Remote operation of Valemon

General concept and the role of human factors

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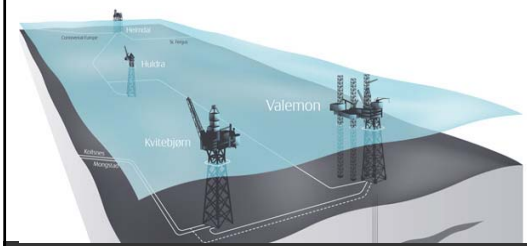
Valemon

- Gas and condensate field operated from 2015
- Drilling ongoing from West Elara jackup rig
- To be remotely operated from Sandsli

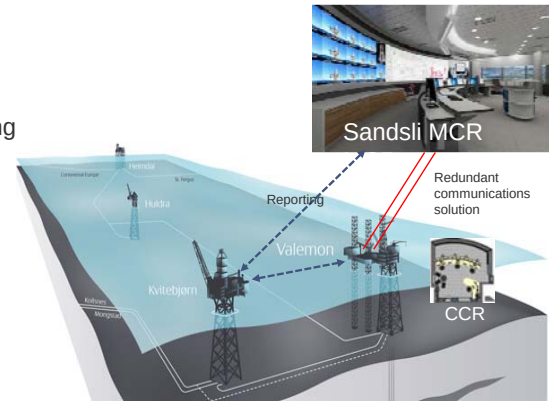


- Platform deck and assembly in South Korea
- Steel foundation and living quarter from Netherlands
- Equipment packages from Norway

Valemon remote operation

- Built to be periodically unmanned
- Ongoing modification for remote operation
- Periodically unmanned after drilling (2017)

- Two paralell control rooms
  - New main control room at Sandsli
  - Exsisting control room at Valemon



Operational model

KvB approve work permits

Ad-hoc team of 5

Sandsli MCR shiftplan of 7 shift where 1 shift do slow offshore rotation

Kvitebjørn
* Management, emergency
* Ad hoc assistance when unmanned

Sandsli MCR
2 operators day/night

Valemon
14 days manned

28 days unmanned

Planned maintenance by team of 17

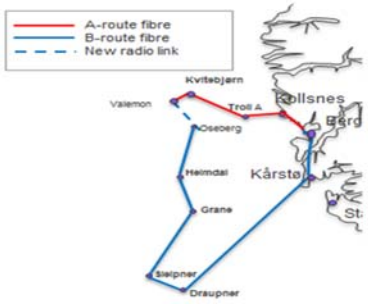
Kvitebjørn – Valemon supported by same operating onshore unit

Main Control Room

- Valemon designed as a *fail safe* process plant with high degree of automation
- Automatic shutdown at loss of communication with MCR
- Sandsli MCR with same user interface as Valemon CCR

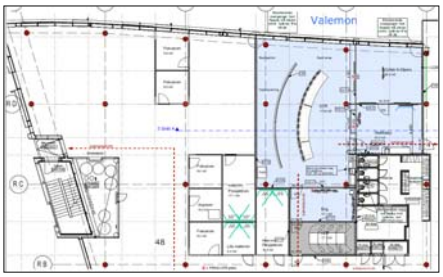
Why Sandsli and onshore ?

- Communication logically and physically separated from other net
- Two always up routes
- Designed with cyber security in mind



Why remote operation?

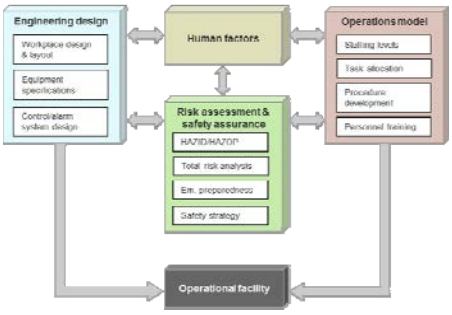
- Lower OPEX
  - Saves 2 shift at Valemon
- Drives efficient campaignbased maintenance
  - Must fit within #hours on maintenace plan
- Improves Statoil's capability for future concept selections
- Potential to scale Sandsli MCR



Key issues

- Develop and verify a new operational model
- Ensure safe and efficient operation
- Engineering designed for safe, efficient, and secure operation

- Valemon As Built HF Analysis and specification
- Which changes follow from new operational model



Human factor analysis as a HUB

Engineering design

- Which requirements apply?
  - NORSOK or TEK 10
- TR's and standards not written with intention to support onshore solutions

Some considerations in design

- Redundancy in support systems such as cooling and power supply
- Security design
- Engineering numbering system

CCR in Offshore LQ

CCR in an onshore office space

Safety issues

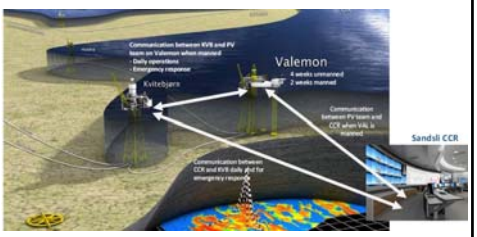
- Maintain safety barriers
- Verify emergency preparedness
- Security in new model
- Impact on health and working environment

Operational barrier :
Safetycritical action performed by operating personel

- Are operational and technnical barriers still intact?
- How do we man and plan emergency preperadness in differnt «modes» of operation
- Security challenges with an unmanned installation, cybersecurity for a new network and security for MCR at Sandsli
- Uncomfort entering an unmanned instalaltion
- Suifficient work for operators at Sandsli – tedious?

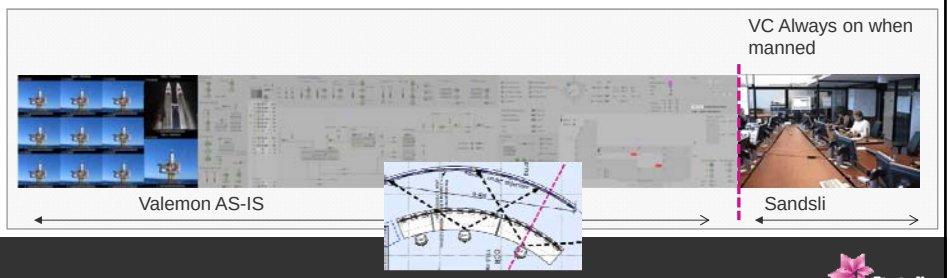
Operation

- Virtual team – communication and collaboration through electronic tools
  - Trust
  - Common understanding
  - Distance vs situational awareness
  - Slow rotation vs familiarity
- Uncover complexity, structure communication tasks and identify specification for communication equipment

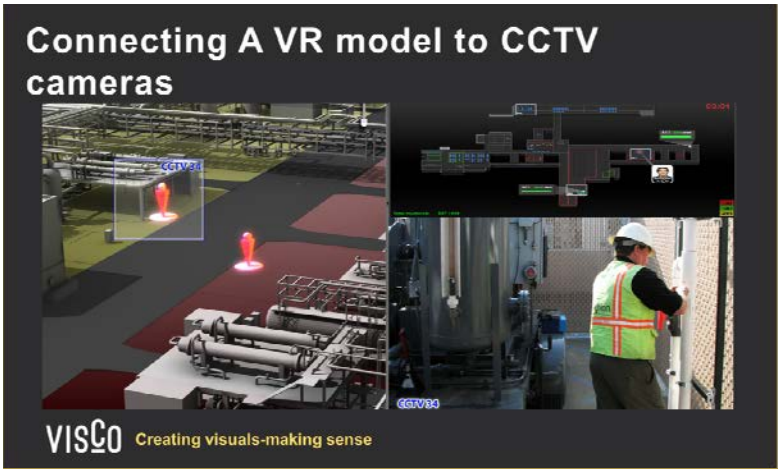


Virtual teams and situational awareness

- Telecommunication as Valemon
  - VHF, UHF, telephony, public announcement
- Large screen display with increased real estate for awareness and collaboration
- Valemon has 150+ CCTV cameras
  - Check and report when unmanned
  - Replace the field operator
- Valemon regarded as a simple process plant



Do we need more?



Summary and conclusions

- Firm plan for remote operation and unmanned installation from 2017
- Solutions can not degrade safety and efficency
- Human factors analysis important to adress operations, engineering design and risk and safety assesment as an integrated solution
- Technically and operationally feasible
- Done before at Huldra and Sleipner B

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