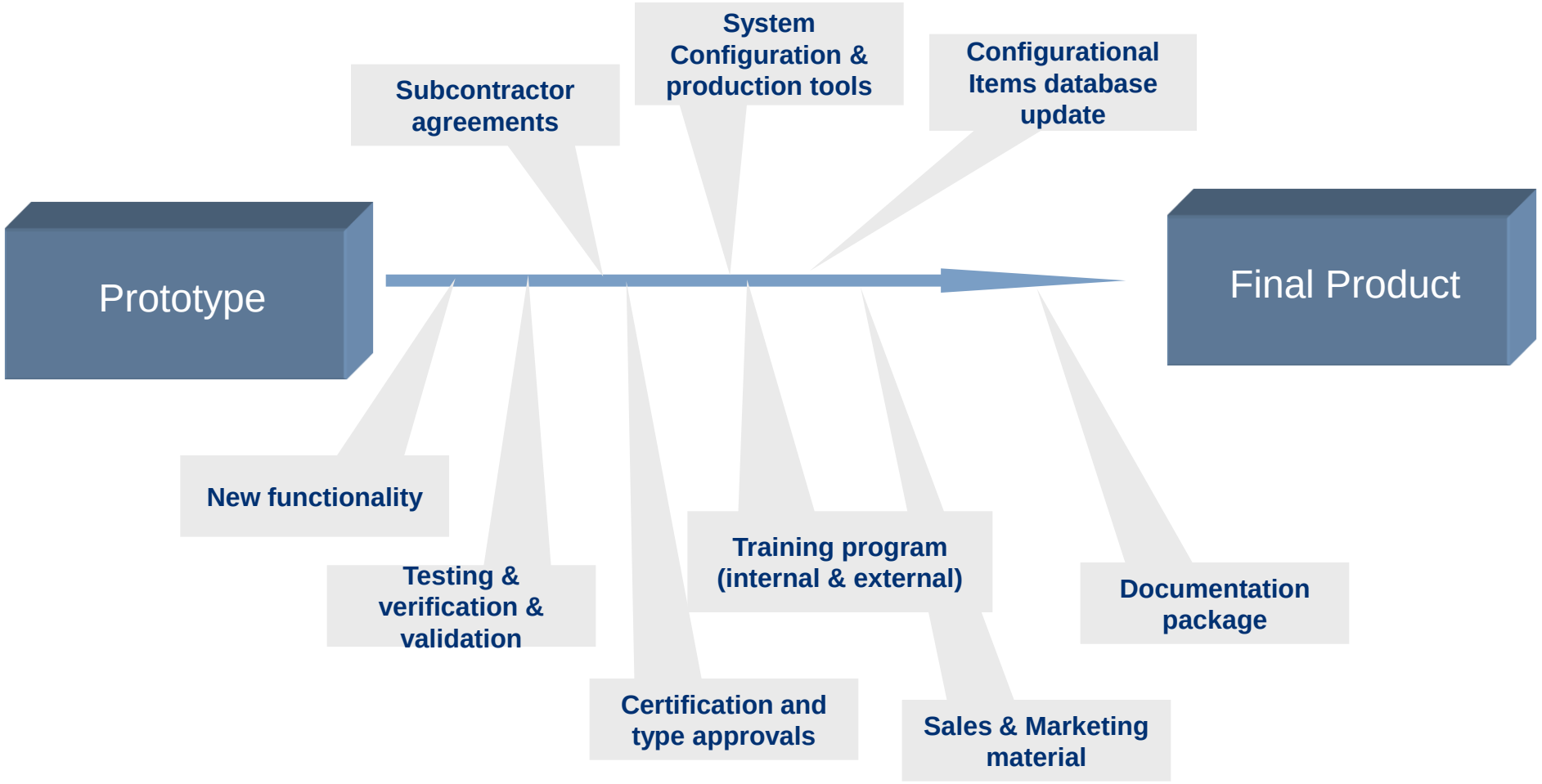
Very successful market launch at Norshipping exhibition

Productification



Productification

- **Certification**
  - This type of products are subject to very strict international certification rules
  - How to certify this highly integrated product?
  - Must satisfy DP Class 2 etc.
- **Environmental testing**
  - Extensive testing to satisfy standards for Temperature, shock, vibration, humidity, etc.
- **Production friendly**
  - Design the system to achieve SW release independence of integrated subsystems.
  - System configuration must be quick and easy
  - Easy assembly of components (both HW- and SW-components)
- **Installation friendly**
  - The product shall be easy to install onboard a ship's bridge
- **Cost-level**
  - The cost goal must be reached.
- **Documentation**
  - Completely new documentation package must be developed

Productification: Document Package example

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- **System Architecture, Functional and Integration Documents**
  1. System Requirement Specification (SRS)
  2. System Description
  3. System Architecture
  4. HW Topology
  5. User Test Plan
  6. User Test Report
  7. Operational Adaptation Functionality
- **System Test & Acceptance Documents**
  1. System Test Document
  2. FMEA Procedure
  3. FAT Procedure
  4. HAT Procedure
  5. CAT Procedure
- **Production, Installation & Maintenance**
  1. K-Chair Production Manual
  2. Installation Manual
  3. Maintenance Manual
  4. Spare Parts List
- **HW Documentation**
  1. Requirement Specification: Thruster Levers
  2. Requirement Specification: Joystick
  3. Requirement Specification: Pointing Device
  4. Requirement Specification: TCP 13 & TCP 8
  5. Requirement Specification: IJS
  6. Requirement Specification: Alarm & Utility Panel
  7. Requirement Specification: K-Master Chair
  8. Requirement Specification: Single Board Computer
- **Software Documentation**
  1. HMI Specifications
  2. Interface Control Document (ICD)
  3. Software Top Design Document
  4. SW Production Tools
  5. TCP SW Maintenance Manual
  6. SW Configuration Control Document
- **Test Reports and Certificates**
  1. Test- and Certification Plan
  2. Test reports (TBD)
- **User Manuals and Training Material**
  1. K-Master User Manual, General Functions
  2. K-Master User Manual, Operational Adaptations
  3. K-Master Training and Course Material
- **Marketing & Sales Material**
  1. K-Master General Presentation
  2. K-Master Quotation Text
  3. K-Master Cost Elements

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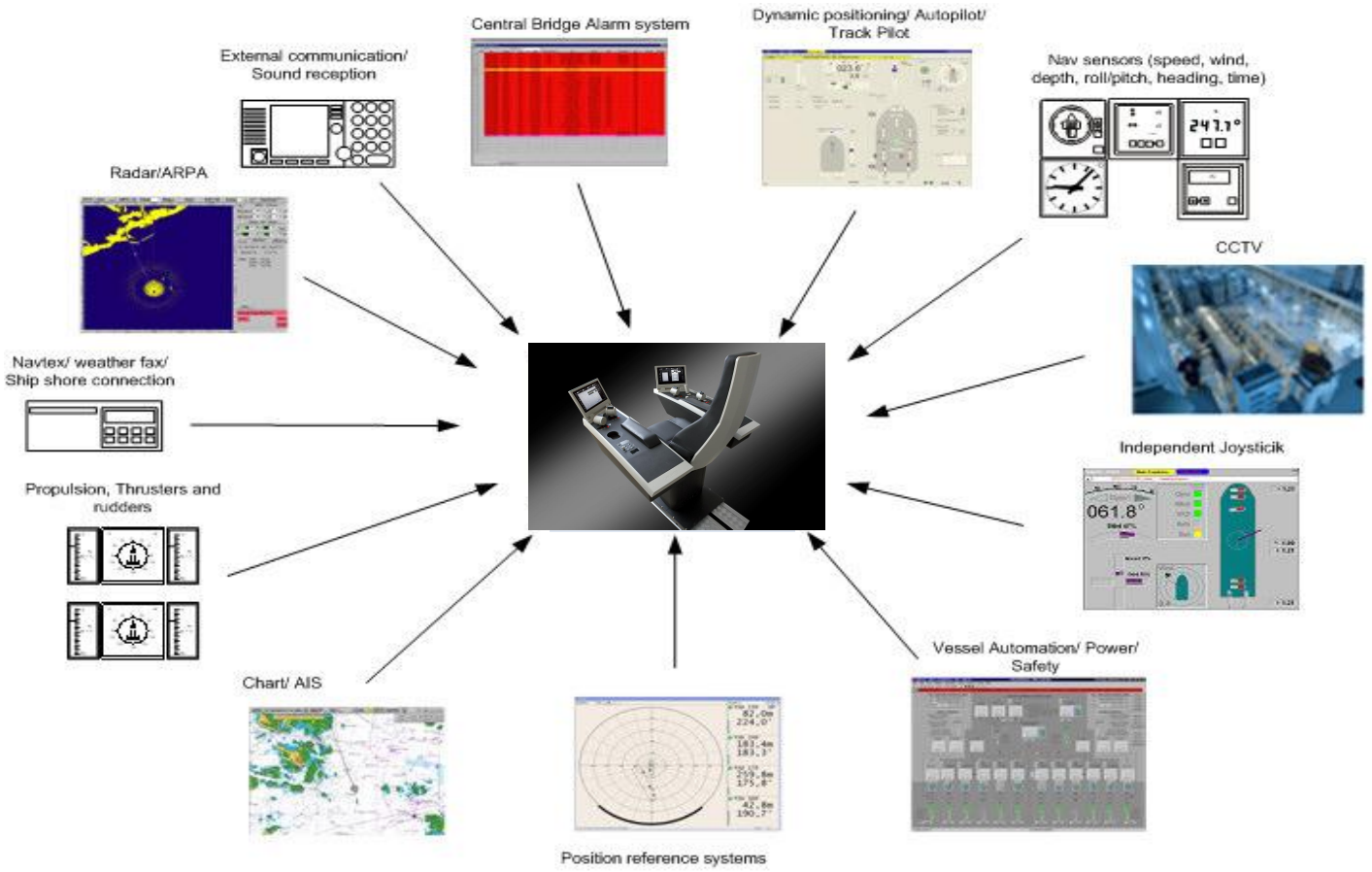
K-Master –The complete OSV Operator Station

- Thuster control
- DP control (class1 and 2)
- Independent DP joystick
- Ship Automation Systems
- Conning display
- Chart radar (Radar / ECDIS)
- Bridge auxiliaries control
- Integration of third party systems



K-Master – User centered design

Heading wheel

Search light control joystick

Touch Control Panels (both sides)

Mode control and control transfer

Joystick for DP and Independent DP joystick

Thruster control levers (both sides)

Microphones/ speakers in backrest

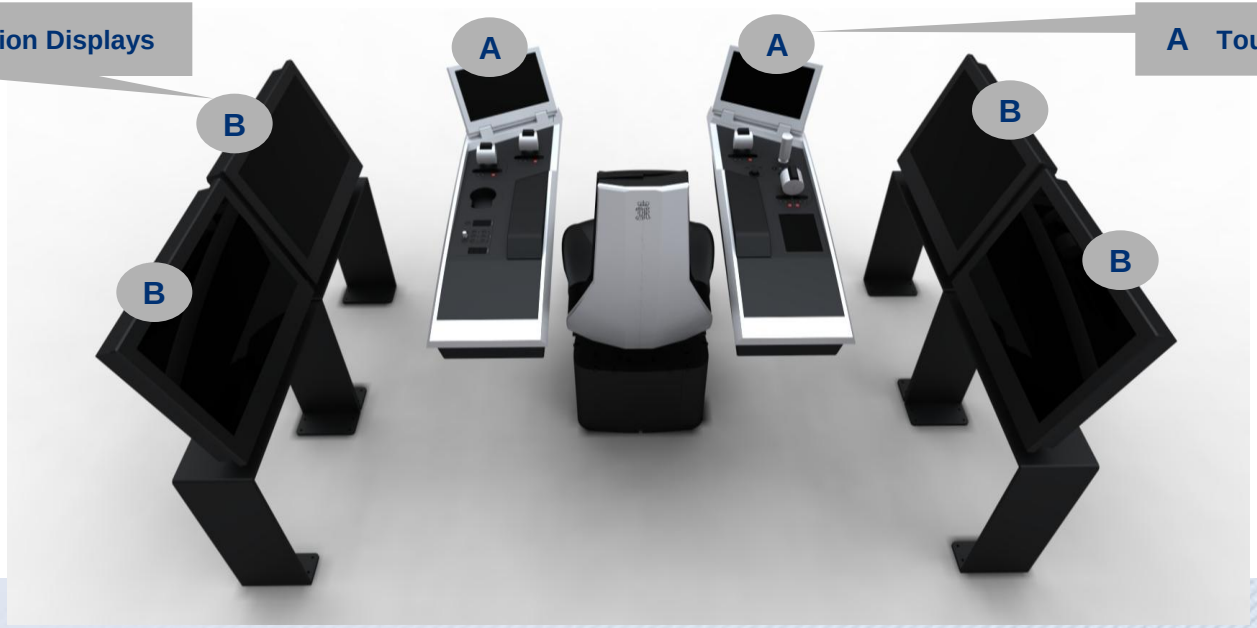
Seat adjustment controls

Space for additional operator units (both sides)

Independent DP Joystick control panel

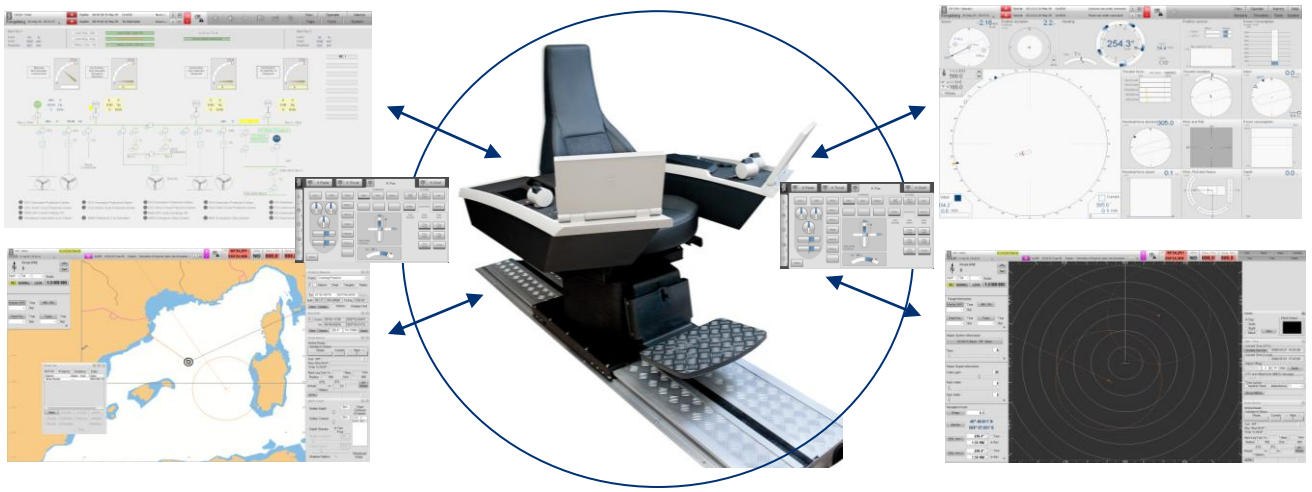
K-Master, Simplicity is the art of technology

- Replaces mechanical knobs and switches with modern displays and screens.
- Many systems – one common user interface
- A new generation of automation equipment that
  - combines simple and easy touch control with
  - unified and harmonized information displays designed for maximum Situation Awareness.



K-Master - Situation & Bridge Awareness (SA)

- SA:
  - Level 1 – *perception* of the elements in the environment
  - Level 2 – *comprehension* of the current situation, and
  - Level 3 – *projection* of future status



- In K-Master
  - Situation and system overview on “remote” displays
  - On hand interaction and immediate response in chair

K-Master, The User Centric Approach

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- Change of focus from boxes, systems and equipment to function, information and operation.
- Adaptation of user functions to operational context, i.e. extended mode control for vessel machinery and systems
- Focus on the 20% of the functions used 80% of the time.

- **The effects:**
  - **Optimal Situation Awareness**
  - **Safer Operation**
  - **Improved User Performance and Satisfaction**

- We make people improve their positions

K-Master – Design with a purpose

Awarded for Design Excellence by Norwegian Design Council Nominated for Honours Award for Design Excellence

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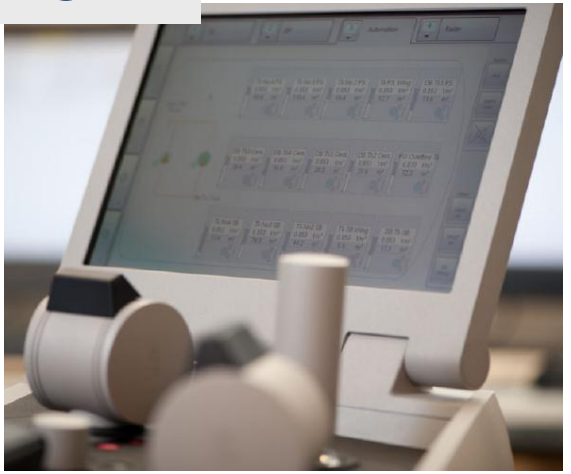
- Well seated for the future



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Lessons learned and Recommendations

- Have fun!
- Be sure to have top-management and marketing department's attention & commitment, all the way to the end! (Not only until the prototype is launched at an exhibition…).
- Use Rapid Prototyping extensively – "paperless design"
- Establish multi-discipline teams & Co-locate all team members "around" the object to be developed.
- Kill the "This is not my problem – somebody else has to fix this" syndrome. Make all to feel responsible for the end-product.
- Focus on developing functionality and visualise progress in SW development by demonstrating functionality
- Do not hide unpleasant facts in progress reports, be clear and communicate the real situation.
- Scope-creep is inevitable, - plan for this.
- Do not underestimate the productification phase! It ALWAYS takes longer time than planned
- In the end: It's all about people. Focus on creating a positive team-spirit where everybody pull in the same direction


Tank you for your attention!
Have a nice summer!