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SESA

Applying A3 reports for early validation and optimization of stakeholder communication in development projects

Kristian Frøvold, Gerrit Muller, and Michael Pennotti

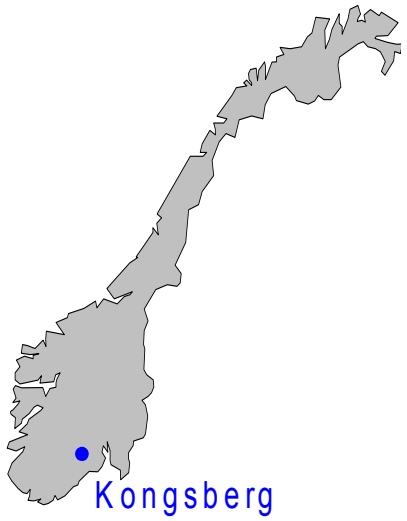
Presented by: Maarten Bonnema (NISE, University of Twente)

STEVENS Institute of Technology

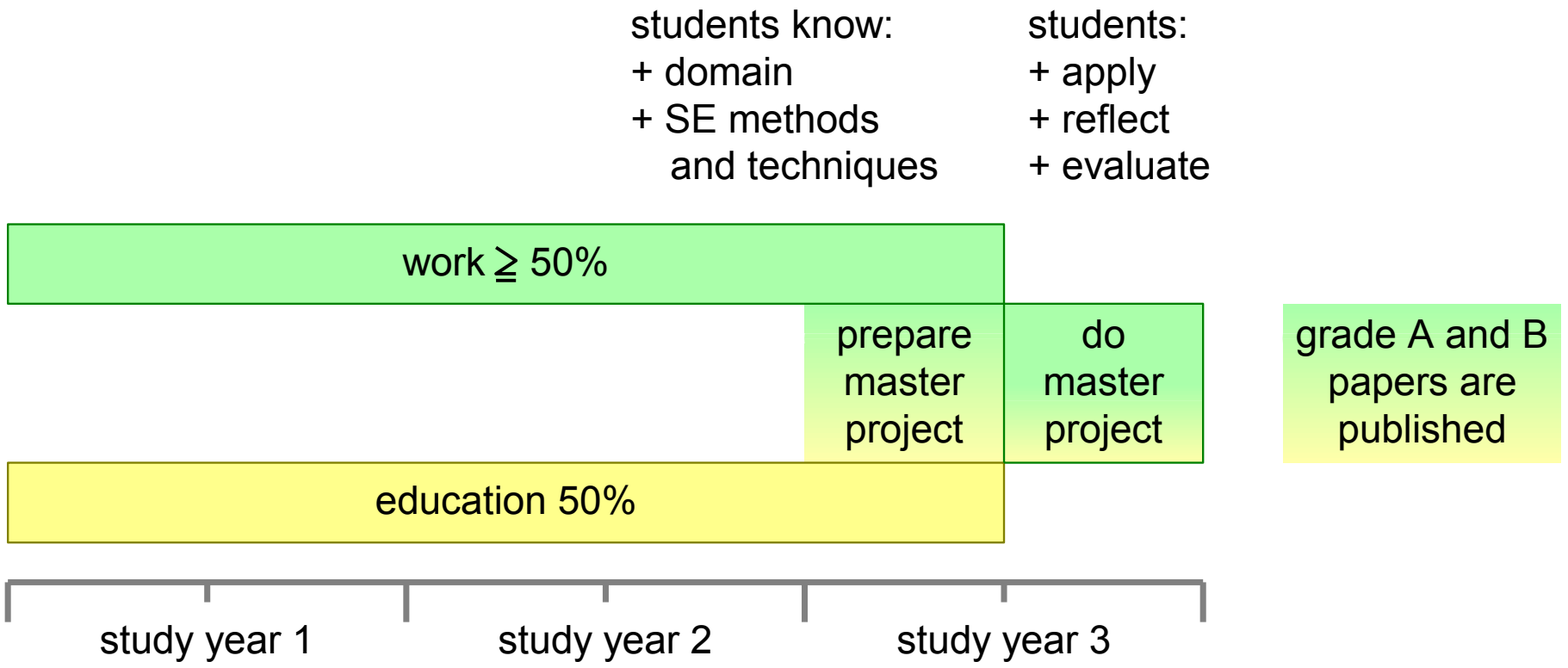
KONGSBERG

HSN University College of Southeast Norway

Technology park Kongsberg



Research Model Master Students Systems Engineering in Kongsberg, Norway



3

Introduction

- Kristian Frøvold: 2008-2011 Systems Engineering - Master
  - HIBU, now University College of Southeast Norway
  - Stevens Institute of Technology
  - Kongsberg Maritime (KM)

- Thanks for close cooperation to Martin Kruse
  - Kongsberg Maritime: Sølve Raaen, Katarina Hagner, Wenche Enga
  - Advisor: Gerrit Muller

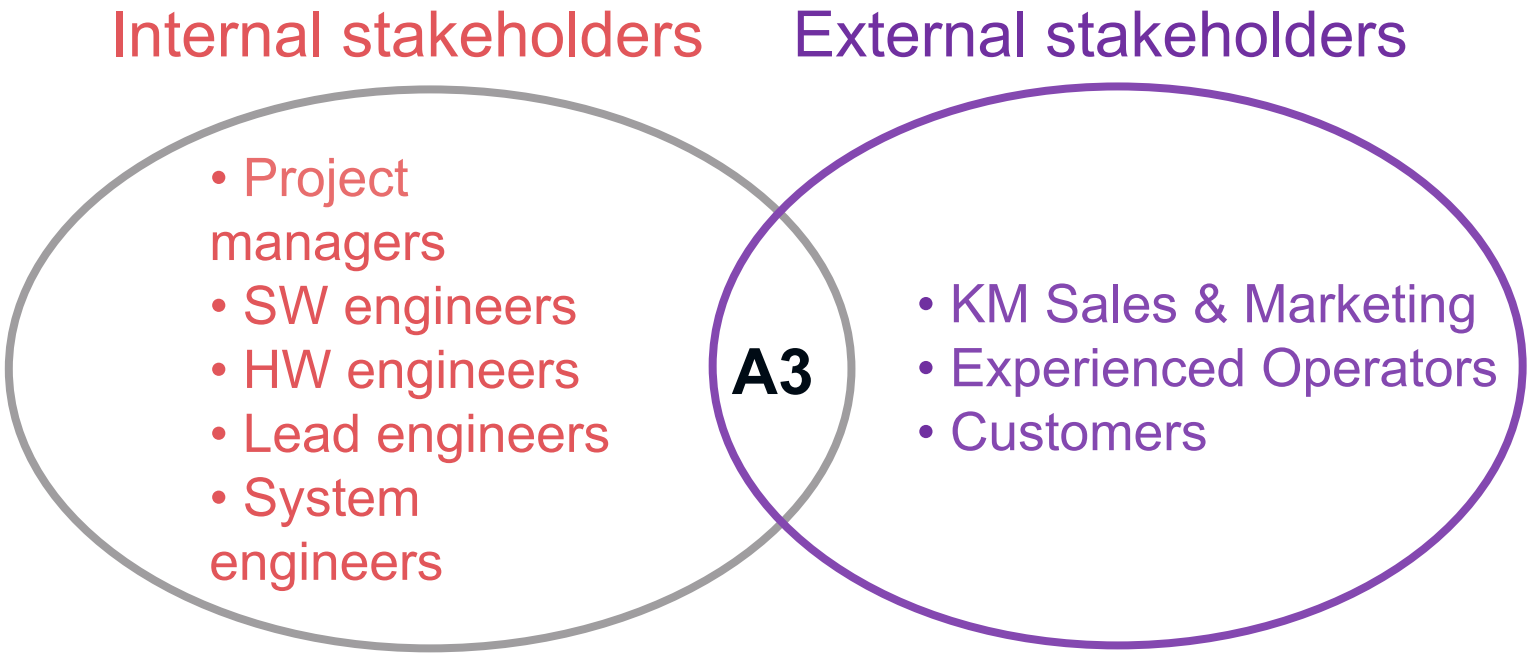
- Have worked in Kongsberg Maritime since 2008 in the Product & Development department
- The study is performed in a large development project for KM, the New Operator Station project
- The new operator stations were presented for the first time at the Nor-Shipping exhibition, May 2011

Introduction – Need and Solution

- The need was to shorten the distance between development groups and external stakeholders, like customers, operators, and sales & marketing
- We had discovered that too little communication could lead to validation problems (bad requirements)
- Our study's goal: To create a tool for early validation and communication (at this stage in the development process)
- Through Early Validation A3 reports, by simple means we increased communication and contributed to early validation
- The high-level system focus became very important

Stakeholders

- The most important factor for the early validation
- Lots of the information is contained in people's heads
- Multi-disciplinary teams



Stakeholders

A3 - History

- Paper size of 297 x 420 mm
- Emerged from Toyotas lean development
- Spread to other domains, such as Health-Care
- Architecture Overview developed by Daniel Borches (http://dx.doi.org/10.3990/1.9789036531054)
- Purpose of early validation (Early Validation A3 reports):

  At an early stage, find out if we are building the right system, service or functionality. Provide this feedback to project

Early Validation A3 – Key features

- Multiple related views
- Different levels of abstraction
- Concise and Digestible
- Mixture of text and models
- Based on story-telling (operation)
- High-level system focus

KONGSBERG

Example

New Operator Stations

Vessel Mode

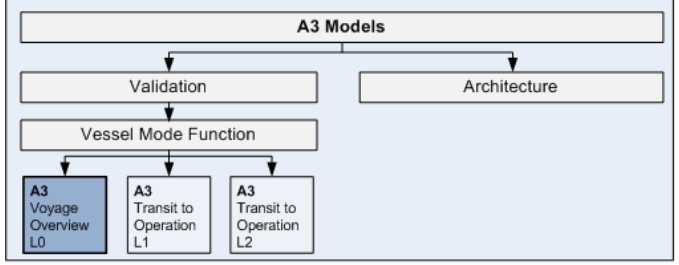
- New Operator Station (OS)
  - Multi-function OS
- New architecture
- Opens for new functions
- A complex function
  - Modes
  - Interfaces DP, Nav, Aut
  - Flexibility

Example

- We depicted a proposed solution for the system function at an early stage
- The Vessel Mode functions goal is to increase safety and efficiency on voyages/operations
- In this case we collected information from and created the A3 reports with stakeholders mentioned earlier
- “To collect real information you have to go there”

Viking Energy – Deepsea Atlantic

6 m (9 m) waves - ±40 knots (20 m/s wind)



Function Goal
Safe and efficient voyage from CCB Ågotnes to Veslefrikk, Deepsea Atlantic and Gullfaks

Model Goal
Model the real events of a container loading operation with a OSV (Viking Energy)

Considerations

There will exist many types of operations. This model only covers one specific example to illustrate work flow and user interaction

Abbreviations

FOW – First Officer on Watch
TTR – Time To Repair
S&M – KM Sales & Marketing

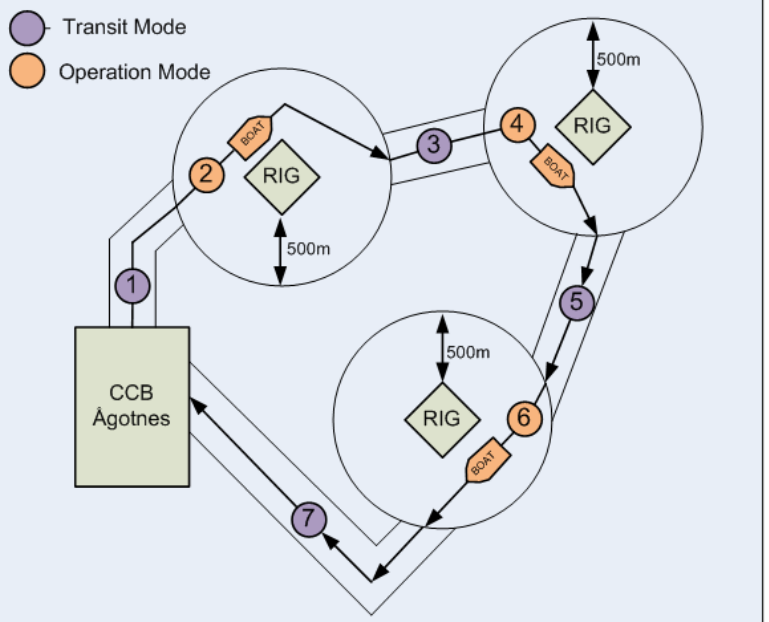
A3 Operation Load Containers V11

Author: Martin K / Kristian F
Version Comment: This A3 is updated after after interviews with operatiors, sales and marketing
Last Update: 04.03.2011

Scope: Transit - Operation
Status: Approved V 1.0

Operation flow

Operation: Load/Transport Containers



Flow Diagram

1 Operation Planning, Manuever from Dock, Transit to Rig

2 Navigate close to Veslefrikk, Maneuver closer w/ Joystick, Set Waypoints, Start Operation

3 Navigate from Veslefrikk, Set heading and route to Deepsea Atlantic (DA)

4 Navigate close to DA, Maneuver closer w/ Joystick, Set Waypoints, Start Operation

5 Navigate from DA, Set heading and route to Gullfax

6 Navigate close to Gullfax, Maneuver closer w/ Joystick, Set Waypoints, Start Operation

7 Navigate from Gullfax, Set heading and route to Statfjord field

8 Cancel trip to Statfjord due to bad weather conditions, return to CCB

Need Statement

A system/function for guidance and operational support for safety and efficency is needed, as there is a trend towards higher safety and increased efficiency.

Vessel Mode Function

What shall the Vessel Mode function do/contain of?

- Create Electronic Checklists
- Manage Electronic Checklists
- RCA/State Readings/Status
- Bridge Setup
- Change screen layouts
- Auto start sequences
- Role Change

Concerns/Feedback

Observed

- Seems like there is no time to save in this voyage
- The operators have lots of time to fill points in checklist, also FOW does this during operation
- Checklist only filled once during 3 days voyage, multiple operations. Filled underways towards the Rig, but not completed before "mode change"
- Basically they use very few screens activly for navigation (1, and some ECDIS) and operation (2)

- Does not secarily need for an Approach Mode

Key Drivers (KM)

1 Improved Safety
- 1.1 Ease of operation/guidance
- 1.2 Availability
  - 1.2.1 System uptime / TTR
  - 1.2.2 Screens and Interaction elements reacable

2 Improved Efficiency
- 2.1 Time savings during Voyage
- 2.2 Fuel savings
- 2.3 More efficient handling of lists

Market

A Vessel Mode function is a function that can be implemented in any ship and operation type (S&M)

Viking Energy operators suggests Diving Operations, Bouy Loaders. OSV w/ only aft bridge

It have to be considered that every market have very different needs

Validation Result (PSV)

For PSV Operations in the Northern sea Vessel Mode function seems at this point as unneccesary and complicating.

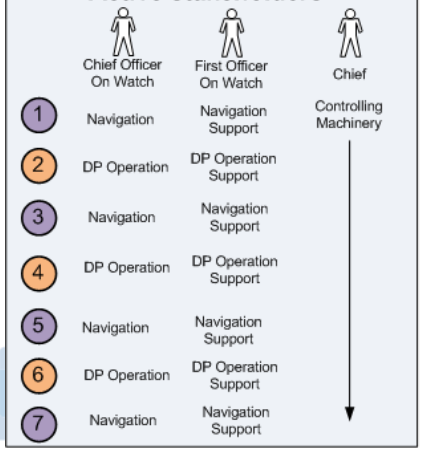
Vessel Mode are probably more suitable for other markets

A mapping of where Vessel Mode suits the most and a design focus towards this application would be perferable

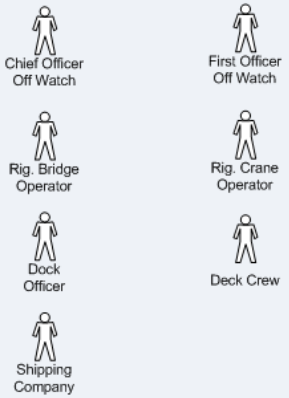
Sources

Operators From Viking Energy and KM external stakeholders.

Active stakeholders

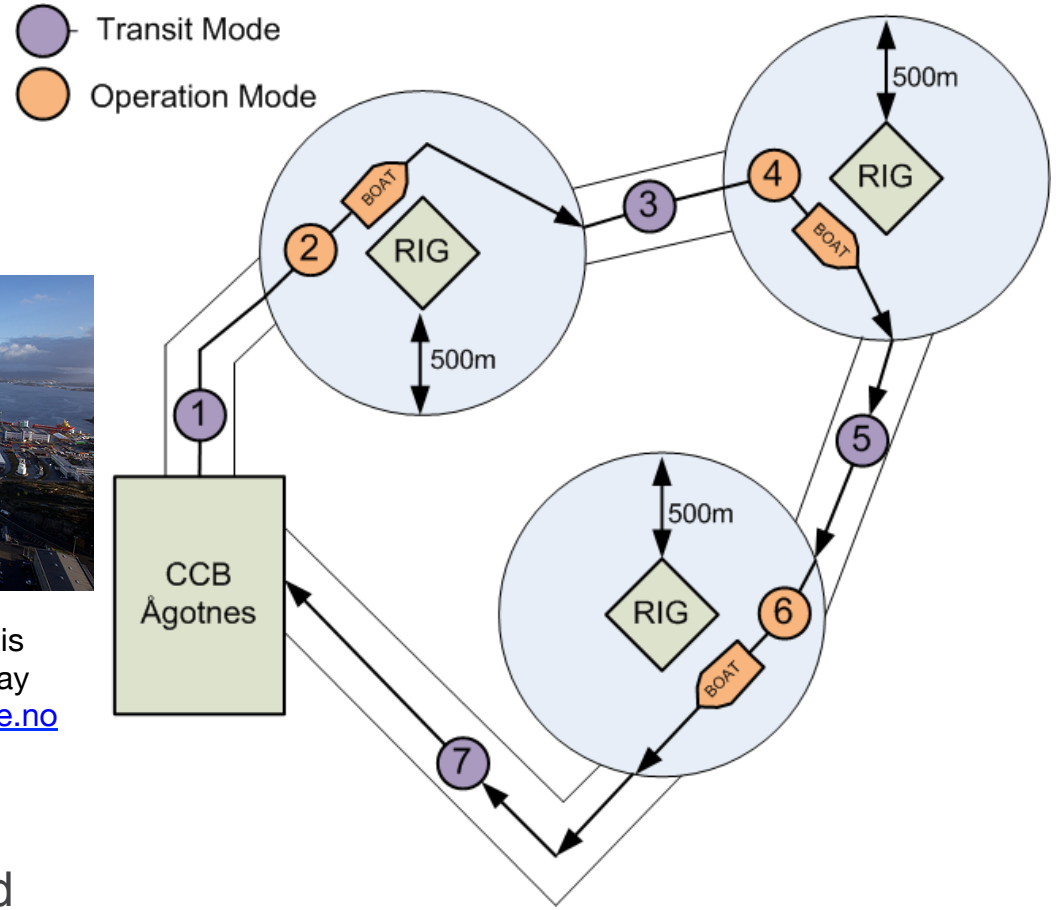


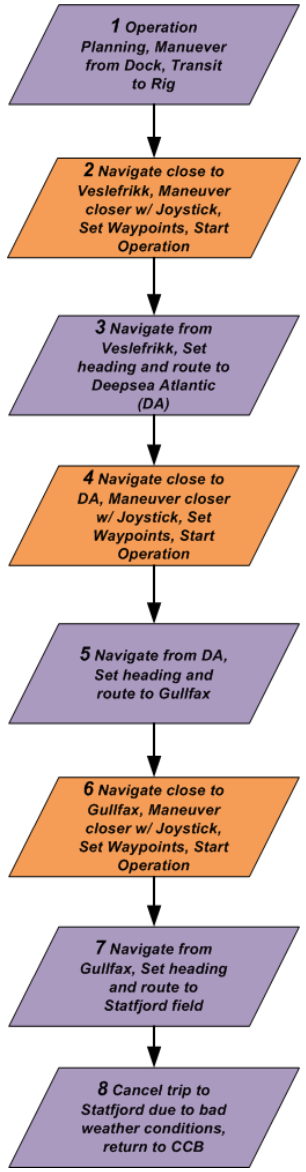
Passive Stakeholders



Pieces of an A3

* Coast Center Base (CCB) is located at Ågotnes in Norway
http://www.coastcenterbase.no

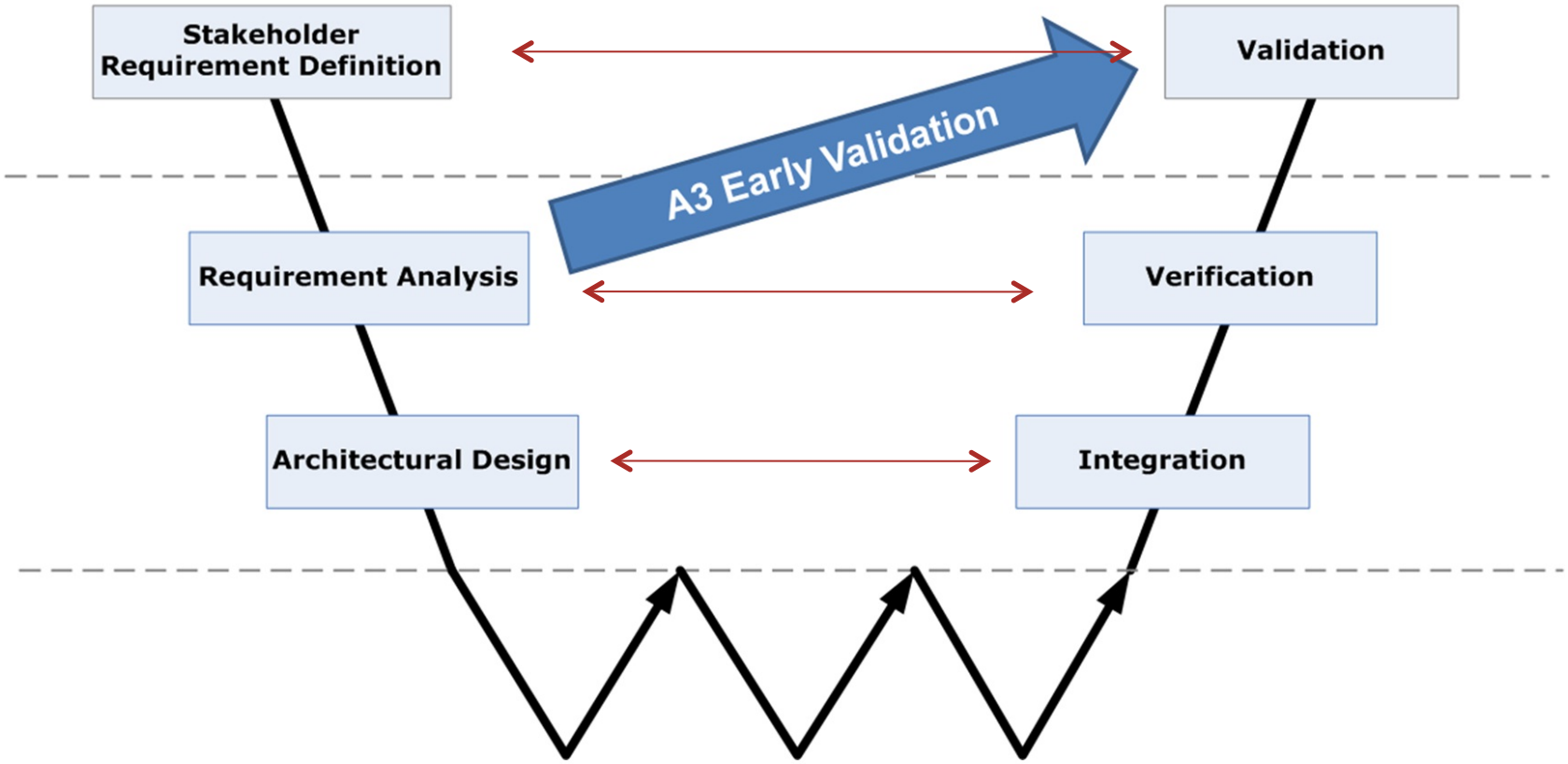




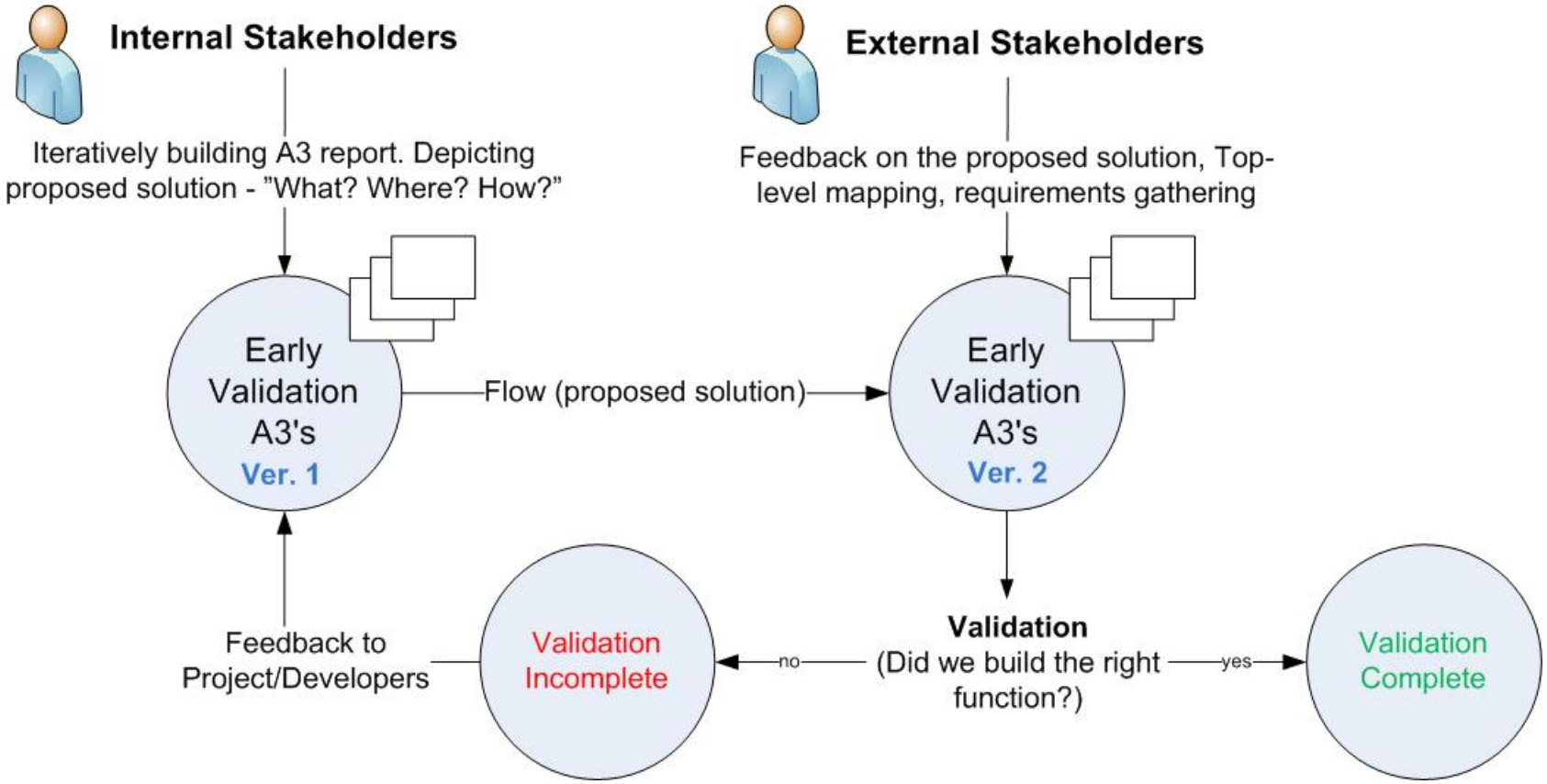
- Interrelated
- Color codes, vizualisations, quantifications ..

The Method and Process

A3 method for Early Validation



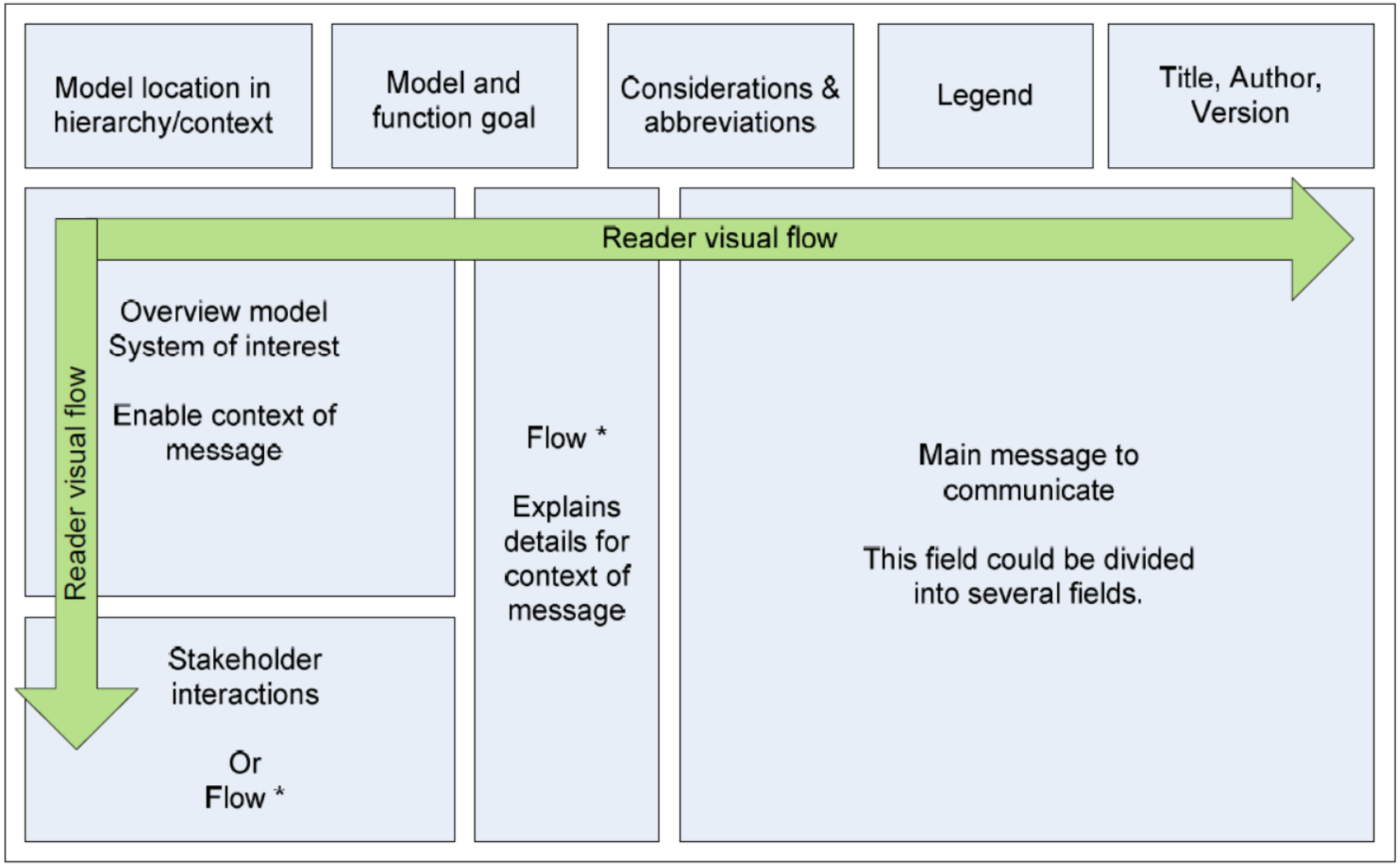
The Process



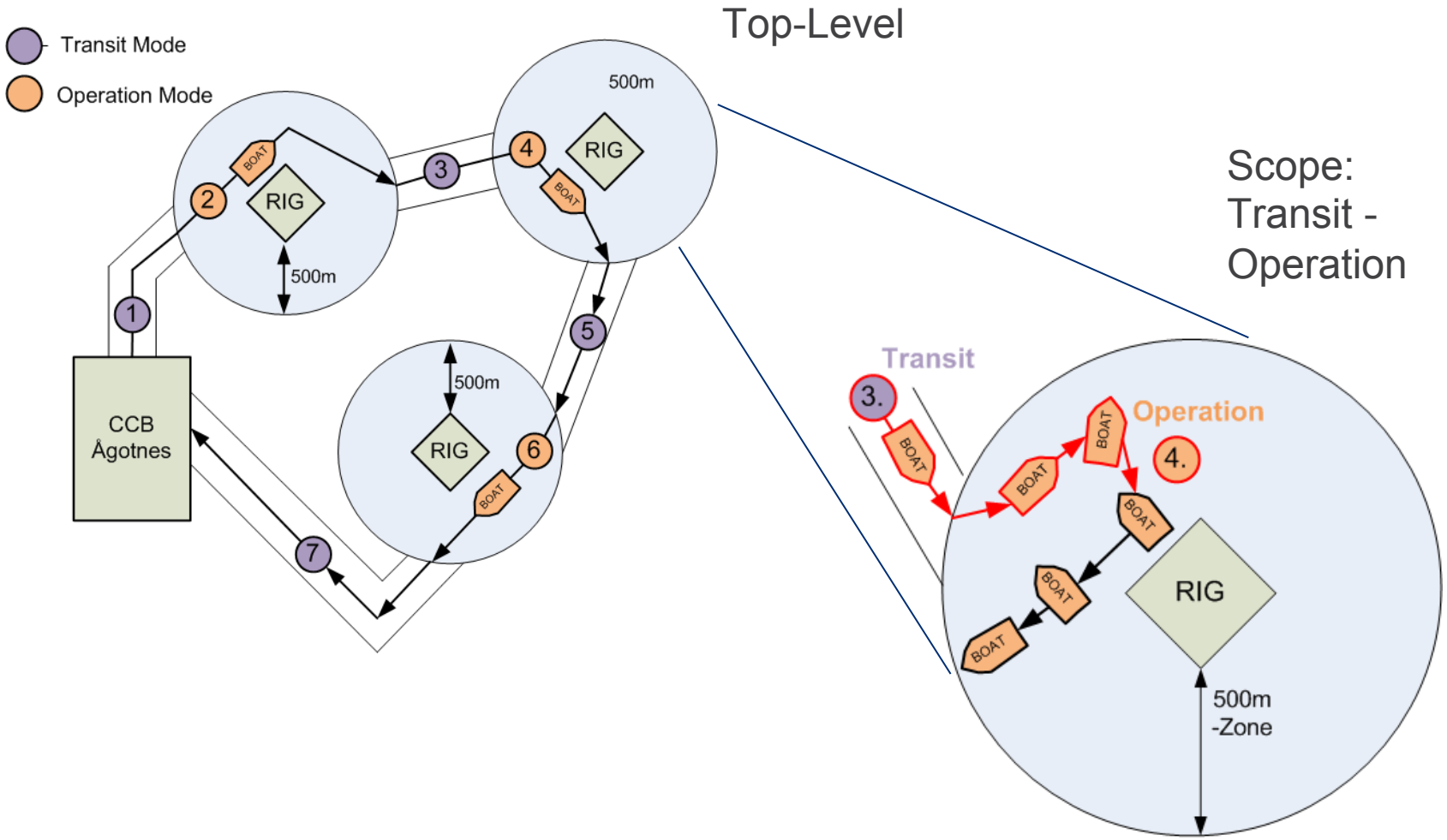
The Process

- Meetings mainly done with one stakeholder at a time, presenting the latest A3 reports
- Many iterations
- Start with a top-level report illustrating the proposed solution for the system/function
- Handing out printed A3 reports and letting stakeholders draw on them and comment as we discussed and led the stakeholder through

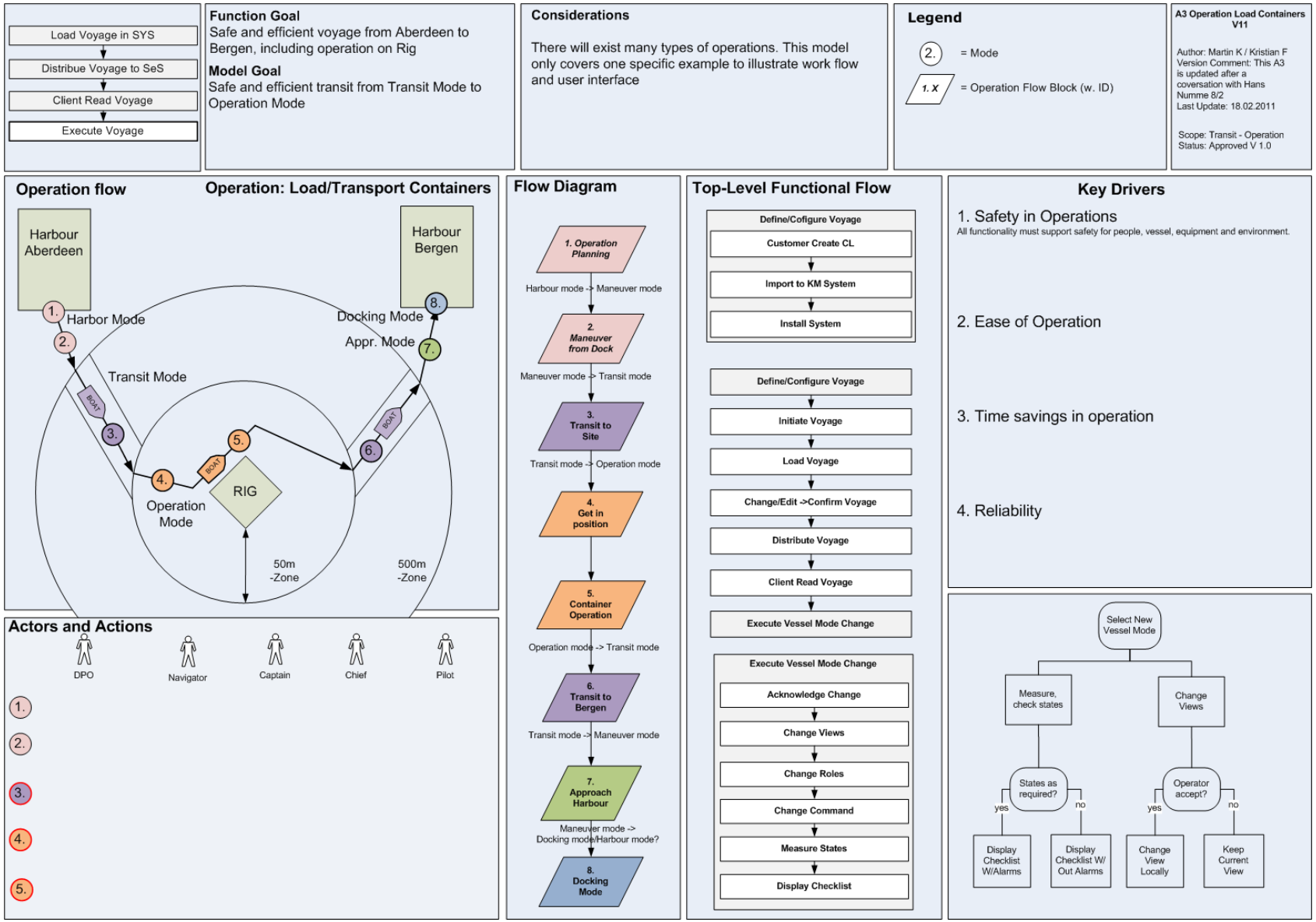
A3 – The Layout



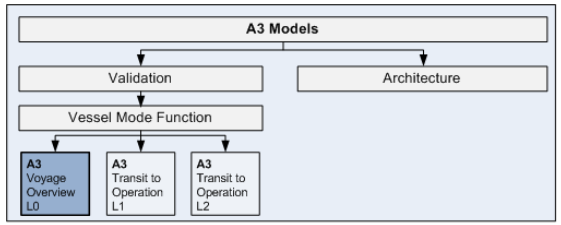
The Levels - Scope



Top-level Overview – Version 1



Top-level Overview – Version 2



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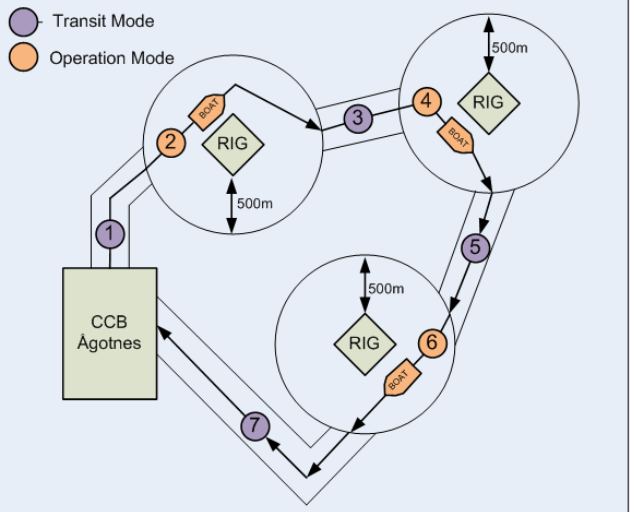
Status: Approved V 1.0

Operation flow — **Operation: Load/Transport Containers**



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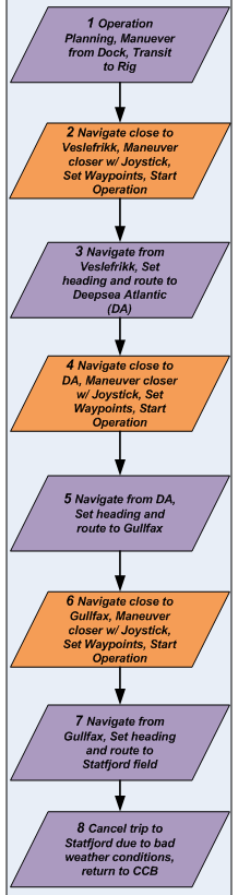

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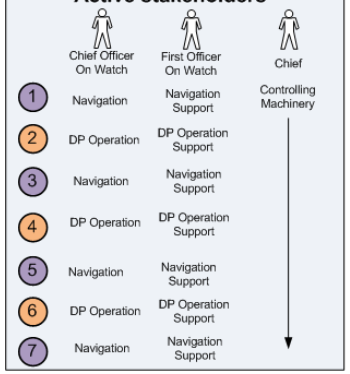

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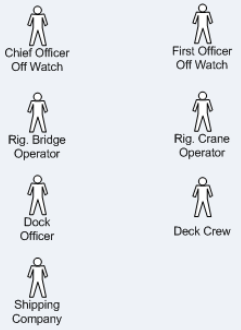

Communication Plan – Version 1

Load Voyage in SYS
Distribue Voyage to SeS
Client Read Voyage
Execute Voyage
Vessel Mode: Transit -> Communication in Transition for Operation (L1)

Function Goal
Safe and efficient transit from Transit Mode to Operation Mode

Model Goal
Validate the operation of going from Transit Mode to "Load Container" Mode/Operation Mode

Considerations
There will exist many types of operations. This model only covers one specific example to illustrate work flow and user interface

Abbrevations
* MFOS - Multi Function Operator Station
* CL - Checklist
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* OS Role - Describes the task that can be performed at that OS. An OS can be able to take different roles.
* OS Layout - The OS layout is a predefined setup of elements on the display(s). Views, Panes etc.

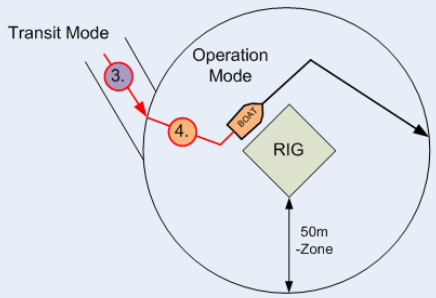
Legend
= Mode
= Operation Flow Block (w. ID)
= Operation Flow Block (w. ID)

A3 Operation Load Containers - Transit to Operation - V4

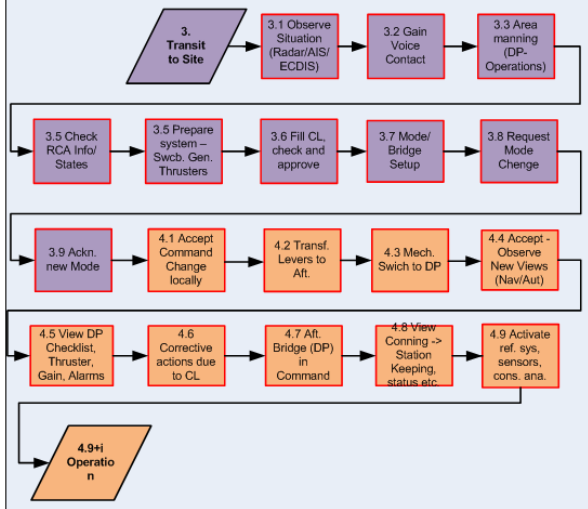
Author: Martin K / Kristian F
Version: 1.0
Version Comment: Updated after advicing with SR. Amund, SB
Last Update: 18.02.2011

Scope: Transit - Operation
Status: Approved Version 1.0

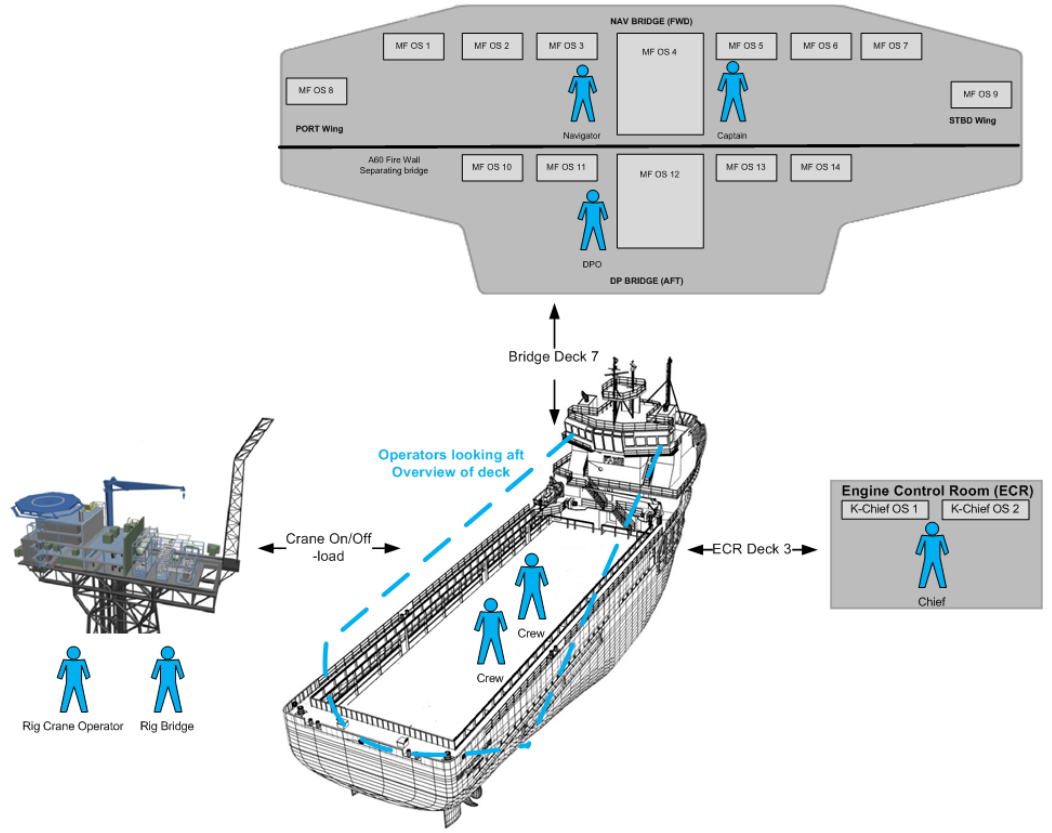
System of Interest From transit to load Containers



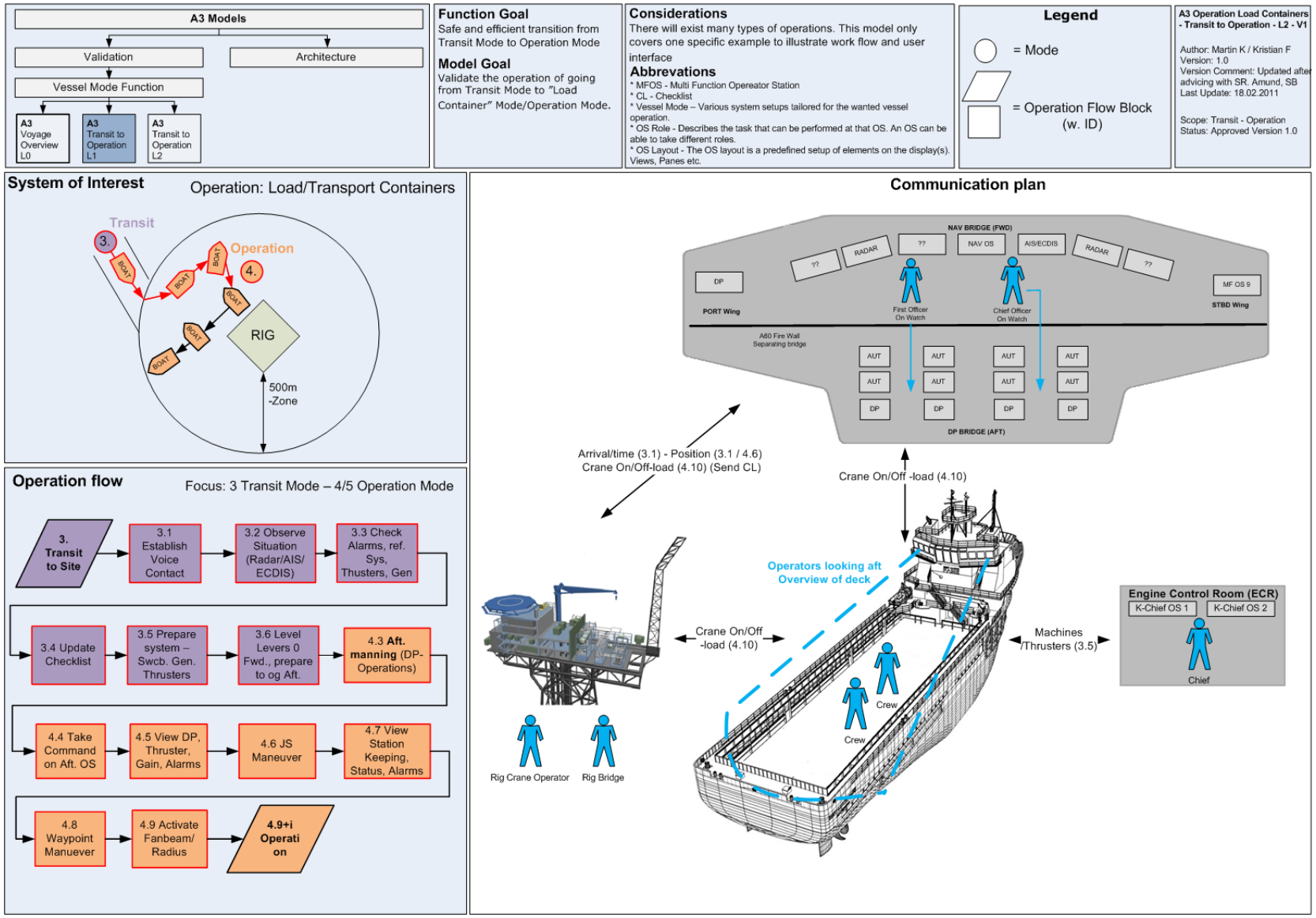
Operation flow Focus: 3 Transit Mode – 4/5 Operation Mode



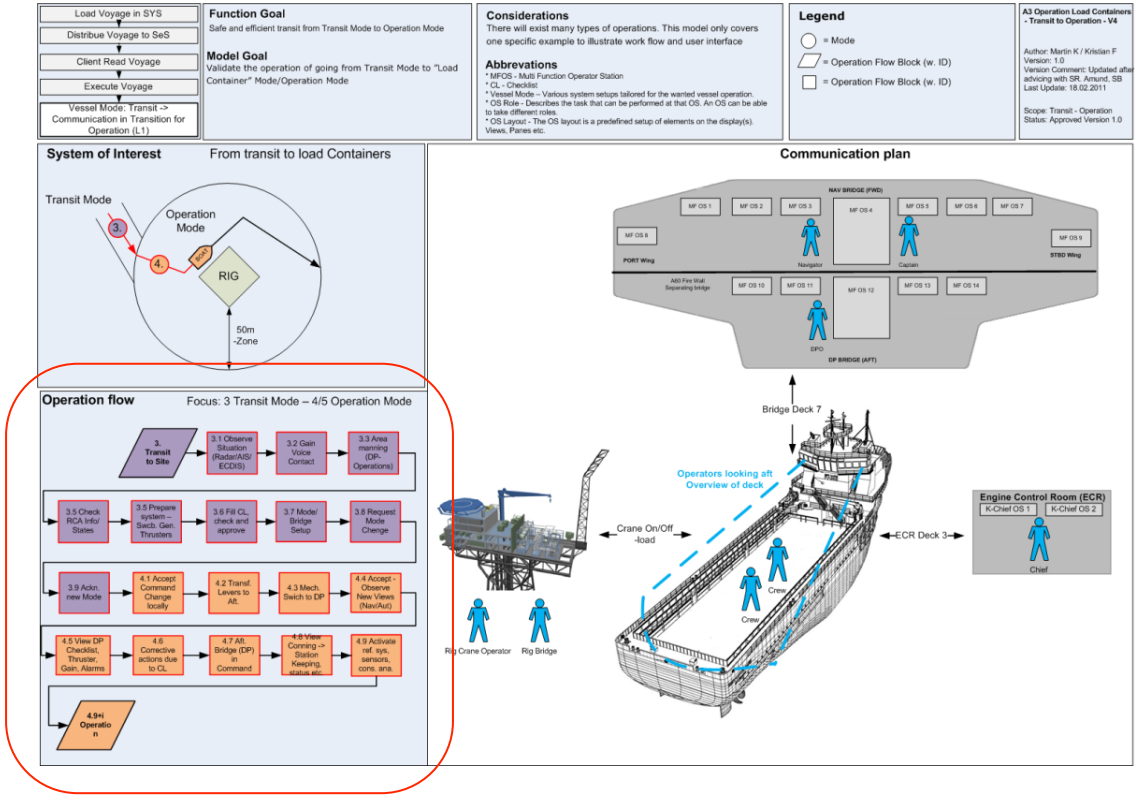
Communication plan

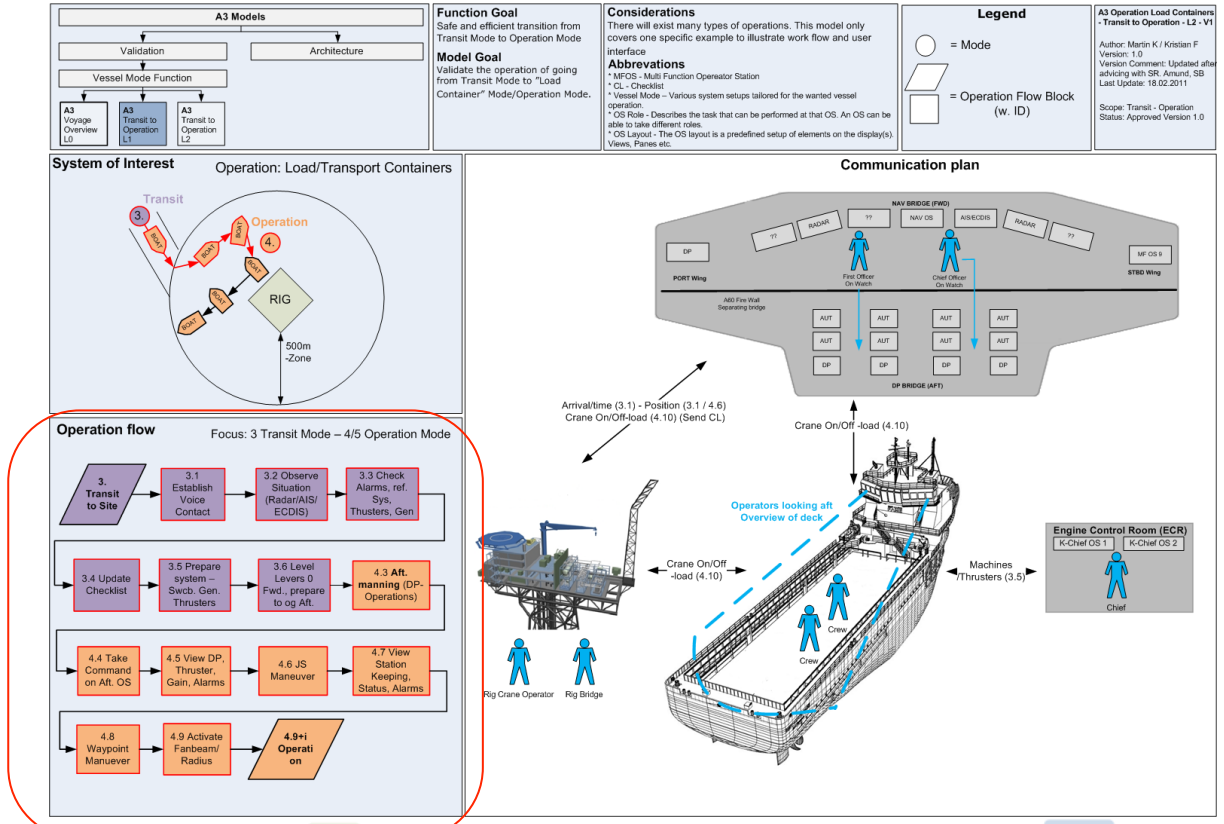


Communication Plan – Version 2



Before (internal) and After (external)





Real/V2 has fewer operations steps

Interaction/Screen pictures – Version 1

Load Voyage in SYS
↓
Distribue Voyage to SeS
↓
Client Read Voyage
↓
Execute Voyage
↓
Vessel Mode: Transit -> Operation (L2)

Function Goal
Safe and efficient transition from Transit Mode to Operation Mode

Model Goal
Validate the operation of going from Transit Mode to "Load Container" Mode/Operation Mode.

Considerations
There will exist many types of operations. This model only covers one specific example to illustrate work flow and user interface

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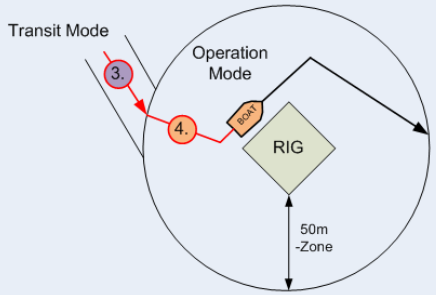
Legend
= Mode
= Operation Flow Block (w. ID)
= Operation Flow Block (w. ID)

A3 Operation Load Containers - Transit to Operation - L2 - V1

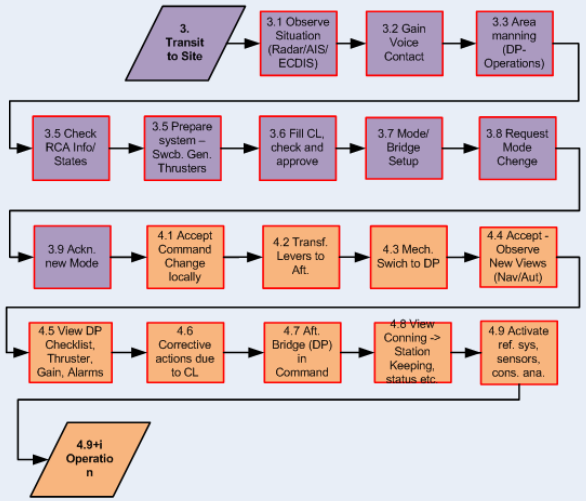
Author: Martin K / Kristian F
Version: 1.0
Version Comment: Updated MFOS screen view page to correlate with flow model
Last Update: 18.02.2011

Scope: Transit - Operation
Status: Approved V 1.0

System of Interest Operation: Load/Transport Containers

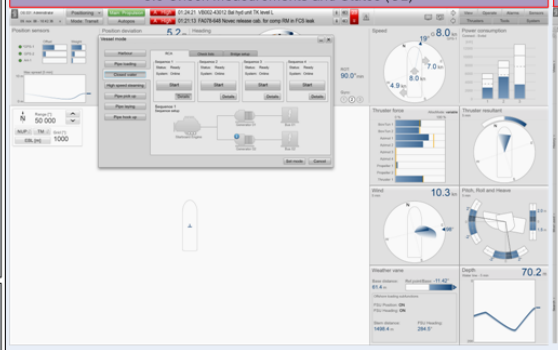


Operation flow Focus: 3 Tranist Mode – 4/5 Operation Mode

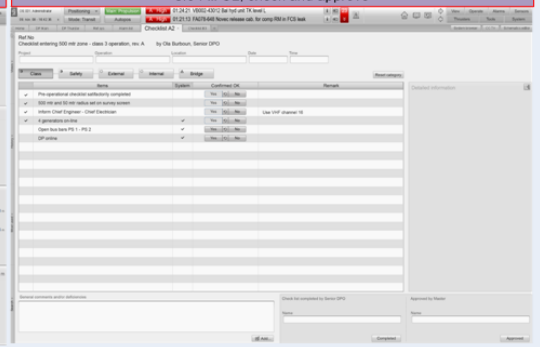


Screenshots from the MFOS screens

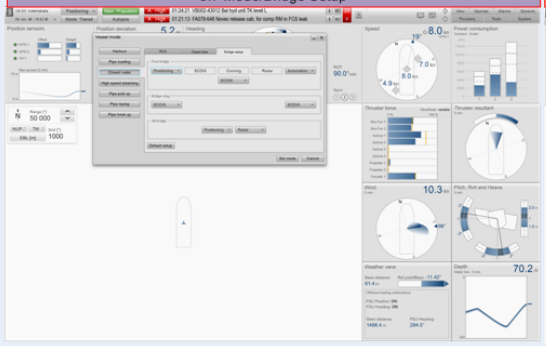
3.5 Check Measurements and States (CL)



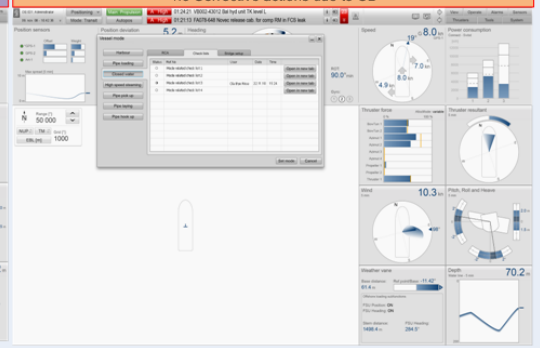
3.6 Fill CL, check and approve



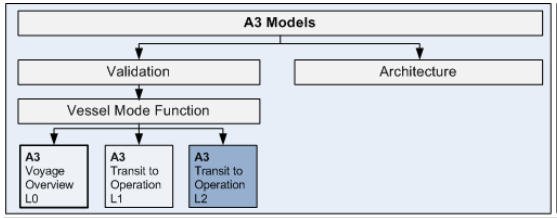
3.7 Mode/Bridge Setup



4.6 Corrective actions due to CL



Interaction/Screen pictures – Version 2



Function Goal
Safe and efficient transition from Transit Mode to Operation Mode

Model Goal
Validate the operation of going from Transit Mode to "Load Container" Mode/Operation Mode.

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A3 Operation Load Containers - Transit to Operation - L2 - V1

Author: Martin K / Kristian F
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Version Comment: NA
Last Update: 18.02.2011

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Status: Approved V 1.0

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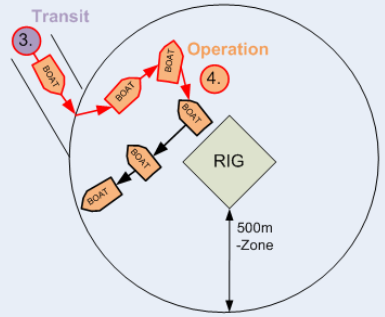

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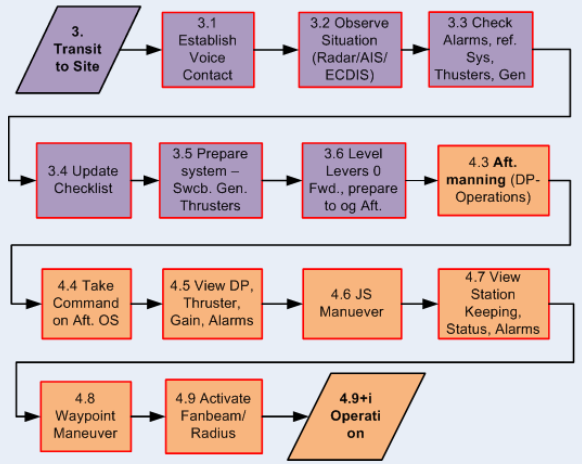


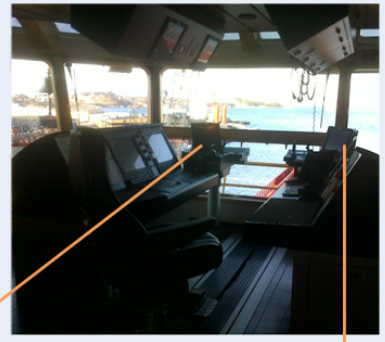
Observations from Viking Energy

Tranist - Fwd. Bridge

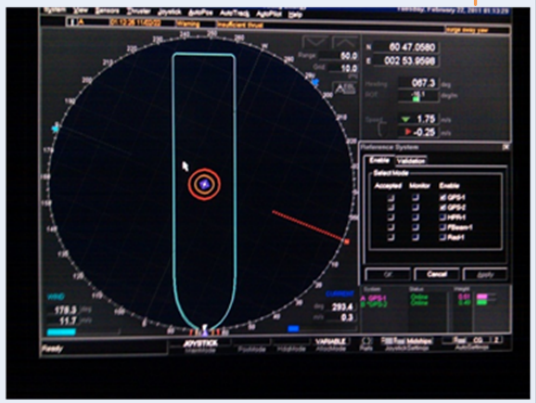
Transit/Navigation
This picture shows parts of the Fwd. Bridge at Viking Energy, when the Ship is in transit this is from where the Ship is controlled, usually Autopilot, but also Thruster Control. Circled screen shows the "Navigation OS"/DP-OS used. This position is also used for radio communication

Transit/Navigation
Operators also focused on 2x radar screens w/ different resolution. All control exept route mgmt done from DP-OS.

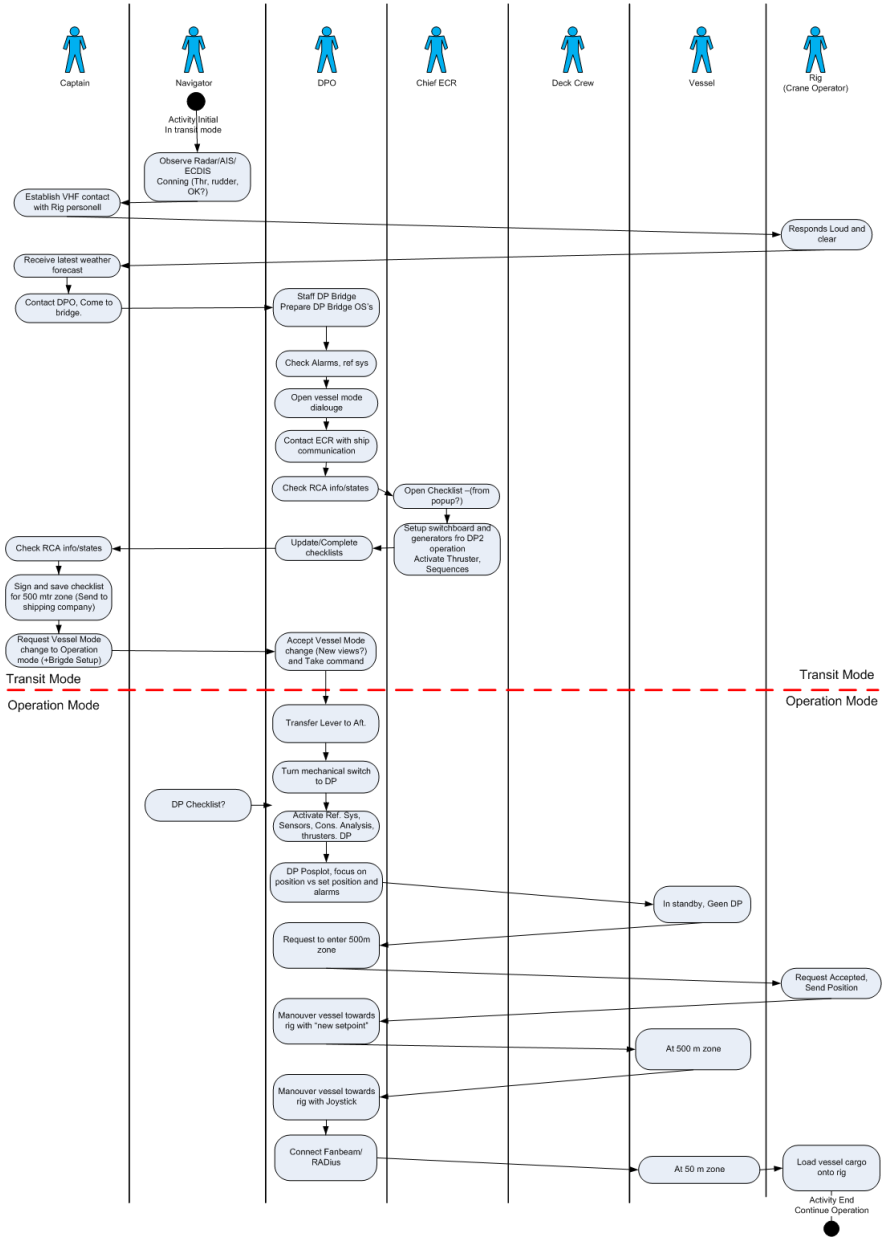
Operation - Aft. Bridge

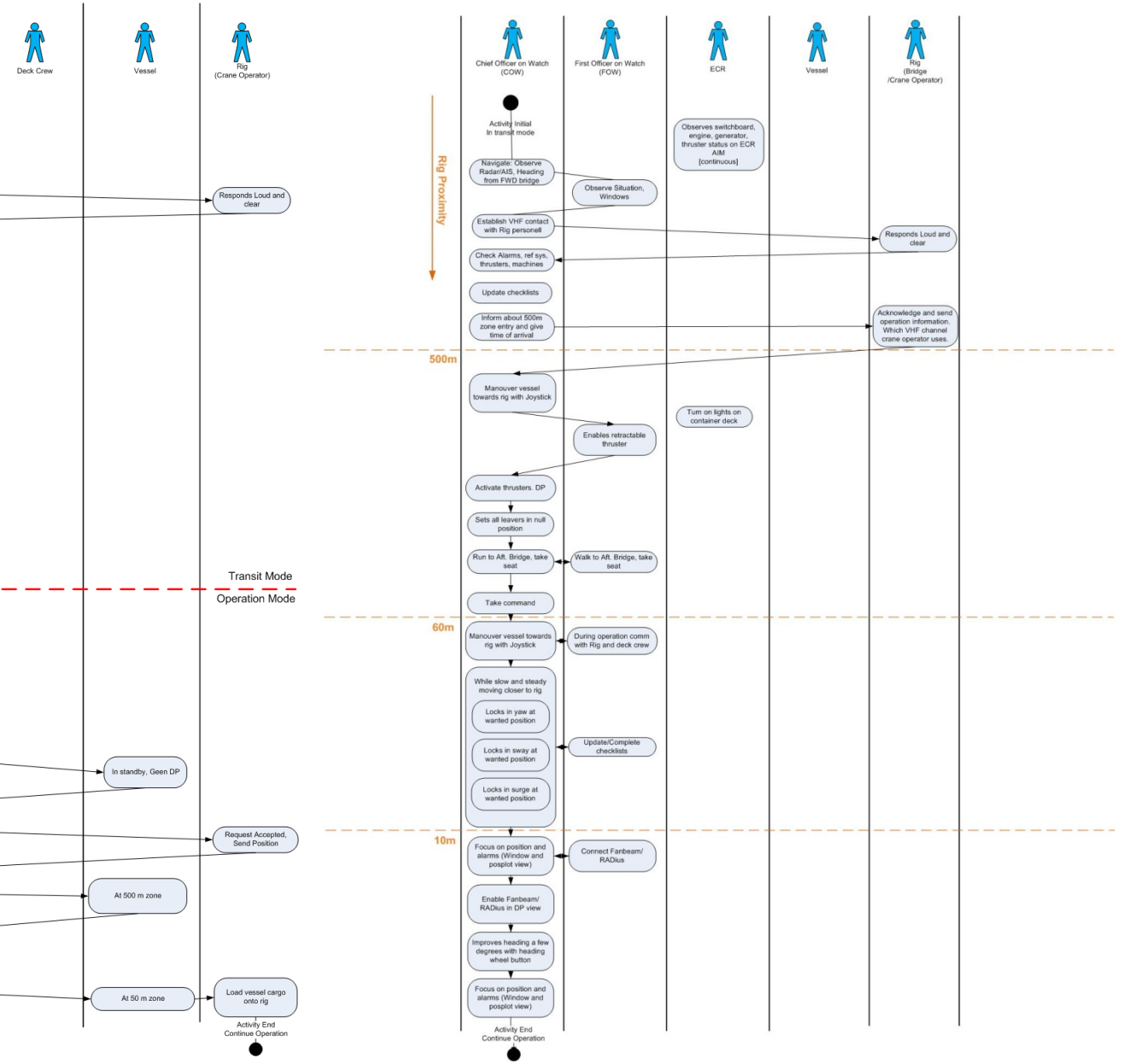


Aft. Bridge Chair (x2)
This picture shows left Aft. Bridge Control position, when operators are going from Transit to Operation these positions are manned, And



Aft. Bridge Screens (During Operations) Picture 1 and 2: Left and Right DP view. This was the same at all times. Additional observations: Wind Sensor Display, CCTV View. At this point both Operator seats in each chair with same set-up. Fwd. Bridge Unmanned. MRU Roll View





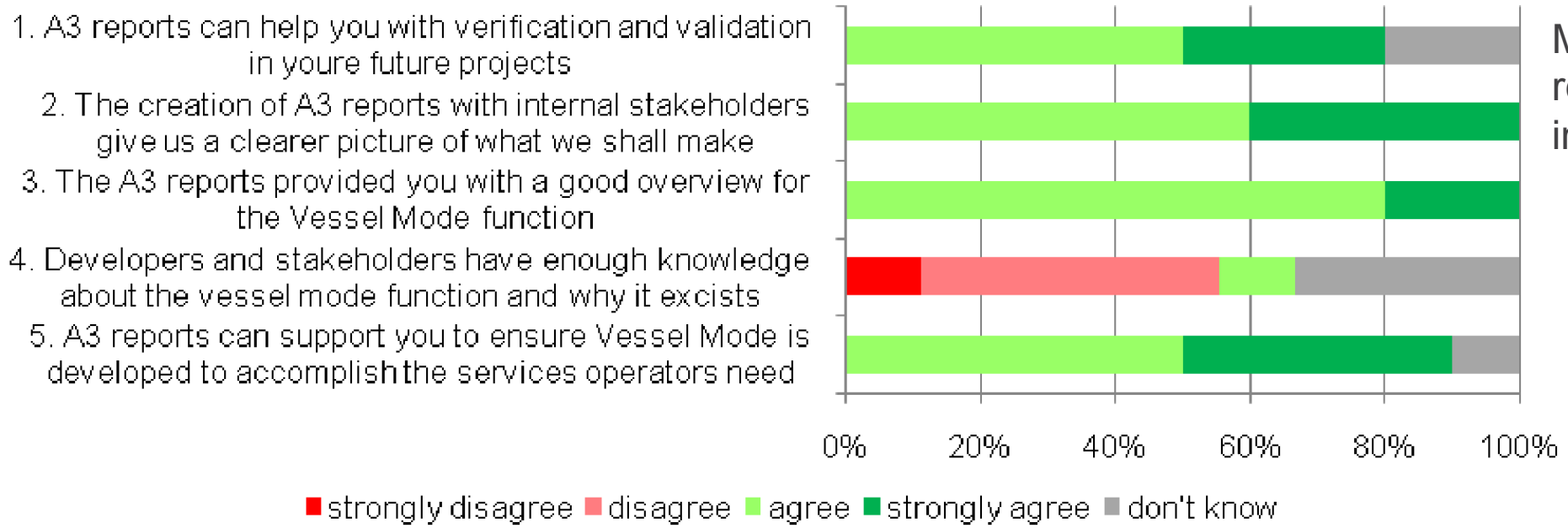
Version 1

Version 2

Findings - Result

Findings

- Observed developers
- Survey to obtain feedback:
  - Project managers 3
  - Lead engineers 2
  - Project engineers 2
  - External Stakeholders 3



More survey results in the paper

Findings

- Too little knowledge about the function and why it existed within the project
- Market focus, and the story the project was based on was not optimal
- Easy and fast method to collect, document and share information from peoples head
- Developing the function through common understanding/agreement
- We were able to document and agree on important statements like needs, key drivers and market
- Bridges development with sales and marketing, and experienced operators (internal + external)
- People will have to consider the operational view and not only the technical perspective

Findings

- Everybody was able to work with the same tool
  - Different focus
  - Cross-fertilization
- Low effort training and implementation costs
- Broader involvement of stakeholders
- The stakeholders saw advantages of model based communication
- Easy to provide feedback
- Many new and improved requirements were collected and reported
- Gives the developers a clearer picture of what to make, a good overview of the function
- Piece of the puzzle
- May not cover all paths to validation failure

KONGSBERG

Thank you for your time!