HFC – forum for human factors in control

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RAPPORT

TITTEL

Fremtidige driftsformer og kontrollsystemer
Resultater HFC Forum, 21. til 22.April 2010, møte #11.

FORFATTER/REDAKTØR

Johnsen S. O.

OPPDRAGSGIVER(E)

HFC forum

RAPPORTNR.	GRADERING	OPPDRAGSGIVERS REF.	
SINTEF A15631	Åpen	Throndsen, T.I. & Ringstad, A.J /Statoil	
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	7/5-2010	Throndsen, T.I. & Ringstad, A.J./Statoil	

SAMMENDRAG

Denne rapporten dokumenterer presentasjoner/artikler, agenda og deltakerliste fra HFC forum møtet den 21.-22.april 2010 i Halden, HFC forum møte nr 11. De vedlagte presentasjonene og artiklene er:

M.Lind /DTU	"Fremtidige driftsformer og kontrollsystemer"..
A.Balfour/HFS	“Important HF issues in future operations”
Ø. Nilsen/Statoil	“Utfordringer med omorganisering av Statoil - nye driftsformer”
H.Koskinen&	
L.Hurlen /IFE	"Fremtidens interaktive teknologier for bruk i kontrollrom"
M. H. Rø Eitrheim/IFE	"Bemanningsstrategier i fremtidige høyautomatiserte verk"
R. Fjellheim /Computas	"Intelligente løsninger for pålitelige arbeidsprosesser"

Forumets visjon og hovedoppgave
HFC visjon: "*Kompetanseforum for bruk av HF innen samhandling, styring og overvåkning i olje og gass virksomheten*."
HFC hovedoppgave: "*Å være et forum for erfaringsoverføring som bidrar til å videreutvikle HF metoder til bruk ved design og vurdering av driftskonsepter*." Om HFC, se: www.hfc.sintef.no

STIKKORD	NORSK	ENGELSK
GRUPPE 1	Menneskelige Faktorer	Human Factors
GRUPPE 2	ISO 11064	ISO 11064
EGENVALGTE	Sikkerhet	Safety

INNHOLDSFORTEGNELSE

1 Evaluering av møtet og innspill

1.1 Innledning

I denne rapporten gis en evaluering av HFC møtet, deltakerliste og presentasjonene fra møtet den 21.-22.april i Halden. Vi minner om neste HFC møte den 20. til 21. oktober.

Det var opprinnelig påmeldt ca 40 deltakere, men på grunn av problemer med aske og konsekvenser for flytrafikken kom det ca. 30 deltakere til HFC møtet i Halden. Møtet ble gjennomført med alle inviterte forelesere og positive og konstruktive deltaker.

Vi minner om mulighetene for å ta kurset "Introduksjon til Human Factors og integrerte operasjoner" våren 2010. Planlagte datoer i 2011 er første samling 8.,9.og 10. februar; andre samling 15., 16., 17. og 18. mars; tredje samling den 26., 27. og 28. april. Påmelding http://videre.ntnu.no.

I det nedenstående har vi sakset inn korte punkter fra de evalueringene som deltakerne leverte inn.

1.2 Evalueringer

Generelt synes det som om de fleste er godt fornøyd med HFC møtene og formen som benyttes, med samling over to dager og oppstart fra lunsj første dag, til lunsj påfølgende dag. Kommentarene vi får er generelt konstruktive og positive, med gode tilbakemeldinger på det faglige og sosiale utbytte. Forumet er bredt med mange forskjellige deltakere, og utfordringen er å gi alle noe, både forskere, konsulenter og industrideltakere. Vi får derfor et bredt sett av innspill.

Programmet var også vellykket denne gangen, foredragene fikk meget god tilbakemelding – samtidig nevnte alle den entusiastiske presentasjonen hos Borregard.

1.3 Formen på HFC møtene

Tilbakemeldingene er generelt positive til formen på møtene. Det ble påpekt at det var viktig med interaktive debatter, workshops og/eller gruppearbeide. Hensikten er å bli kjent med folk, diskutere og samarbeide – ikke bare å sitte og høre på andre. HFN nettverket fra Sverige vil fortsatt gjerne delta og bidra inn i møtene.

1.4 Tema og forelesere til de neste HFC møtene

Vi har i tidligere plannotat skissert følgende grove møteplan for HFC forum møtene fremover, ref tabell-1.

Periode	Forslag til tema og forelesere
Høst 2010	HF i ulykkesgranskinger, hvordan forstår vi Human Factors i ulykkesgranskninger, refleksjoner rundt organisatoriske faktorer
Vår 2011	HF i endringsprosesser, "Design for resilience", Perspektiver som Actor-network theory (ANT) i HF granskninger.
Høst 2011	Inntog i det globale: Språk, kultur, tidsforskjell, HF i global setting.
Vår 2012	Fokus på HF i andre land, som USA og Sørøst Asia – erfaringer, muligheter og trusler

Tabell-1: Tema og forelesere i HFC forum foreslått tidligere

Av tema som ble trukket frem som spesielt interessante av deltakerne denne gangen kan nevnes:

- MTO perspektivet i ulykkesgransking, hvordan evalueres organisatoriske faktorer og rammebetingelser inn i ulykkesgransking? (NB: Helhetlig – ikke bare kontrollrommet.) Hvordan få fram organisatoriske rot årsaker på en god og systematisk måte? Hvordan skal man tilrettelegge for mennesket i design, med allokering, testing, ansvarsroller - for eksempel for å unngå nye godstog ulykker som vel var svikt på mange plan. (Ref http://no.wikipedia.org/wiki/Jernbaneulykken_p%C3%A5_Sjurs%C3%B8ya_2010) Var det systemet rundt som ikke var godt nok for å hindre menneskelige svikt, eller var det mennesket selv – og hvordan kan vi hindre slike utviklinger?
- Hvordan skal vi takle HF utfordringene knyttet til øktgrad av automasjon? Hvordan skal interaksjonsdesign utføres i slike sammenhenger?
- Diskusjon om dagens Criop dekker Integrerte Operasjoner(IO) dvs. faktorer som er knyttet til lite bemannet anlegg/ eller normal ubemannet anlegg. Trenger man ny type tankeganger for å analysere og håndtere dette? Er det laget informasjonssystemer for IO, dvs systemer utenfor kontrollrommet, som tar hensyn til Human Factors?
- Hvordan skal man forbrede og klargjøre samarbeidet mellom Automasjon og Human Factors når det gjelder HMI design for nye anlegg?
- Human Factors og standarder / regelverk. Hva som gjelder, hva som er umulig å følge, hva som gir rom for ulike tolkninger?
- Trening av personell og kunnskapsoverføring mellom nye og erfarne medarbeidere, evaluering av nye driftsformer.

Av forelesere ble følgende nevnt (eller har vært trukket frem tidligere uten at de har fått plass):

- Ingrid Danielsson – ønskes mht interaksjonsdesign.
- J.Frohm eller K.Gould – Automasjon eller lean production.
- Petroleumstilsynet, eks Siri Wiig.

- M.Endsley (Situational awareness), G.R. Hockey fra Univ of Leeds, Mark Young.
- C. Weick eller J.Reason.
- Interessant å utvide HF mot community of practice og praksisfellesskap som J.S.Brown, P.Duguide – eks. hvordan mobiliserer man et praksisfellesskap?
- K. Haukelied

1.5 Kontakt opp mot Human Factors fagnettverket i Europa og USA

For de som er interessert i faglig kontakt opp mot Human Factor nettverket i Europa og USA viser vi til: hfes-europe.org – som er den europeiske Human Factors and Ergonomics Society.

Beskrivelse: ”*HFES - The Human Factors and Ergonomics Society, Europe Chapter, is organised to serve the needs of the human factors profession in Europe. Its purpose is to promote and advance through the interchange of knowledge and methodology in the behavioural, biological, and physical sciences, the understanding of the human factors involved in, and the application of that understanding to the design, acquisition, and use of hardware, software, and personnel aspects of tools, devices, machines, equipment, computers, vehicles, systems, and artificial environments of all kinds.*”

HFES er tilknyttet den internasjonale Human Factors and Ergonomics Society, Inc. www.hfes.org.

HFC Møte

AGENDA

21 til 22 april
2 0 1 0

Fremtidige driftsformer og kontrollsystemer

Halden, IFE – Park Hotel, Marcus Thranes gate 30

Dag 1	Foredrag med spørsmål etter foredragene;	Ansvar/Beskrivelse
11:30-12:30	Registrering og lunsj	HFC/IFE
12:30-12:45	Velkommen til møtet – presentasjon av møtedeltakere	HFC
12:45-13:30	Fremtidige driftsformer og kontrollsystemer	Prof. M.Lind/ Danmarks Tekniske Universitet
13:30-13:45	Diskusjon	
13:45-14:00	Kaffe/Pause	HFC/IFE
14:00-14:30	"Important HF issues in future operations":	A.Balfour/HFS
14:30-15:00	"Utfordringer og erfaringer med omorganisering av Statoil i forhold til nye driftsformer":	Ø. Nilsen/Statoil
15:00-17:30	Kombinert besøk og presentasjon hos Borregaard, Sarpsborg- bl.a. erfaringer med omorganiseringer	HFC/IFE
17:30-	Transport tilbake	HFC/IFE
19:00	Middag inkl underholdning	HFC/IFE

Dag 2	Foredrag med spørsmål etter foredragene;	
08:15-08:30	Kaffe	HFC/IFE
08:30-09:30	Diskusjonspanel med deltakelse fra operatører (eks Statoil/ Øivind Nilsen) og leverandører (ABB, Kongsberg/ Olav Revheim)."Framtidens driftsformer – muligheter/ strategier og utfordringer"	Moderator A.Balfour/HFS
09:30-10:15	Workshop: HFC; organisert i to grupper i regi av seminarets hovedtema og paneldebatten - framtidens driftsformer – muligheter/ strategier og utfordringer.	HFC/IFE
10:15-10:30	Kaffe/Pause	HFC/IFE
10:30-11:00	Fremtidens interaktive teknologier for bruk i kontrollrom	H.Koskinen & L.Hurlen/VTT & IFE
11:00-11:30	Bemanningsstrategier i fremtidige høyautomatiserte verk	M. H. Rø Eitrheim /IFE
11:30-12:00	Intelligente løsninger for pålitelige arbeidsprosesser	R. Fjellheim/COMPUTAS
12:00-13:00	Lunsj	HFC/IFE

Neste møte i HFC forum er planlagt til 20-21 oktober 2010

(Påmeldte) **og Deltakere Human Factors in Control Halden, 21th - 22th April 2010**

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HFC

"Fremtidige driftsformer og kontrollsystemer"..

M.Lind /DTU

Mere informasjon:
Se http://www.iau.dtu.dk/~ml/
CV with all publications– ref http://www.iau.dtu.dk/~ml/cv.pdf

Selected publications

- Lind, M. (1994). Modeling Goals and Functions of Complex Industrial Plant. Applied Artificial Intelligence, Vol 8 No. 2 , April-June. Ref: http://www.iau.dtu.dk/~ml/aaai94.pdf

- Lind, M. (1999). Plant Modeling for Human Supervisory Control. Transactions of the Institute of Measurement and Control, Vol 21. No 4/5, pp. 171-180. http://www.iau.dtu.dk/~ml/timc99.pdf

- Lind, M. (1999). Making Sense of the Abstraction Hierarchy. Proc. Conf. on Cognitive Science Approaches to Process Control CSAPC'99. Villeneuve d'Asc, France, Sept 20-24, pp 195-200. http://www.iau.dtu.dk/~ml/csapc99.pdf

- Lind, M. (2001). Semiotic and Intelligent Control. Proceedings IFIP WG8.1 Working Conference Organizational Semiotics: Evolving a science of information systems. Montreal, Canada. July 24-26. http://www.iau.dtu.dk/~ml/ifip01.pdf

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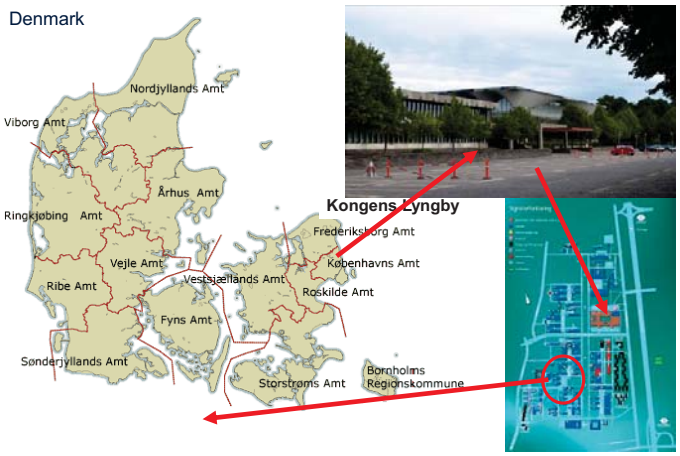
Future and Operation and Control Systems -Automation in Context

Morten Lind
AutomationDesign Centre

DTU Elektro
Institut for Elektroteknologi

DTU
IPU



Department of Electrical Engineering

Competance group

Centre

More info: www.elektro.dtu.dk

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Background

1969-1985 Risø National Laboratory
Department of Rector Technology
Cognitive Systems Group (Rasmussen, Hollnagel)

1985- Technical University of Denmark
Department of Electrical Engineering
Automation DesignCentre:Scientific Director
Center for Electric Technology

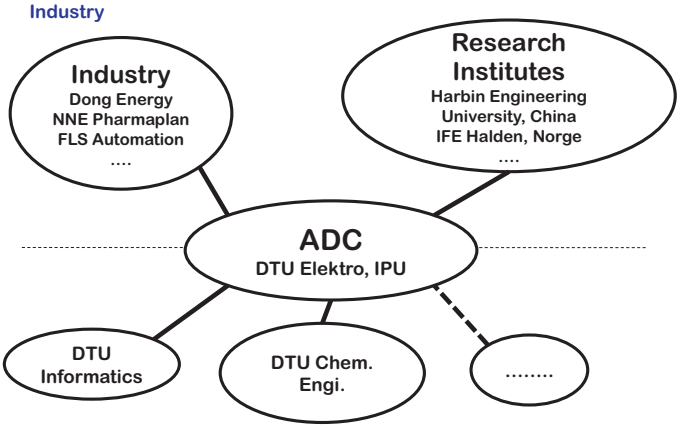
2008- Harbin Engineering University
Nuclear Engineering: Visiting Professor

Interests

Research
- Automation Design
- Human-Machine Systems
- Modelling and Reasoning about Complex Systems (Functional Modelling)
- Applied Artificial Intelligence (Agents)

Teaching
- Introduction to Automation and Robotics
- Intelligent Systems (Agents and FM)
- Hierachical and Distributed Control Systems

A DTU Gateway Within Automation for Research Institutes and Industry



Agenda

- From ”Buisnes to Performance”: Challenges
- Technology drivers in automation
- Integrated Design and Operation
- Model based control
- Goal function modeling
- New control architectures

From buisnes to performance: Challenges

Integrated system design and operation

Reducing systems engineering costs by knowledge management
Integrating process and automation design
Integrating design and operation

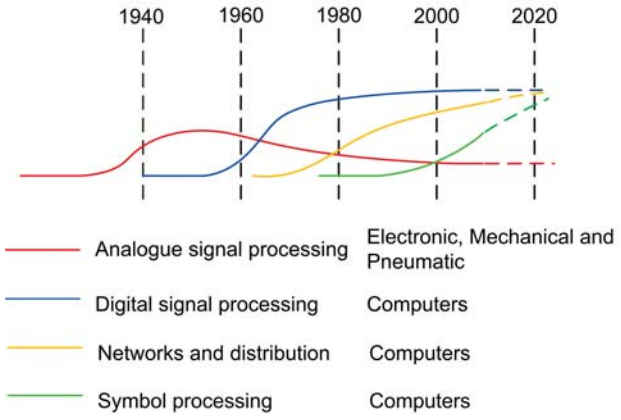
Intelligent automation

Increasing plant flexibility, efficiency and safety by more intelligence
Control and supervision using proces knowledge and advanced sensors
Fault tolerance and adaptability to changes in operational requirements

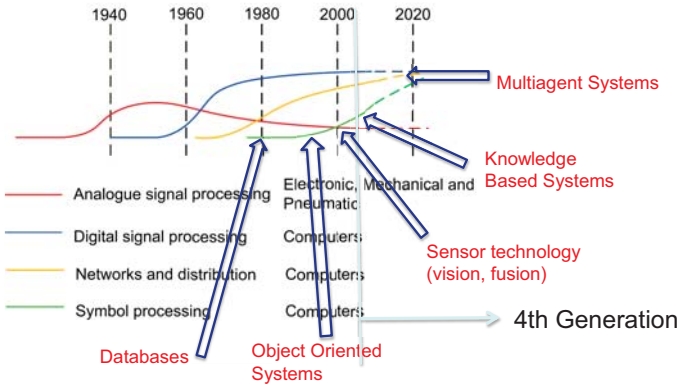
New system architectures

Distributed automation and control: from hierarchy to heterarchy
Situation dependent levels of automation
Use of advanced information and communication technology (agents)

Technology Drivers in Automation and Control

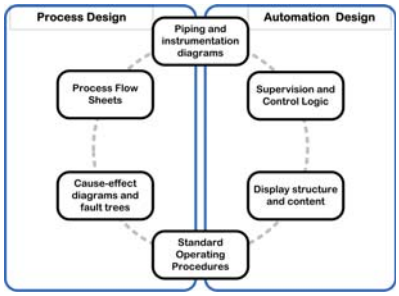


4th Generation Automation will be more "intelligent"

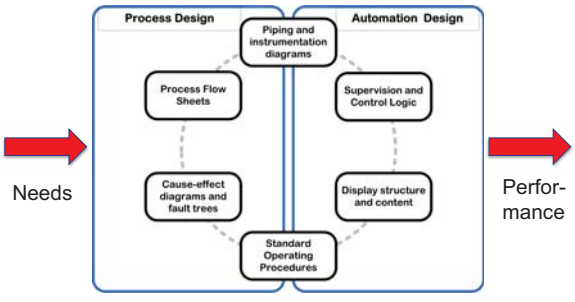


Integrated system design

3rd Generation Automation Systems: Lack of Knowledge Integration

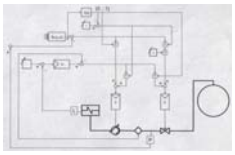


The Bottleneck: Knowledge Management and Integration

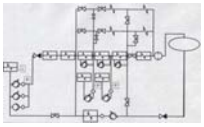


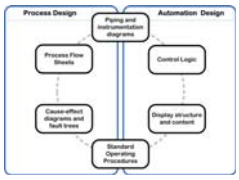
No direct path from needs to performance

Piping and Instrumentation Diagram

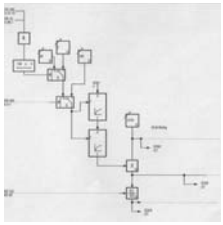


Process Flow Sheet





Control Logic



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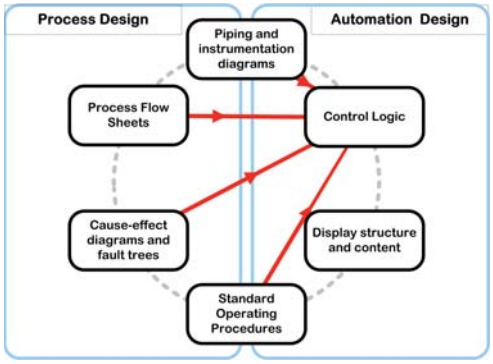
Design of Control Logic



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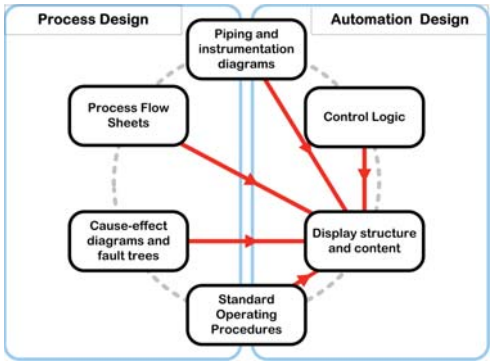
Human Machine Interface Design



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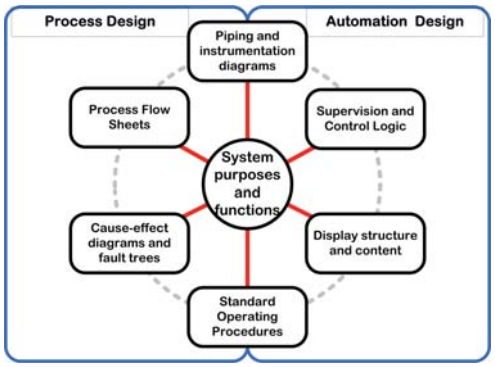
Integrating Process and Automation Design



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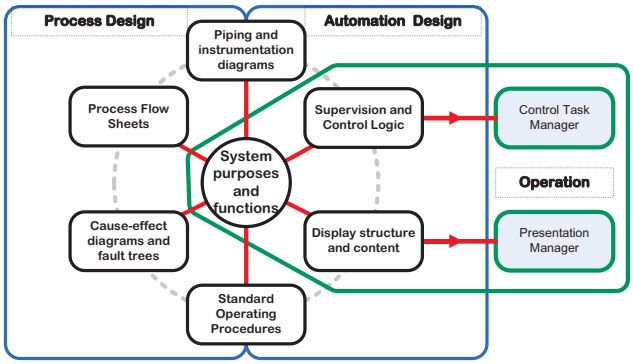
4'th Generation Automation:Integrated Design and Operation



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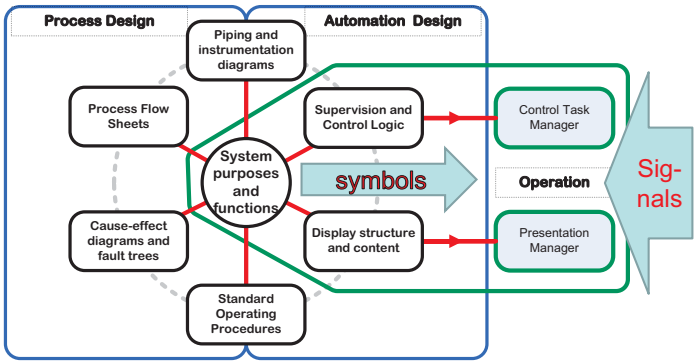
4'th Generation Automation:Integrated Design and Operation



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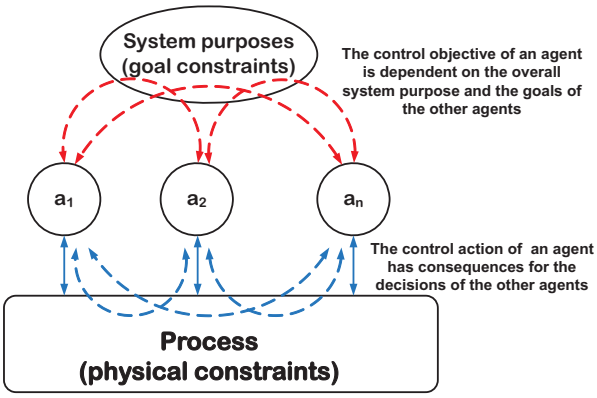
Managing Complexity



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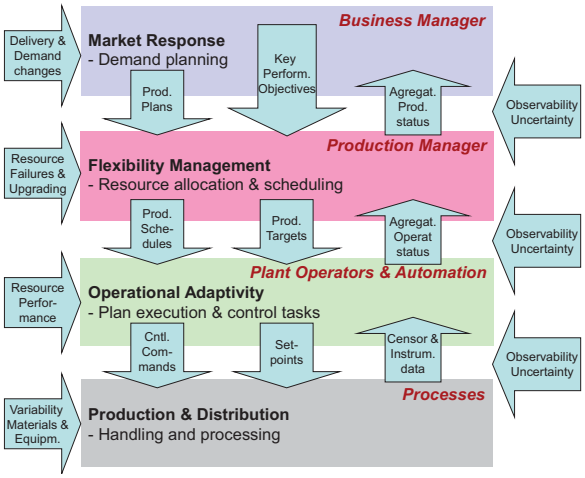
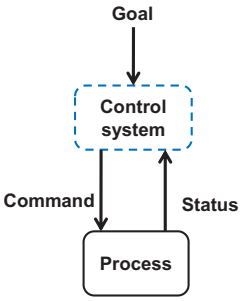
Automation Design for Flexibility

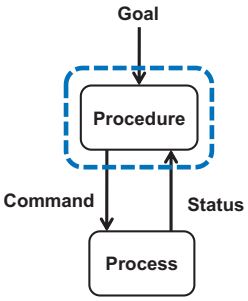


Model based control

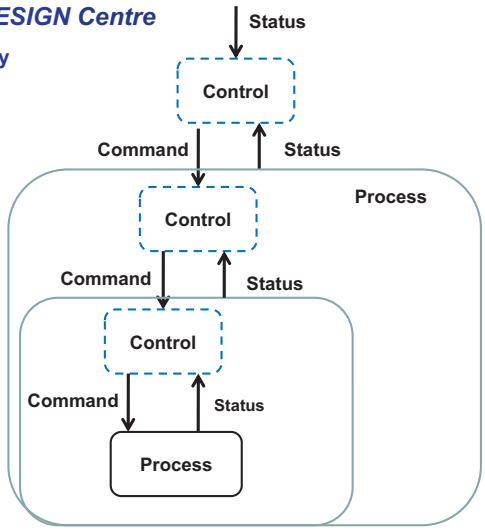
Basic principle of control



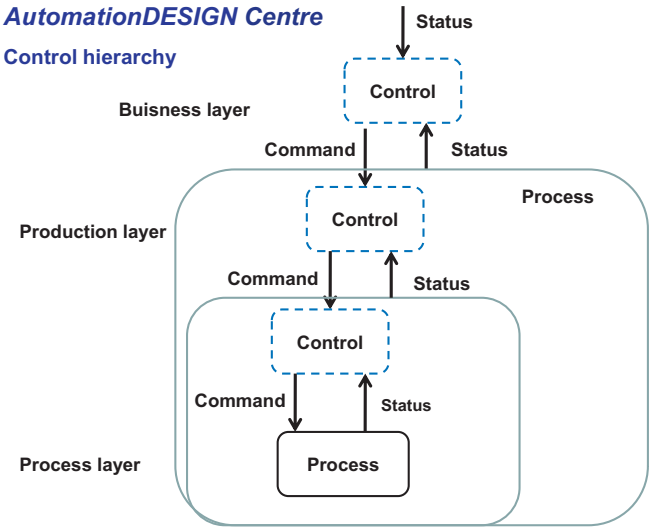
Simple control based on a procedure, algorithm or set of rules



Control hierarchy



Control hierarchy



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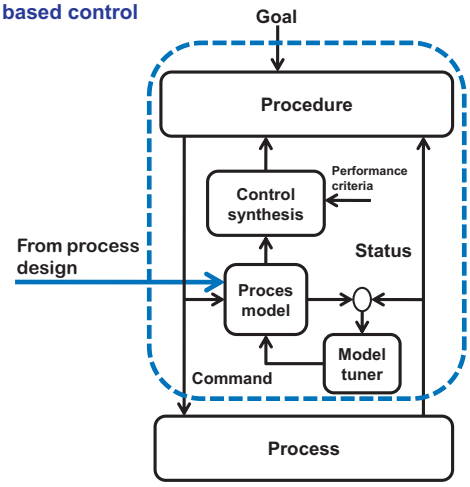
Model based control



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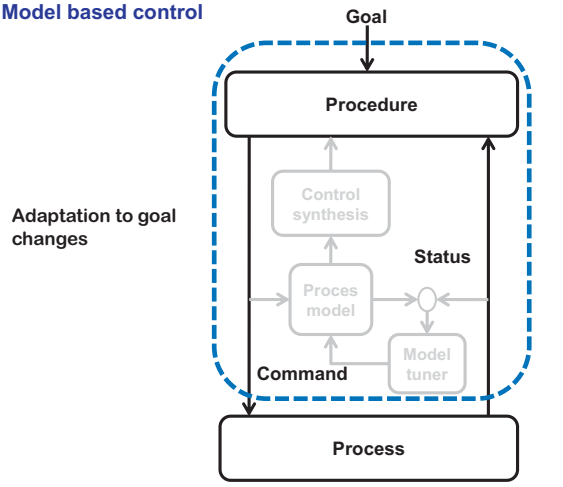
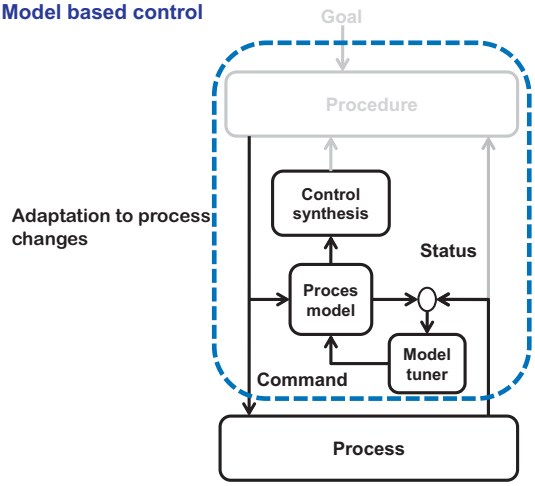
Model based control



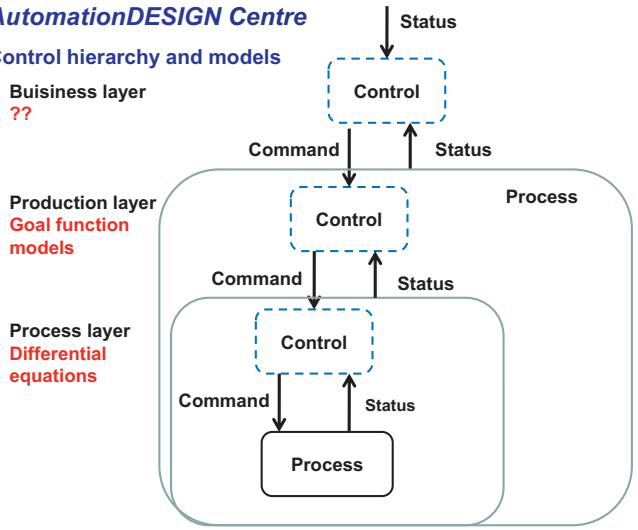
AutomationDESIGN Centre

Model based control



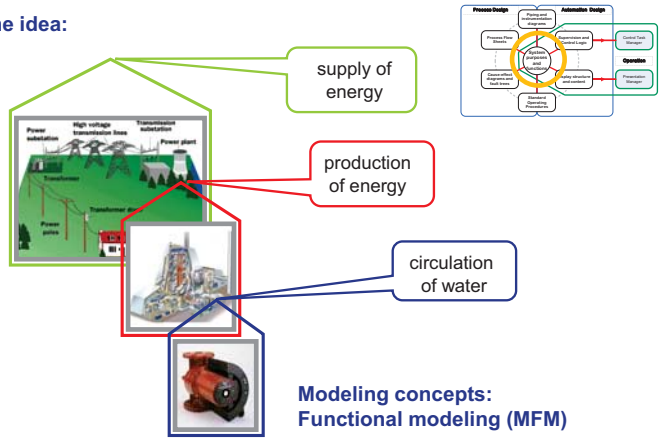
AutomationDESIGN Centre

Control hierarchy and models



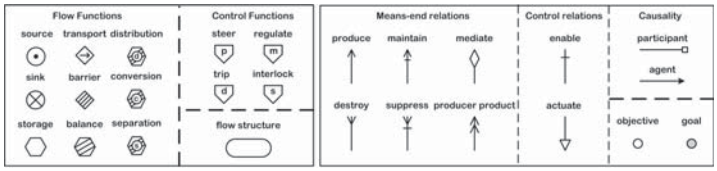
Goal function modeling for Integrated Design and Operation

The idea:

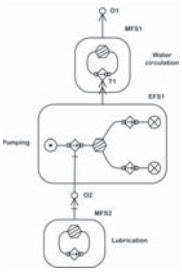


Modeling concepts: Functional modeling (MFM)

Multilevel Flow Modeling (MFM)



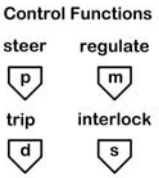
- **Process functions are represented by *elementary flow functions* interconnected to form flow structures *representing* a particular *goal oriented view* of the system.**
- **MFM is founded on *fundamental concepts of action: Ea*ch of the elementary flow and control functions can be seen as instances of more generic action types.**

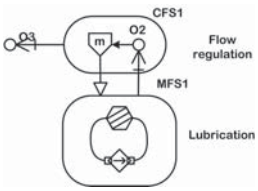


Control Functions

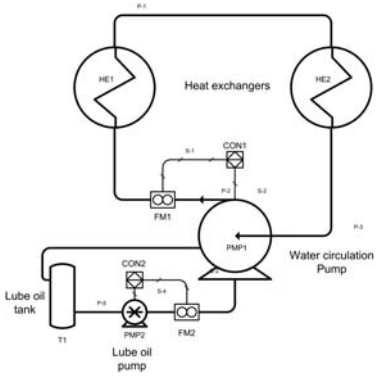
A control structure represent the <u>purpose</u> of a control action.

- **Combine objective and control function**

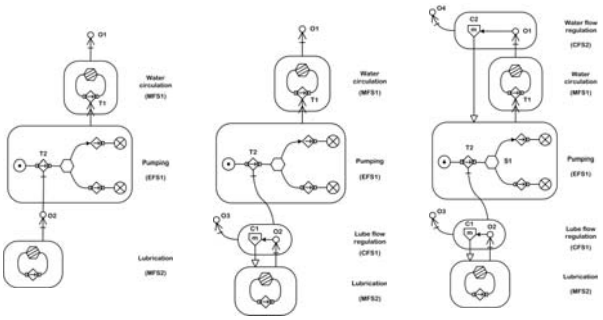




An example: Heat transfer loop



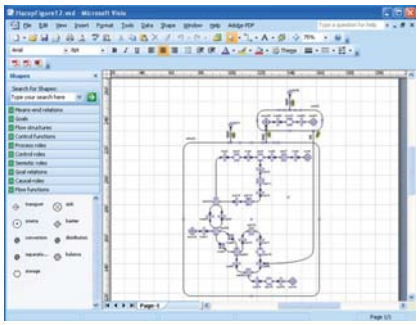
MFM models of heat transfer system

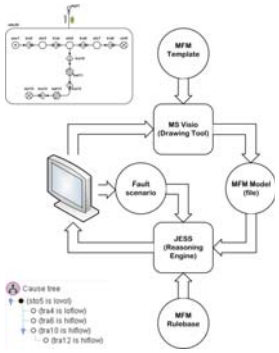


No control

With control

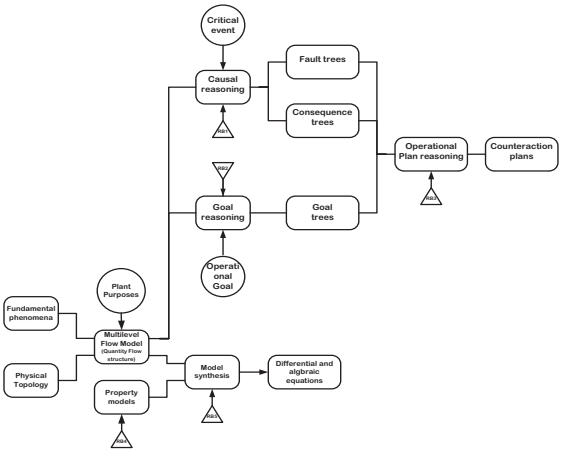
Modeling and reasoning tools for Multilevel Flow Modeling (MFM)



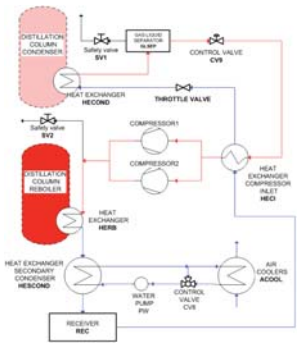


Reasoning tasks: Root cause and consequence analysis, counteraction planning

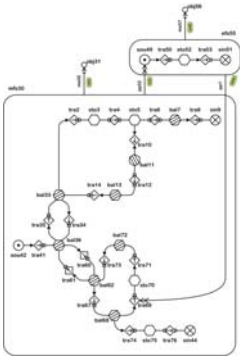
Relations between model types and rule bases



MFM for Functional Hazop
Cooperation with DTU Kemiteknik

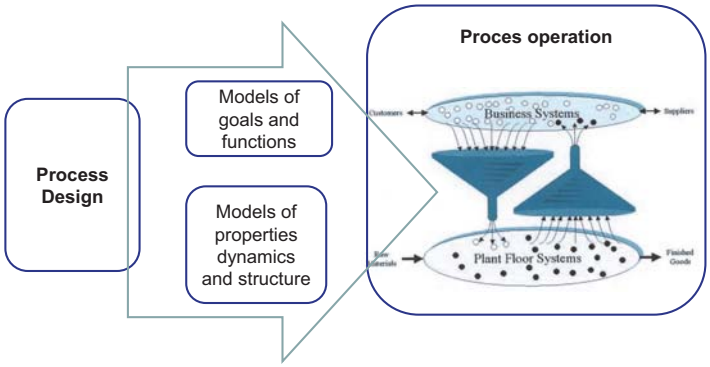


Heat Integrated Destillation Column

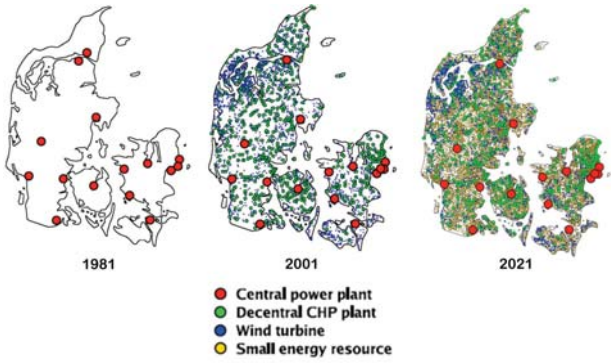


MFM Model of the Destillation Column

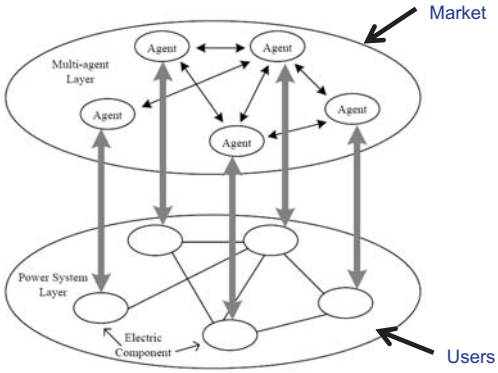
From business to performance through integrated design and operation



New System Architectures
Case:The Danish Power System



From centralized to a distributed control architecture



Thank you for your attention

HFC

“Important HF issues in future operations”

A.Balfour/HFS

Mere informasjon:
Se http://www.hfs.no/

HFS

Tomorrow's human factors standards, today

Future Human Factors Issues

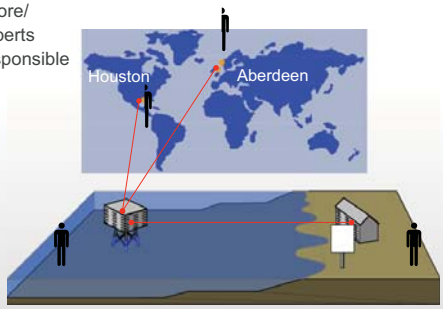
Adam Balfour 21.04.2010

Future HF / technological Issues?

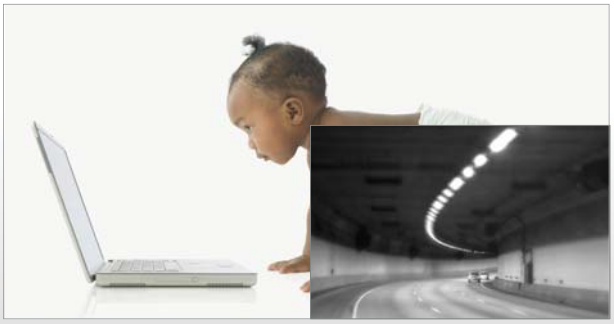
- Tracking gloves
- Head-mounted display
- Force-feedback devices

Example: IO - Concept 4: Distributed control

Operated from onshore/ offshore, various experts around the world responsible for specific tasks.

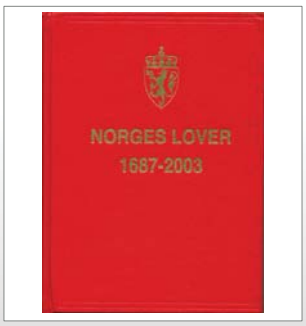


HF Issues - Where is HF today?



Context: Oil and Gas Industry today

- Demand will outstrip supply
- No more “Easy oil”
- Industry conservative
- Big Crew Change / Brain Drain
- Integrated Operations
- Regulatory Regime
- Focus HSE



Context: Oil and Gas Trends: No Easy oil

No more Easy Oil - difficult:

- politically
- geographically
- technically
- Environmentally
- Regulatory
- Organisational
- decisions

Oil and Gas: Human Factors focus

Source: UK HSE and OGP

The scientific study and practice of applying knowledge about people to the design and evaluation of products, systems, services and environments

HF(S) goals - solutions that are:

- Safe
- Promote Health
- Efficient
- Motivating to use

Context: Oil and Gas Trends: Big Crew Change

Context: Societal trends

Technological development:

- Convergence
- Increase in automation
- Increase in functionality
- Globalisation
- 24/ 7 Society
- Short term profit
- Environmental focus
- Entertainment society
- Information security

Context: Societal trends

Technological development:

- Convergence
- Increase in automation
- Increase in functionality
- Globalisation
- 24/ 7 Society
- Short term profit
- Environmental focus
- Entertainment society
- Information security

Context: Societal trends

- Entertainment society
- Information security
- Aging population
- More critical population
- Standards/ regulatory compliance
- Function creep
- Technological convergence
- Everything is possible – but what is it to be used for?

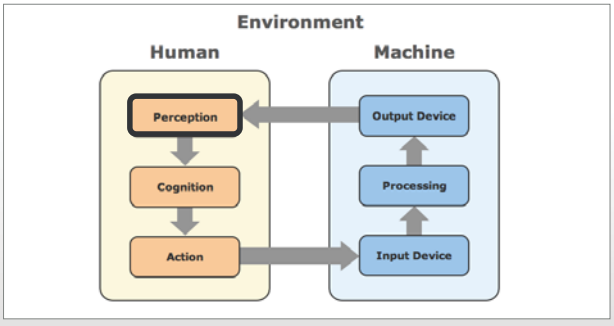
Users expectations / demands

- People are used to good UI on personal/ home devices - why not at work?
- Self actualisation next?

Users and new technology on a collision course

Security Society - Access control

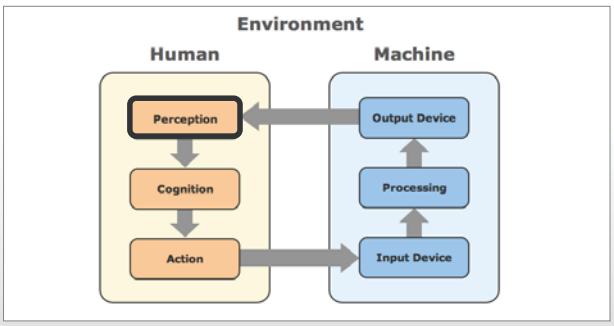
Model for Man-Machine Interaction



Today´s situation – “product related”

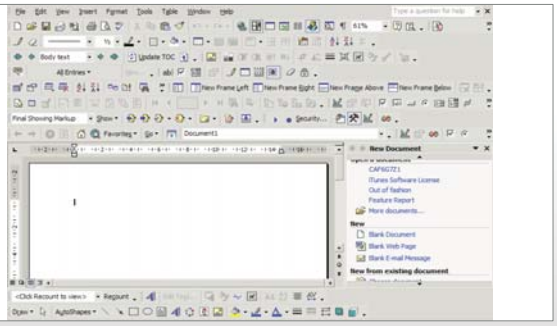
- Information overload – increased amount of RT data - visual channel
- Increase in shared / new types of data
- Input devices – mainly via fingers/hands
- Increase in automation (e.g. drillers cabin)
- Inconsistent interfaces within + between technologies
- Functionality not relevant to the task
- Mental models – designer – user – different
- Focus on security (physical as well as electronic)
- Breach of population stereotypes

Model for Man-Machine Interaction



Control room design

Functionality: Complex user interfaces



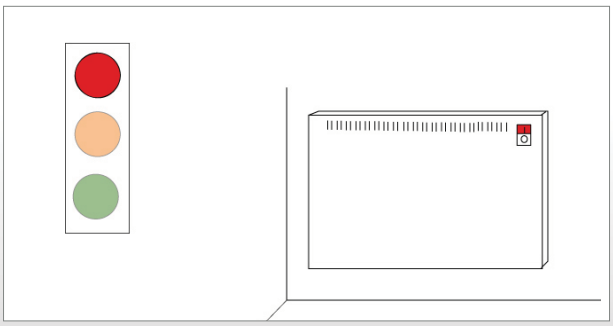
Why? Readability

Bright red text is always clear, isn't it?!

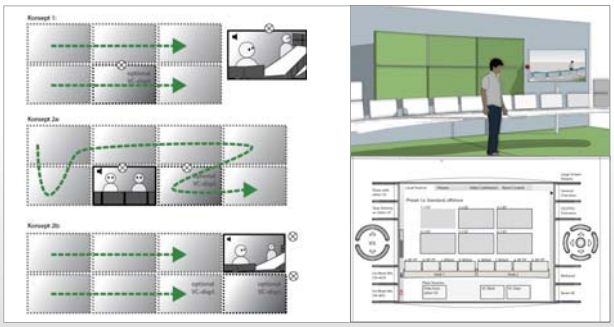
AND AREN'T SENTENCES IN CAPITAL LETTERS EASIER TO READ THAN LOWER CASE?!

Flashing lights are good attention grabbers, aren't they?!

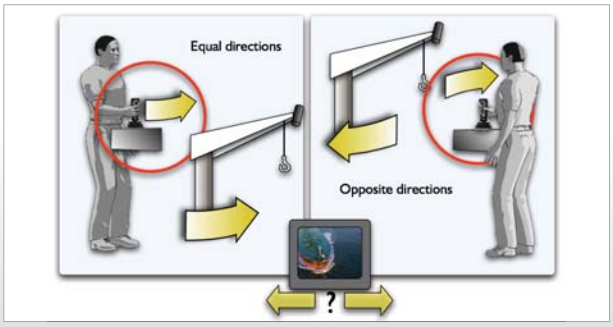
Mental models - Red light ? What does it mean?



Concept development: converging technologies



Why?: breach of population stereotype

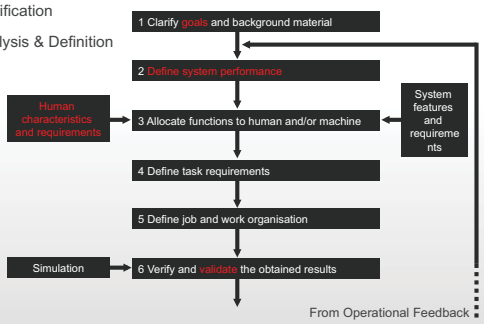


Today´s situation – process: Requirements

- Requirements for HF in PSA Regulations and Guidelines, (international) Company requirements, Norsok S002, etc
- Only reason for doing HF – "*in regulations/ contract*"
- Varied understanding when ordering HF work
- ISO 11064 Design process (2000) suboptimal
- Standards out of date and a jungle
- Systems performance criteria missing
- Missing (HRA) data for new (current) technologies
- Concept development/ assessment – no consensus

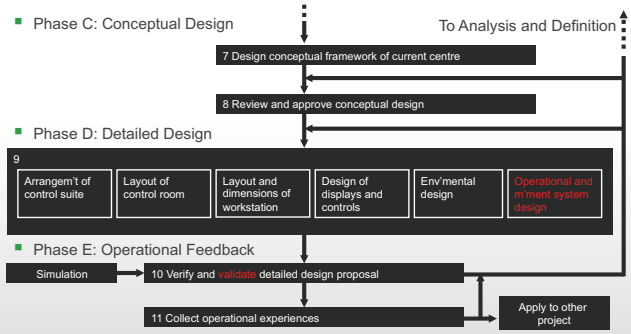
HF Approach: Design process: ISO 11064 (1 of 2)

- Phase A: Clarification
- Phase B: Analysis & Definition



HF Approach: Design process: ISO 11064 (2 of 2)

- Phase C: Conceptual Design



- Phase D: Detailed Design

- Phase E: Operational Feedback

Today´s situation – “process” related

- Language and culture – in project / operations
- Skill gaps / change in competencies
- Changes in communication (channels/ methods)
- Projects groups often sequential – not goal/team based
- New ways of working – reactive to proactive
- Loss of perceptual indicators
- Save money for hardware/software – not people costs
- Cost benefit of HF not clearly documented and accepted

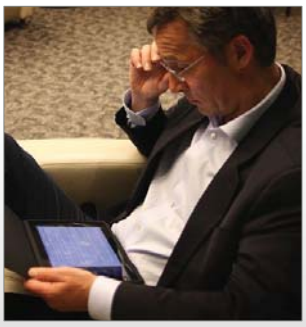
Culture / values (safety)

Skills/ competence

- Social
- Organisational
- Technological
- Practical

Changes in communications

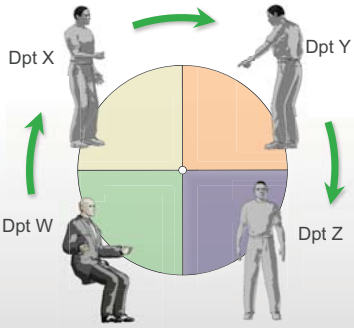
- Less face to face ..
- 2 changes – one is use of Twitter, blogs, facebook, the other is new channels of communication that company imposes on you - e.g. Video comms, documents in ProArc, STID, team site, APOS, eroom, etc. i fill out holiday form in 4 different sites ….



Project management

Traditional

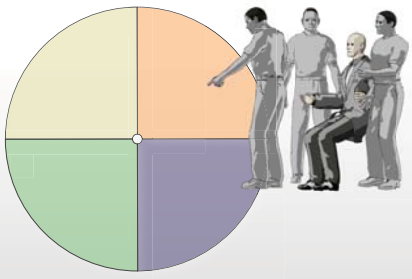
- Organisation oriented – departmentalised, sequential



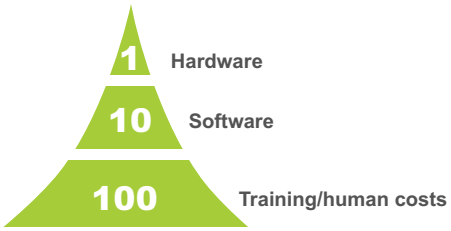
Project management

Product/ goal oriented

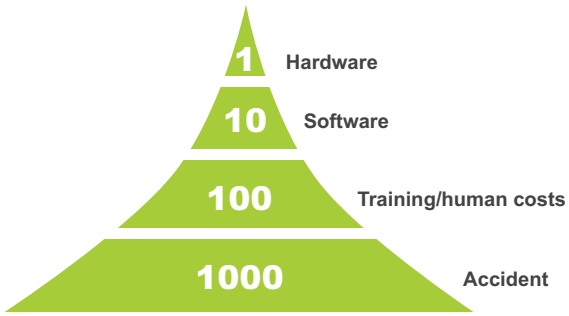
Team based



System costs

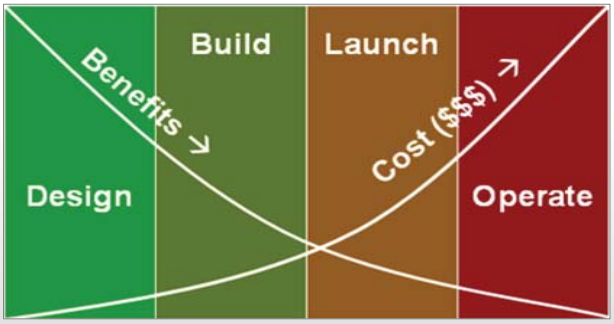


System costs



Why? Lack of standardisation

New ways of working – proactive vs reactive system



Conclusion

- Walk before we run
- Improve understanding of HF
- Demonstrate that HF improves efficiency / motivates users
- HF applies to whole organisation
- Demonstrate that HF integrates training – hardware – selection
- Need clear objective HF goals
- Learn other industries

HFC

“Utfordringer og erfaringer med omorganisering av Statoil i forhold til nye driftsformer”

Ø. Nilsen/Statoil

Ref: http://www.statoil.com


Statoil
Utfordringer og erfaringer med omorganisering av Statoil i forhold til nye driftsformer
Øivind Nilsen, Leder for kjerneteam felles driftsmodell
Classification: Confidential 2010-04-27


«Forstår at det oppleves som
Innrømmer økt fare for ulykke
Omorganisering på StatoilHydros plattformer øker risikoen for ulykker, innrømmer
«Vi har kontrollen»
– Vi hadde aldri iverksatt innføring av en ny driftsmodell dersom vi ikke hadde kontroll, sier pressetalsmann i StatoilHydro Gisle Johanson.
Camilla Bjørheim
Publisert 09.07.2009 16:05
Oppdatert 09.07.2009 16:07
Classification: Confidential 2010-04-27
Statoil

Utfordringer og erfaringer med omorganisering av Statoil i forhold til nye driftsformer

- HVORFOR? Bakgrunn og mål
- HVORDAN? Implementeringsstrategi og gjennomføring
- HVA? Driftsmodellen
- UTFORDRINGER!
- ERFARINGER!

Statoils forbedringsagenda på norsk sokkel

Standardisering, forenkling og institusjonell læring

Ny og enhetlig driftsmodell offshor

- Industrialisering av brønnleveransene
- Industrialisering av prosjektporteføljen

Operations and Maintenance (O&M)
- Strategic objectives

Where did we come from:

- Safe and efficient operations based on a variety of models
- Key lessons learned from serious incidents focus on lack of:
  - Experience transfer
  - Co-operation
  - Maintenance management
  - Competence
  - Compliance to governing documents

Ambition

Safe and efficient operations based on:
- Prioritizing of operations and critical maintenance
- Effective execution of planned maintenance
- Sufficient competence for the tasks

Improved transfer of experience through:
- Common work processes and best practices
- Flexibility and mobility

Improved collaboration through:
- Common solutions
- Common interfaces

Improved knowledge management through:
- Recruitment, training and competence development
- Improved use of the corporate competence
- Ensure necessary installation competence

Strengthened compliance through:
- Clear roles and responsibilities
- Dedicated, hands-on leadership

2009 – taking the integration offshore

- Offshore installations and supply bases were not part of the first phase of the StatoilHydro integration process in 2007
- 10 former Hydro installations and 18 former Statoil + new onshore organisation
- Approx 5000 EPN employees are in current scope
  - 650 managers
  - 4500 skilled personnel

Major change – unique opportunity

- Prudent operations is key to the company's development
- HSE improvements necessary
- Operation excellence most important response to meet future challenges

→

- One organization
- One way of working

New offshore teams combines continuity and renewal

Offshore management

- 640 managers in place in offshore organisation
- High level of participation in "notify interest process"
- Over 50 percent assigned 1. or 2. priorities
- Good balance between continuity and renewal

Skilled personnel

- 90 percent participated in "notify interest process"
- 4500 skilled personnel assigned to new positions
- 70 percent assigned to 1. or 2. priorities
- 20-40 percent share of "new" personnel on each installation

An integrated operating organisation

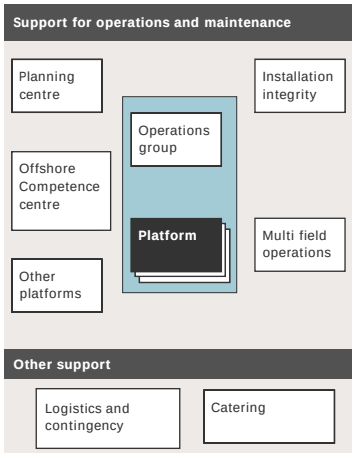
New operating model - "Like having the platform next door". A unique opportunity to build confidence between sea and shore by integrating personnel by rotation

Sea

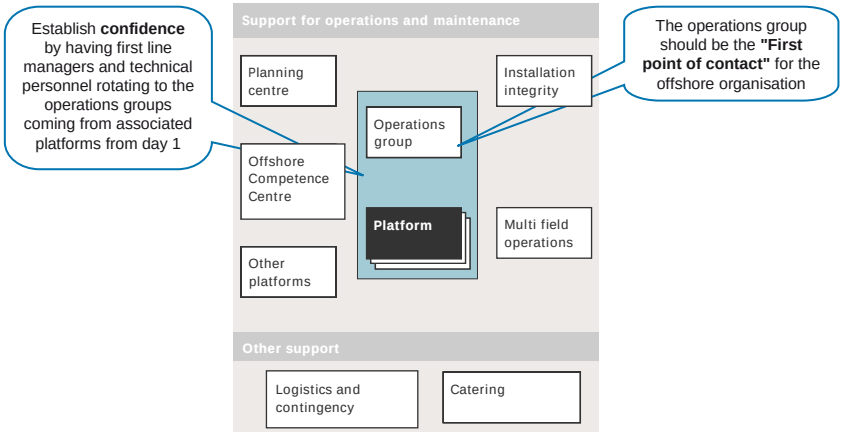
Shore

An integrated operating organisation

Standard operating model - "Like having the platform next door". A unique opportunity to build confidence between sea and shore by integrating personnel by rotation



Increasing focus on the platform as part of a larger operating system



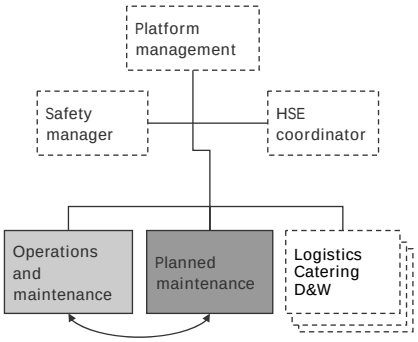
Organising operations and maintenance

Objective

- Priority should be given to operations and critical maintenance
- More systematic and planned implementation of planned maintenance tasks

Solution

- Separate unit responsible for operations and maintenance tasks with a planning horizon less than 5 days
- Separate planned maintenance unit responsible for maintenance tasks with a planning horizon longer than 5 days and follow up with maintenance and modifications contractor
- Employees in both departments are assigned to a platform
- Establish a plan for rotation between the operations and maintenance and planned maintenance units
- Such a model permits flexible organisation in which platforms can get or loan out resources to cover competence and activity needs



Four main principles in the model

4 + 6

Six main principles for the onshore operating team

Hands-on (1:4)

Strengthened co-operation offshore-onshore

- Maximum onshore support
- Preparations of prioritized tasks onshore
- Administrative tasks moved to shore
- Workorders not requiring field inspections, to be planned and detailed by the OPS team

Work according to plan (2:4)

The OPS team are the owner of the plan and we work according to plan

- Only changes due to safety critical or production critical issues may trigger revisions of the plan
- All changes in the plans shall be documented

Operations and critical maintenance (3:4)

D&V responsible for operations and critical maintenance

- Responsible for maintenance that has to be carried out within the next 5 days
- Also involved in selected maintenance work >5 days
- Performance measured on HSE, production, production efficiency and maintenance lag on critical maintenance

Efficient planned maintenance (4:4)

Foto: Øyvind Hagen

PV team responsible for effective execution of planned maintenance

- Execute maintenance with a planning horizon >5 days
- Excellent planning, effective execution and protected against interventions from other activities (70/30)
- Assists D&V on larger high-priority workorders
- Performance measured on HSE, total maintenance lag (corrective and preventive), work according to plan, quality costs and M&M work related to operational support

Six main principles for the onshore operating team (OPS team)

Common location

Available but shielded

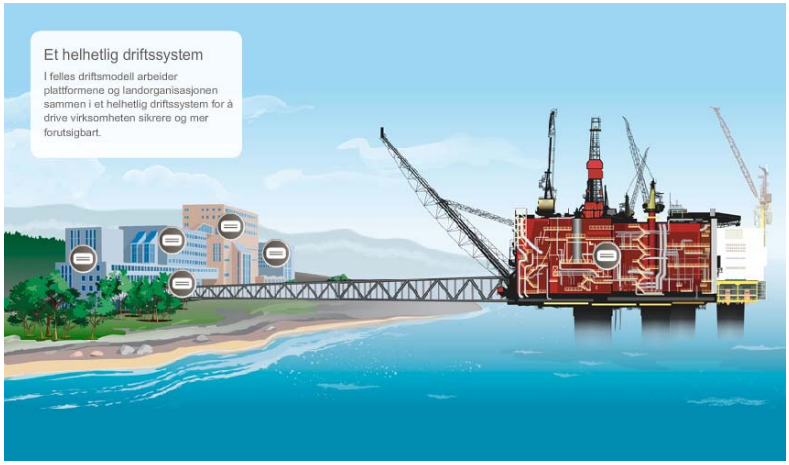
First point of contact

Closely linked to other professionals

Active use of real-time data

Collaboration and information sharing

The common operation model have been documented as an interactive WEB solution



(Click on the illustration to enter the interactive WEB model)

The implementation strategy is fourfold

1. Risk management and consequence assessment

2. Setting up the organisation

- Establishing systems, routines and work processes (e.g. APOS)
- Training and learning

3. Introduction of joint operating model

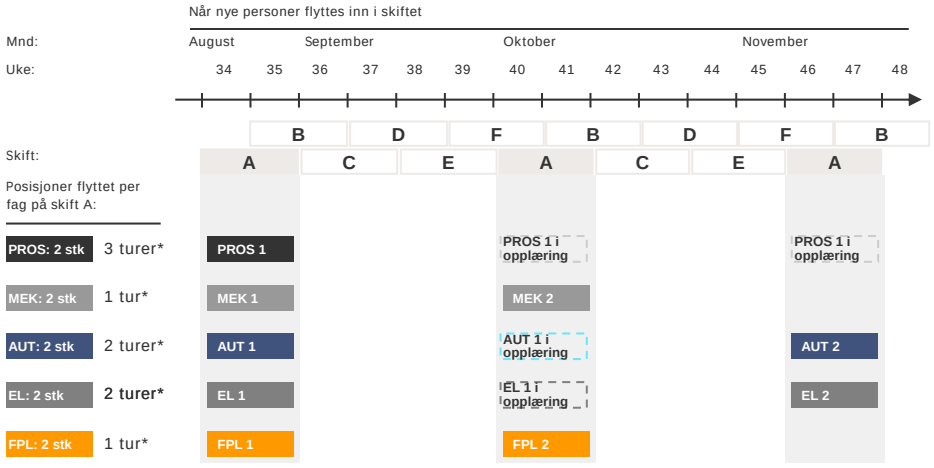
- Managed introduction of joint operation model simultaneously at all installations and affected onshore units

4. Moving personnel to new positions

- Start moving personnel based on notification of interests

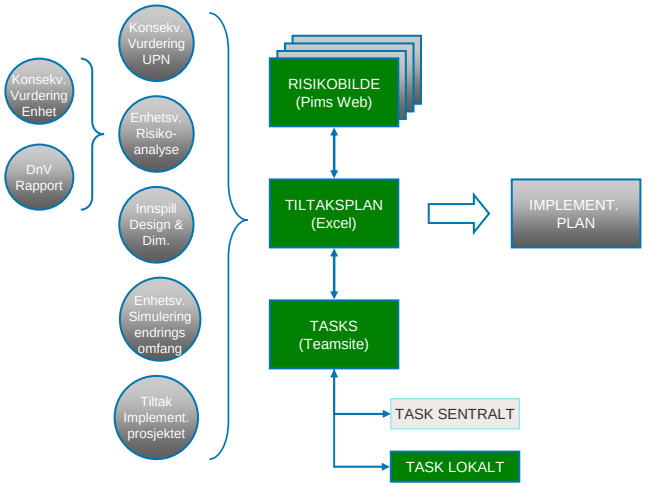
EKSEMPEL

Illustrativ skisse på flytteplan – ett skift (A), liten installasjon

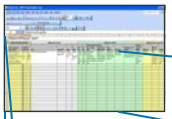


- Individuelle kompetansegap fastsetter sekvensiering i fagdimensjonen
- Bruk av mertid, 58+ ressurser, innleie dekker 'kapasitetshull' i overgangsperioden

En omfattende endring med et omfattende underlag



Tiltaksplanen har oversikt over samtlige tiltak som må fullføres for å nå de satte milepælene



Tiltaksplan for UPN Integrasjon - Installasjon X

Oppdateres ikke etter opprettelse			Oppdateres hver 14. dag			Oppdateres ved behov			
Risk / Consequence / Input / Goal ID	Task Id	Title	Assigned To	Status	% Complete	Start Date	Due Date	Estimated duration (days, calendar time	Resource allocation (% of fulltime resource)
M-1.1.1.1	1	Opprette nye stillinger i SAP HR i henhold til ny org. struktur	Anita Andersen Stenhaug	Not Started	0 %	22.12.2008	1.2.2009	20	50 %
M-1.1.1.1	2	Tilegne personer til stillinger i SAP HR i henhold til ny org. struktur	Rune Nedregård	Not Started	0 %	15.1.2009	1.2.2009	14	50 %
M-1.2.1.1	3	Oppdatere OMC beskrivelser i henhold til ny organisering	Bjørn Fosen	In Progress	50 %	12.12.2008	22.12.2008	10	200 %
M-1.2.1.2	4	Etablere og kvalitetssikre stillingsinstrukser	Joacim Christiansen	In Progress	20 %	15.12.2008	15.1.2009	30	25 %
M-1.2.1.3	5	Oppdatere alle telefonlister i henhold til ny bemanning og organisasjonsstruktur	Anita Andersen Stenhaug	Completed	100 %	1.12.2008	10.12.2008	10	25 %
M-1.3.1.1	6	Etablere innsjeksrutiner på land	Rune Nedregård	Not Started	0 %	15.1.2009	1.2.2009	14	33 %
M-1.3.1.1	7	Etablere system for livbåttildeling ved innsjekk	Bjørn Fosen	In Progress	70 %	1.12.2008	22.12.2008	35	33 %
M-1.3.1.1	8	Opprette mottaksapparat for nytt personell offshore (omvisning, beredskapsinformasjon, osv.)	Joacim Christiansen	Completed	100 %	1.12.2008	17.12.2008	17	33 %

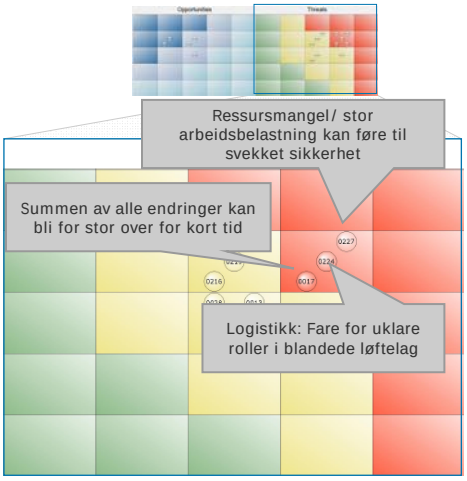
Prosjektleder bestemmer ansvarlig i enheten for tiltaket

Ansvarlig rapporterer status og % ferdig for sine tiltak

Prosjektleder og ansvarlig anslår tidsbruk og ressursallokering for tiltaket

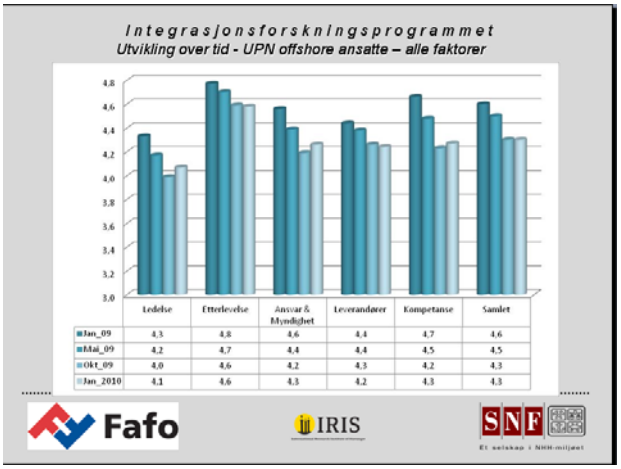
Risikostyring som en gjennomgående del av prosessen

Kommentar:
- Rød risiko betyr at dette forholdet har relativt stor mulighet for å påvirke virksomhetsrisiko
- Rød risiko krever at det er identifisert tiltak for å kontrollere risiko og at disse gis høy prioritet og ledelsesfokus



Følgeforskningsprogrammet følger utvikling over tid

- Gjennomføres som utvalgsundersøkelser
- Kvartalsvise målinger
- Eksterne fagmiljø er tungt involvert



Installasjoner	N	Ledelse	Etterlevelse	Ansvar&Mynd	Leverandører	Kompetanse	Org_Saf
Åsgard A	54	4,1	4,6	3,9	4,2	4,1	4,2
Åsgard B	70	3,7	4,1	3,7	3,7	3,7	3,8
Heidrun	97	3,9	4,5	4,3	4,2	4,1	4,2
Kristin	54	4,2	4,6	4,2	4,2	4,2	4,3
Njord	46	4,2	4,7	4,6	4,4	4,6	4,5
Norne	54	4,5	4,9	4,3	4,5	4,6	4,6
Grane	51	4,7	4,9	4,5	4,7	4,5	4,7
Kvitebjørn	54	4,3	4,5	4,1	4,3	4,3	4,3
Sle							4,2
Bra							4,6
Hei							4,4
Hul							4,1
Tro							4,4
Tro							4,3
Tro							4,6
Vis							4,3
Sno							4,2
Sno							4,4
Gullfaks A	105	3,6	4,5	4,1	3,9	4,1	4,1
Gullfaks B	59	4,2	4,6	4,3	4,4	4,3	4,4
Gullfaks C	104	3,6	4,3	4,0	3,9	4,0	4,0
Statfjord A	60	4,0	4,9	4,3	4,6	4,4	4,4
Statfjord B	76	4,0	4,5	4,2	4,1	4,3	4,2
Statfjord C	79	4,1	4,4	4,3	4,1	4,2	4,2
Oseberg Feltsenter	117	3,8	4,4	4,1	4,2	4,2	4,1
Oseberg C	35	4,3	4,8	4,4	4,2	4,5	4,5
Oseberg Øst	40	4,7	4,9	4,7	4,6	4,6	4,7
Oseberg Sør	56	4,6	4,7	4,5	4,5	4,7	4,6
Offshore fagsener	86	4,0	4,4	4,0	4,3	4,4	4,2
Forpleining	118	4,3	4,7	4,8	4,7	4,7	4,6

Følgeforskningsprogrammets vurdering:

1. Statoil har en robust driftsorganisasjon med marginer til sikker drift
2. Integrasjonsprosessen har tært på marginene. Gul sone betyr ikke umiddelbar svekket sikkerhet, men at marginer er mindre enn det ønskelig
3. Den siste målingen viser at nedgangen har stoppet opp og vi ser enkelte tegn på forbedring

Key effects observed

- Strong and dedicated management commitment at all levels
- Hands-on follow-up from early phase to implementation
- Risk management as the basis for all the main decisions throughout the process
- Increased cross-organisational collaboration throughout the process

"No, Hoskins, you're not going to do it just because I'm telling you to do it. You're going to do it because you believe in it."

The way forward

- Implement and follow up actions to ensure sufficient capacity and competence
- Balance the activity level offshore to avoid excessive stress on the organisation as well as the individual

Bilder fra middagen – HFC forum 21.April

HFC

"Fremtidens interaktive teknologier for bruk i kontrollrom"

H.Koskinen & L.Hurlen/ IFE

Future technologies for use in control rooms

Lars Hurlen & Hanna Koskinen

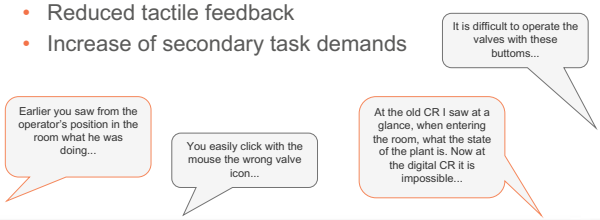
Outline of the presentation

1. Background
2. Re-introducing “space” as a control room quality
3. Some seen future CR trends
4. Emerging interactive technology
5. Early concepts for NPP operation
6. Conclusion & Future work

Background: From analogue CR to the digital one

Background: Challenges of digitalized, desktop-based CR

- Increased separation from the process
- Keyhole effect
- Reduced team situation awareness, inhibitions of communication, reduction of collaboration
- Reduced tactile feedback
- Increase of secondary task demands

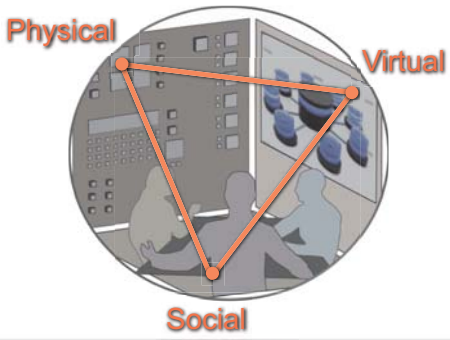


” Do not think a large dislay as merely a large desktop monitor, instead focus on the propertices of the entire space.” (Khan et al. 2005)

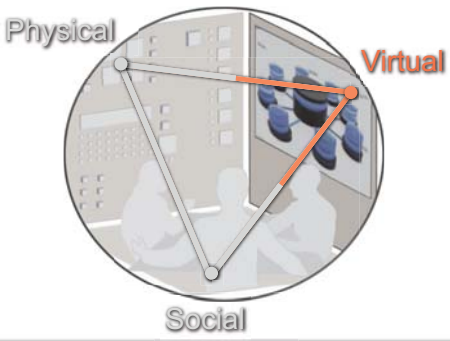
” Well designed work materials become integrated into the way people think, see, and control activities” (Hollan et al. 2000)

” *The very thing that makes place work* – the shared understanding of appropriate use, and the social interpretation of cues in the physical environment.” (Harrison et al. 1996)

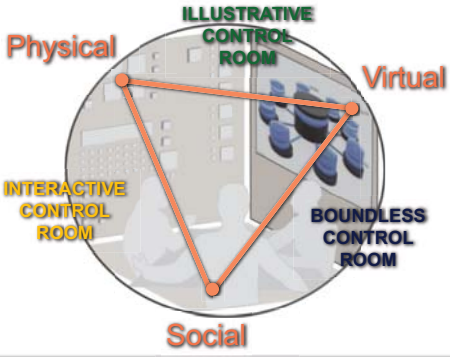
The three qualities of space



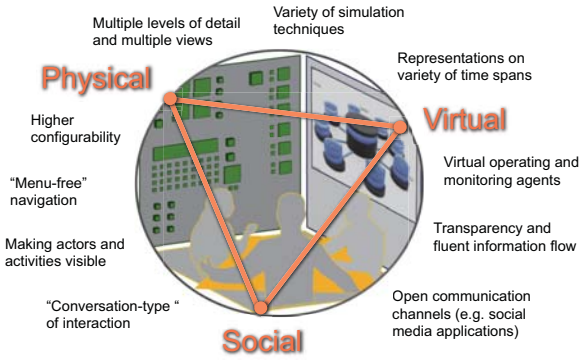
Spatial qualities in control room environments



Spatial qualities in control room environments



Some seen future CR trends



Merging the best of two worlds?

Analogue

Direct observability
- Visual patterns
- Activity of others

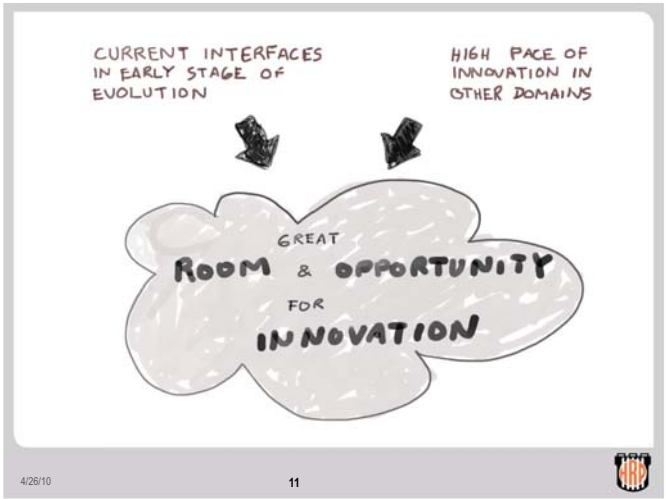
Direct control
- Fixed placement controllers
- Haptic feedback

Digital

Computational powers
- Information synthesis
- ...from various sources

Vizualization powers
- Cognitive support
- Guide attention

Future



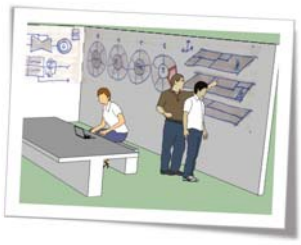
Emerging interfaces for use in control centers

Potential of "natural" interfaces

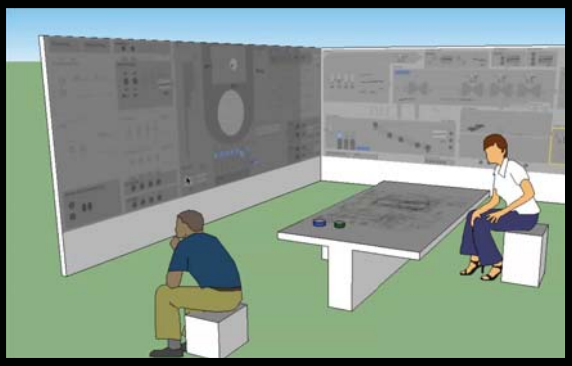
1. A more "natural" way of using computers
   - Intuitive: Easy to learn and efficient/satisfactory to use
   - Increased user acceptance
   - Immersive experience
2. Supporting collaborative work
   - Larger interfaces easier to gather around
   - More than one can interact at once

Early concepts for NPP operation

The large operator workstation desk



Interactive walls



Conclusion & Future work

- Emerging interface technology provide some unique opportunities to impact the user experience in operating centers
- Set up “Future Plant Prototyping Environment”
  - Future Control Environment
  - Human-Automation Teamwork
  - Outage Control Centers (with EDF)

Thank you!

✉ Lars.hurlen@hrp.no
✉ Hanna.koskinen@hrp.no

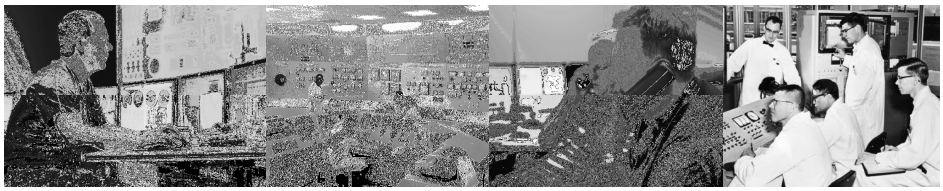
HFC

"Bemanningsstrategier i fremtidige høyautomatiserte verk"

M. H. Rø Eitrheim/IFE

Vedlagt: "Extended summary of HWR-938 Staffing Strategies in Highly Automated Future Plants Results from the 2009 HAMMLAB Experiment" - full rapport kan fås fra Maren.Eitrheim@hrp.no

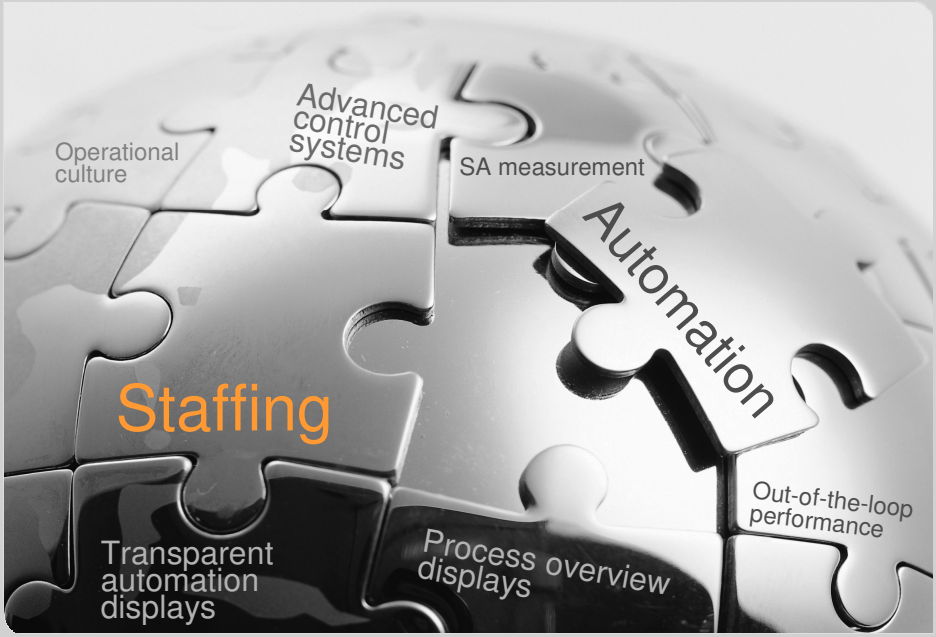
Staffing Strategies in Highly Automated Future Plants



Presented by Maren H. Rø Eitrheim

Gyrd Skraaning Jr., Nathan Lau, Tommy Karlsson,
Christer Nihlwing, Mario Hoffmann, Jan Erik Farbrot

OECD Halden Reactor Project



Research goal

- Explore staffing strategies that can support future designs and maintain safe operation

Staffing strategies (1/3)

- According to plant systems
  - e.g. reactor vs. turbine side

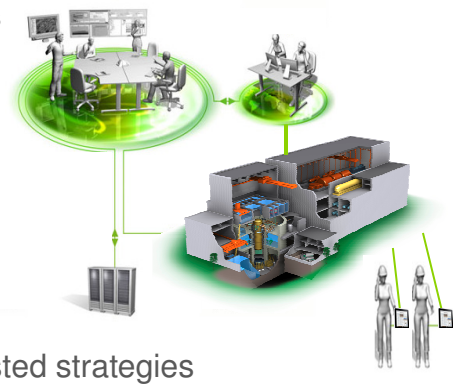
- According to process states
  - e.g. start-up, disturbances
- According to operator needs
  - e.g. workload

Staffing strategies (2/3)

- Allocation across units
  - e.g. common control centre

Staffing strategies (3/3)

- Allocation across geographical distances
  - e.g. off-site support teams

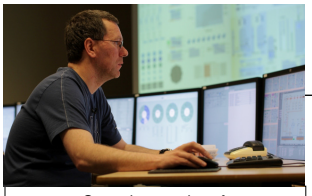


- A combination of suggested strategies
  - e.g. according to plant systems across units

The 2009 HAMMLAB experiment:

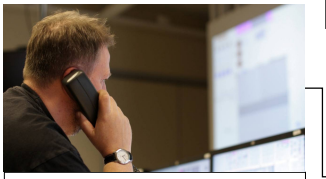
How will three operators manage to control two nuclear plants?

MTO-laboratories

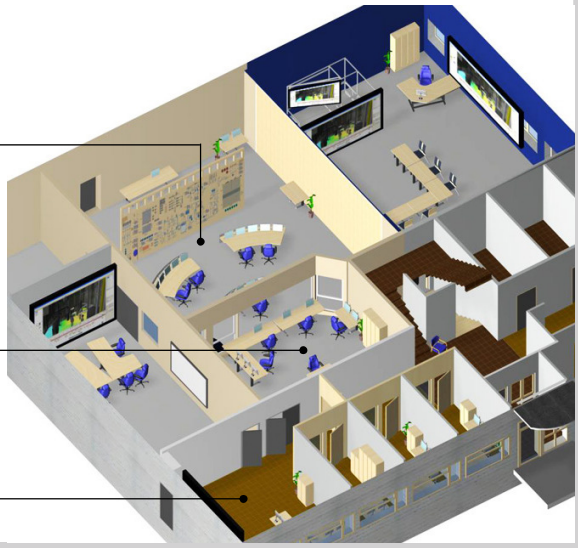


Control room plant A

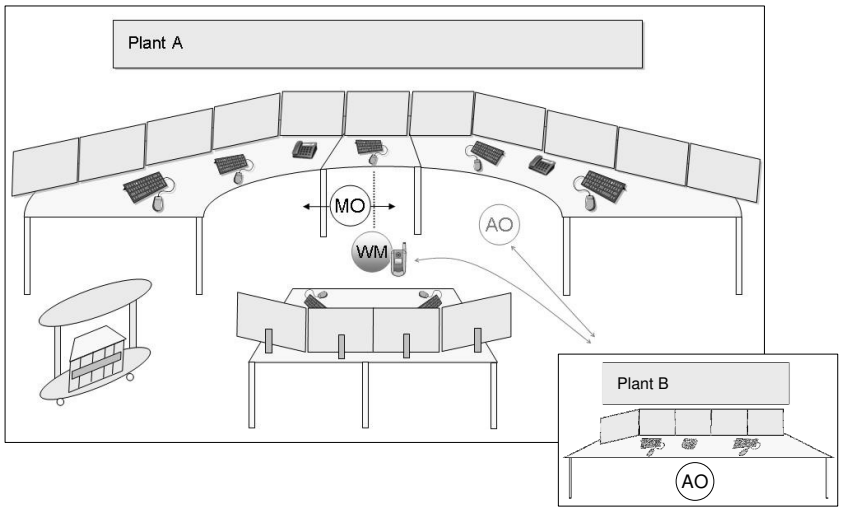
Experimental gallery



Control room plant B



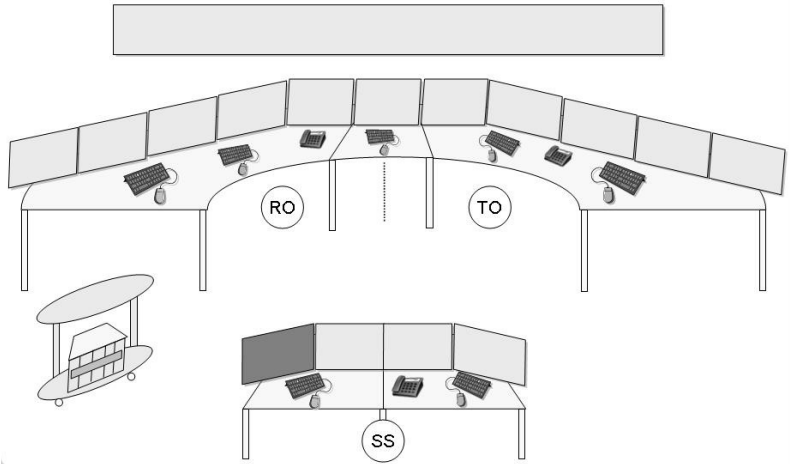
Untraditional staffing solution



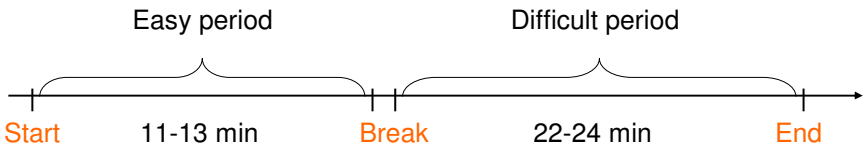
Untraditional operator roles

- Main Operator (MO)
  - responsible for reactor and turbine side of Plant A
  - monitors the automatic system
- Assistant Operator (AO)
  - controls the turbine side of Plant B
  - supports turbine side of Plant A when needed (as judged by the WM)
- Work Manager (WM)
  - responsible for Plant A and Plant B
  - makes decisions of operator allocation between plants
  - administrative tasks

Traditional staffing solution

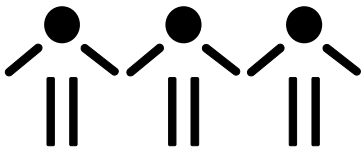


Test scenarios

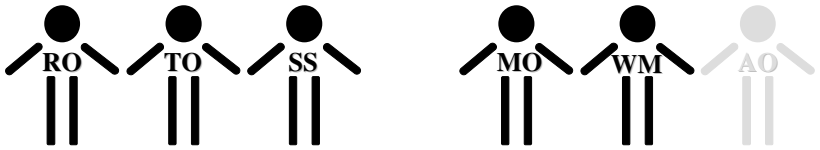


Participants

9 crews



4 scenarios + 4 scenarios



TRADITIONAL UNTRADITIONAL

Human performance data

- Before first scenario run
  - Demographic questionnaire
- During scenario runs
  - Task performance
  - Situation awareness
  - Self-assessment scales
  - AV-recordings
  - Log systems
- After last scenario run
  - Debriefing (semi-structured interview)

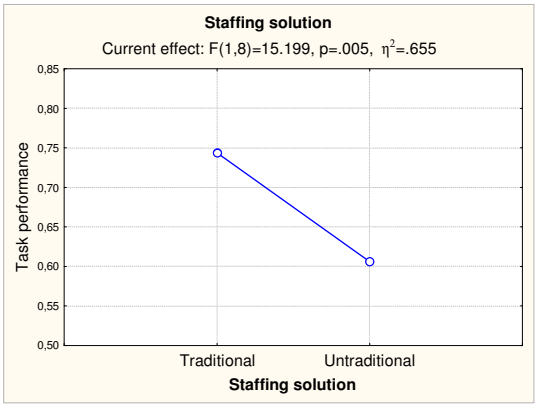
Task performance

- Expert rates whether operators work in accordance with ideal scenario solutions (predefined)
  - **Detections**, i.e. registration of deviating signals or plant states, such as alarms
  - **Operations**, such as intervening actions, active verification of information, other control room activities

	Operation	Score
	Call field operator to change filter. Contact maintenance to clean the filter	2
	Call field operator to change filter	1
	No operation	0

Task performance

- The untraditional staffing solution degraded operator task performance



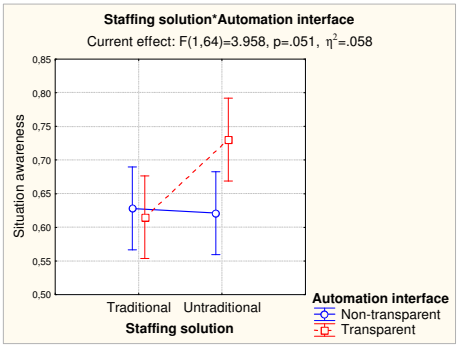
Situation awareness (SA)

- Operators' ability to make accurate observations of changes to process parameters
  - Operators responded to SA queries during break and after each scenario run
  - Expert scored the actual change of the selected parameters
  - Agreement between operators and expert: proportion correct

Items	Response alternatives
Recently, the reactor effect 531KW077 has	(a) decreased, (b) remained stable, (c) increased
Recently, the level in the condenser 461KA402 has	(a) decreased, (b) remained stable, (c) increased
Recently, the total feedwater flow 312KA031 has	(a) decreased, (b) remained stable, (c) increased

Situation awareness

- Higher SA in the untraditional staffing solution with the transparent automation interface
- Innovative staffing strategies may improve situation awareness with new tools



Conclusion

- The study of nuclear staffing solutions
  - Controlling more than one nuclear process may be feasible, but more operators are needed during disturbances
  - The new operator roles were beneficial for
    - Utilising new tools
    - Simplifying communication between the operators in the control room
- IFE Halden provides laboratory facilities that can be applied for empirical studies of innovative staff concepts and distributed teamwork

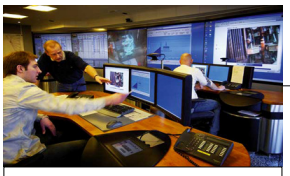
The staffing study transferred to other industries...

Idea for an empirical study of task allocation within the petroleum industry

Integrated operations

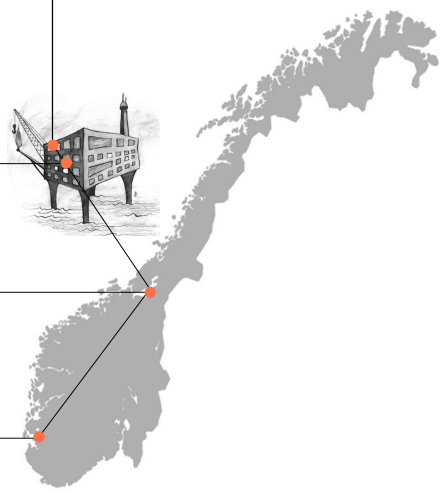
Offshore control room

Field process technicians



Onshore operation centre

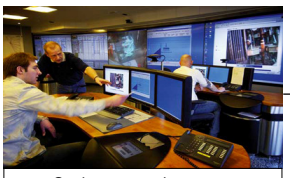
External experts



MTO-laboratories

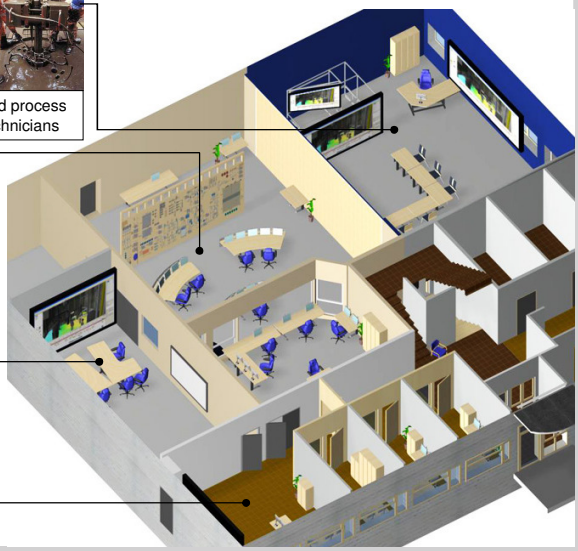
Offshore control room

Field process technicians

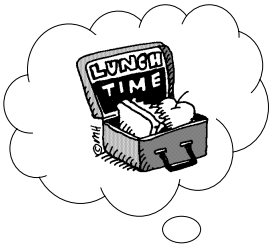


Onshore operation centre

External experts



External experts



Field process technicians

Offshore control room

Onshore operation centre

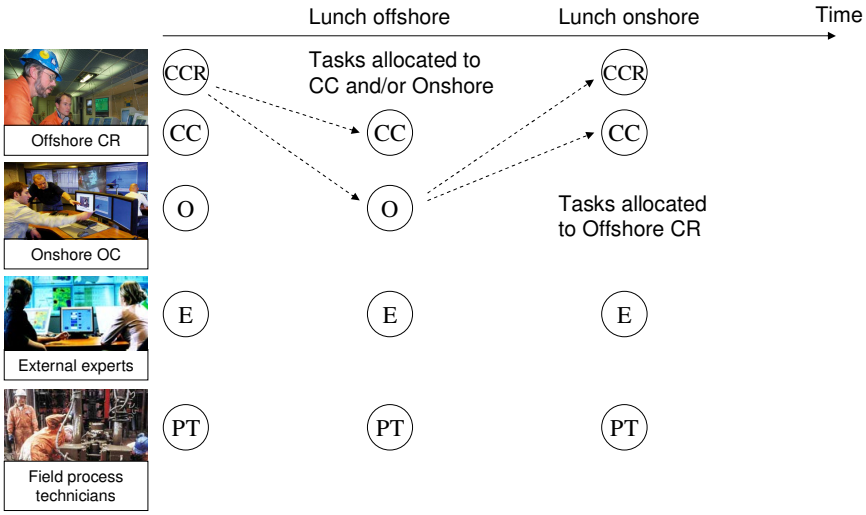
Case: lunch

- Could an onshore operator temporarily replace an offshore operator and vice versa?
  - Allocation of tasks between offshore control room and onshore operation centre during lunch
    - Predefined vs. dynamical allocation of tasks
- Operators have competence and experience from both offshore control room and onshore operation centre

Example of tasks offshore and onshore

- Offshore Control Room: Coordinator (CC) and Operator (CCR)
  - Write procedures
  - Fill in production optimization plan
  - Update and check preventive maintenance
  - Respond to phone calls and e-mails
  - Meetings
  - Fire & Gas testing
  - Handover documentation
- Onshore Operation Centre: Operator (O)
  - Optimize production and coordinate activities
  - Decision support
  - Respond to phone calls and e-mails

Roles and tasks during lunch



Further ideas

- To which extent do operators offshore and onshore need to
  - see each other?
  - have access to the same monitoring and alarm systems?
- Design scenarios to challenge the communication and exchange of information across localisations
- Human performance measures
  - Task performance
  - Situation awareness
  - Trust
  - Workload

Extended summary of HWR-938
Staffing Strategies in Highly Automated Future Plants Results from the 2009 HAMMLAB Experiment

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1. INTRODUCTION

The role of the human operator is changing in high-risk industries. Introducing higher levels of automation and new designs will affect the operator roles and responsibilities, composition and size of the crews controlling nuclear power plants [1]. A general trend for future operational concepts seems to be fewer human interventions. Advanced human system interfaces may increase the capacity for monitoring and controlling nuclear processes, and reduce the number of staff required for normal operation. However, the human abilities to handle beyond design basis events and new situations will also be crucial in future plants. As current staffing structures are adapted to existing plant designs, we need to organise future operators and teams in a way that suites tomorrow's technology. To anticipate the requirements of the future, new staffing strategies need to be explored. We have investigated the feasibility of future staffing strategies for controlling two parallel nuclear processes in cooperation with an automatic system [2]. The background and design of the HAMMLAB experiment are described below.

Increased capacity due to new technology and automatic systems may prepare the way for parallel monitoring of two or more nuclear processes. The Canadian modular plants are an example of a flexible staff allocation in multi-unit stations. One shift supervisor oversees the operation of all four units; two operators control one unit during normal operation; and three to four operators are available on a unit during upset situations. Two or more extra operators are available to support all units as needed. A flexible allocation could reduce staffing and training burdens. All but normal operations could be handled by off-site specialist teams who come to the plant when needed or perform tasks remotely. Their level of expertise would be superior to what could be attained by current teams trained to handle all situations [3]. Utilisation of distributed expertise of different geographical teams is a driving force behind the introduction of Integrated Operations in the Norwegian petroleum industry [4]. A common issue for staffing strategies with distributed and ambulant teams is how process information can be effectively exchanged across disciplines and distances.

We have designed an *untraditional staffing solution* for a hypothetical future plant. The purpose of the experiment is to test whether a crew of three operators is able to simultaneously control two nuclear processes with new roles and responsibilities. For

comparison, three operators will control one plant in a *traditional staffing solution*. The experiment evaluates underlying principles for role allocation and staffing performed in a hypothetical future work environment.

2. THE EXPERIMENT

The study included two experimental manipulations: scenario period and staffing solution. The manipulation of scenario period was a comparison of an easy first scenario phase with a more difficult problem solving phase towards the end of the scenario. The staffing manipulation compared an untraditional to a traditional way of organising the work. In the untraditional staffing solution, a crew of three operators were responsible for two nuclear processes in collaboration with the automatic system [2]. A Main Operator (MO) controlled the reactor and turbine side of the highly automated Plant A. The MO operated the plant alone, except in critical situations such as periods with high workload, intolerable time pressure, or during emergencies, where he/she was supported by an Assistant Operator (AO). Plant B was fully automated on the reactor side with the turbine side manually controlled by the AO. A Work Manager (WM) was responsible for both plants. To compare with current operational practices, a Reactor Operator (RO), Turbine Operator (TO) and Shift Supervisor (SS) controlled one highly automated plant in a traditional staffing solution.

The exploration of staffing strategies was conducted as a part of a larger study on the operation of future plants. The experimental manipulation of automation interface, comparing non-transparent and transparent automation interfaces [2], was included in the analysis of situation awareness.

Nine crews were exposed to eight scenarios and all experimental conditions. Each crew consisted of three operators that served different roles in the two staffing solutions. A highly automated plant was realised by running the HAMBO simulator with computer scripts. The scenarios lasted for maximum 35 minutes and covered different aspects of the transition from cold start-up to 50% reactor power.

We measured the impact of the staffing solutions on the operators' task performance, situation awareness, self-rated performance and workload. We used the Operator Performance Assessment System (OPAS) to measure whether operators worked in accordance with ideal scenario solutions prescribed by process experts. The situation awareness indicator measured the individual operator's process overview, i.e. their ability to observe meaningful changes to relevant process parameters.

After the completion of each scenario period, RO, TO (traditional staffing solution) and MO (untraditional staffing solution) responded to a self-rated performance scale and subjective task-complexity scale. The operators having the managing role (SS and WM) responded to a short version of the NASA-TLX questionnaire to assess workload.

A semi-structured interview was conducted with each crew after completion of all scenario runs. The crews were asked about their experiences with the two staffing solutions and the control room design.

3. FINDINGS

The results showed higher task performance in the easy than in the difficult scenario period, and higher task performance in the traditional than in the untraditional staffing solution. The

lowest task performance was observed during the difficult period in the untraditional staffing solution, see Figure 1 below.

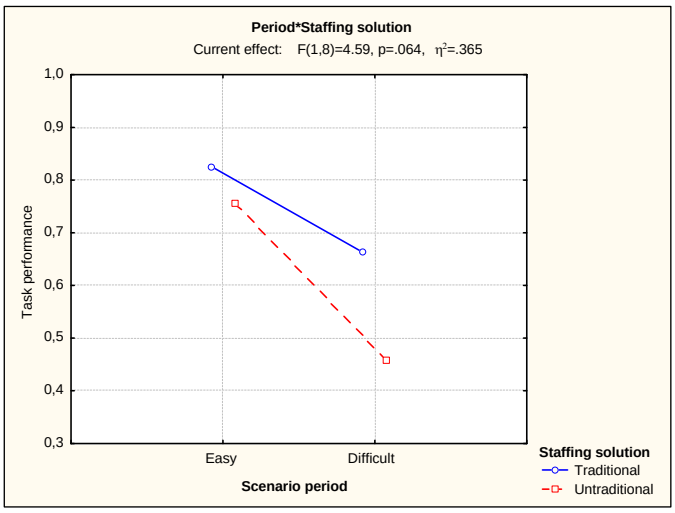

Figure 1: Task performance scores across scenario periods and staffing solutions

The analyses of self-rated performance and workload for RO and MO showed higher self-rated performance in the traditional staffing solution and the highest workload during the difficult scenario period in the untraditional staffing solution. The WM also reported higher workload in the untraditional staffing solution compared to working as SS in the traditional staffing solution. These results are reasonable as the operators have years of training and experience with working the traditional way. Although these results favour the traditional staffing solution, operators were able to perform a considerable amount of prescribed tasks when acting in the new roles. The differences between the staffing solutions were smaller in periods with low workload.

Surprisingly, the operators showed better situation awareness in the untraditional staffing solution with the transparent automation displays than in the traditional staffing solution, see Figure 2.

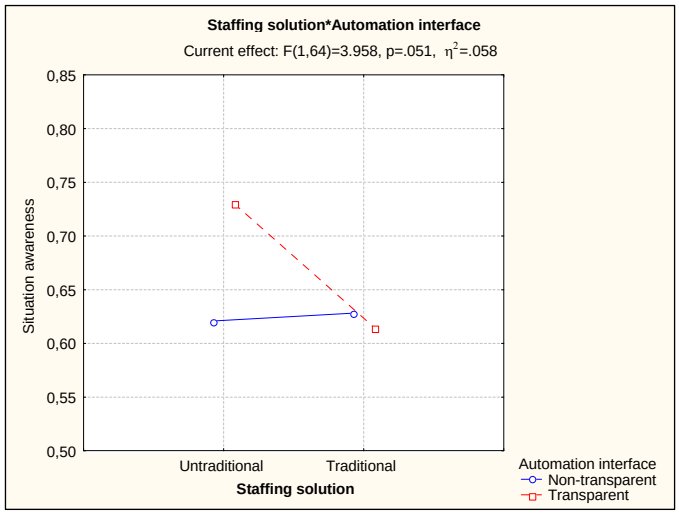

Figure 2: Situation awareness across staffing solution and automation interface

This result may indicate that the operators were able to adapt to their new roles, and that the untraditional staffing solution enhanced the utilisation of displays that visualised automation activity. However, task performance may have been sacrificed for maintaining an overview of the plant status and automation activities.

The participants' feedback on the staffing solutions was mixed. In general, operators preferred the traditional way of working: A majority of the crews highlighted the advantages of being more people in the control room. However, the untraditional staffing solution was not completely rejected. Communication might be easier when only two persons are present. The reduced staffing level might be sufficient during normal operation, but more operators are needed during disturbances and start-up.

Three participants working as Main Operator felt that attending both the reactor and turbine side of the plant exceeded their capacity. An issue brought up by several crews was the transition from being alone as a Main Operator to including an Assistant Operator in the handling of disturbances. The AO is not aware of the history or context of the problem solving, and needs time and guidance to be updated on the process state.

The opinions among the Work Managers were mixed. Some Work Managers found the extended responsibility acceptable or experienced no difference between controlling one or two nuclear processes. Others experienced increased workload or prioritised one nuclear process above the other.

4. CONCLUSION

The untraditional staffing solution degraded the operators' task performance, especially in difficult scenario periods. Nonetheless, the findings from the experiment suggest that parallel operation of more than one plant may be a feasible future strategy. The operators managed to perform a considerable amount of the prescribed tasks when they worked untraditionally. The new operator roles also turned out to be beneficial with regard to utilising new tools (transparent automation displays). In an unfamiliar situation with high workload, operators may prioritise to keep an overview of the plant status at the sacrifice of diagnosing and mitigating disturbances. New roles and extended responsibility for two nuclear processes in the untraditional staffing solution seemed to overload the operators during disturbances. Thus, more specialised teams and roles might be necessary in future plants. Finally, staffing concepts that involve support teams or shifting roles will probably require additional training and tools for effective acquisition and exchange of information.

5. REFERENCES

[1] Persensky, J., Szabo, A., Plott, C., Engh, T., & Barnes, V. (2005). *Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)*. NUREG-1791. Washington, DC: US Nuclear Regulatory Commission.

[2] Skraaning Jr, G., Eitrheim, M. H. R., Lau, N., Nihlwing, C., Hurlen, L. & Karlsson, T. (2010). *Coping with Automation in Future Plants: Results from the 2009 HAMMLAB Experiment* (HWR-937). Halden, Norway: OECD Halden Reactor Project

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HFC

"Intelligente løsninger for pålitelige arbeidsprosesser"

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Intelligent Solutions for Reliable Work Processes

HFC Forum, Halden, 21.-22.2010
Fremtidige driftsformer og kontrollsystemer

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Computas 25 år
1985 – 2010
Kunnskap i system

- Norwegian company specializing in work proc solutions and knowledge management
  - BPM – Business Process Management
  - Human centric and collaborative processes
  - Knowledge-based solutions and products
  - Web and portal solutions, semantic technology
  - Software engineering, consulting, project management
- Large customers in government and private sector
  - Case handling systems
  - Integrated operations
- 180 project managers, engineers and consultants
- Active participation in EU and domestic R&D programs
- Established 1985 as spinoff from Det Norske Veritas
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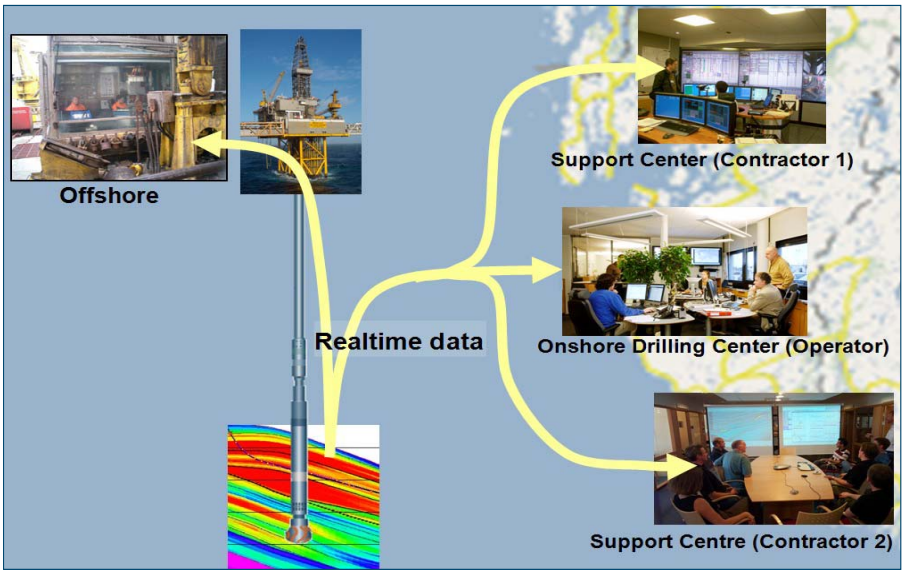
Outline

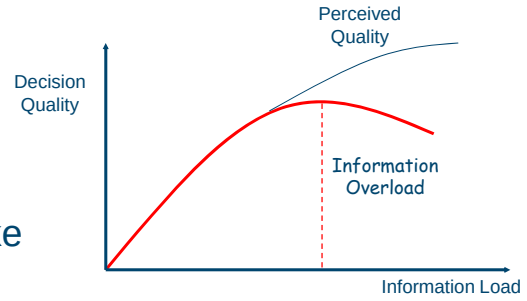
- Introduction
- Work processes in Integrated Operations
- Process-enabled experience transfer
- Collaboration and decision support
- Autonomous agents in operations
- Prospects and summary

Integrated Operations (IO) in oil&gas



IO challenges – From data to decisions

- Getting enough data is no longer the problem …
- The challenge is to use data to make better decisions



- **Work processes** define how people and ICT collaborate, including decision making and value creation, and may be the key to meet the challenge

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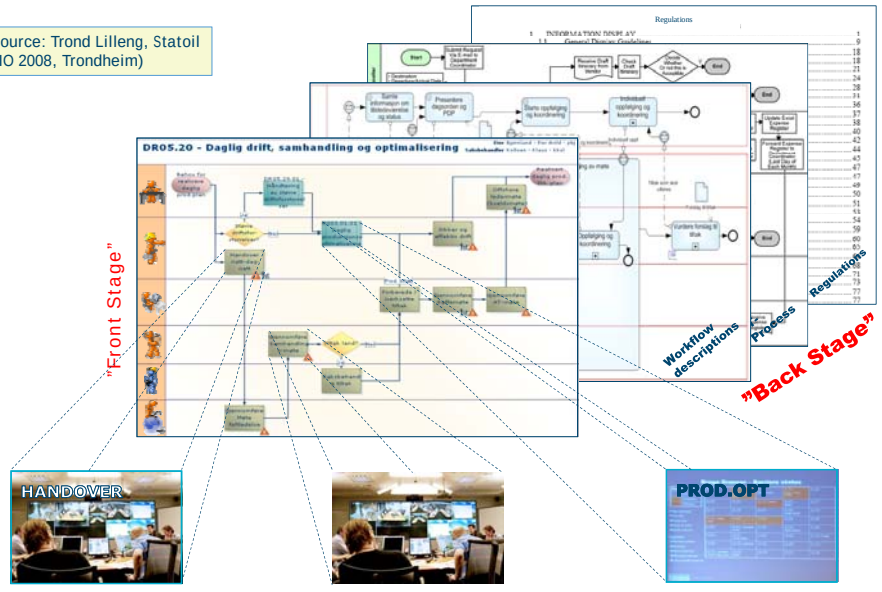
Bring work processes to the front stage!

Source: Trond Lilleng, Statoil (IO 2008, Trondheim)



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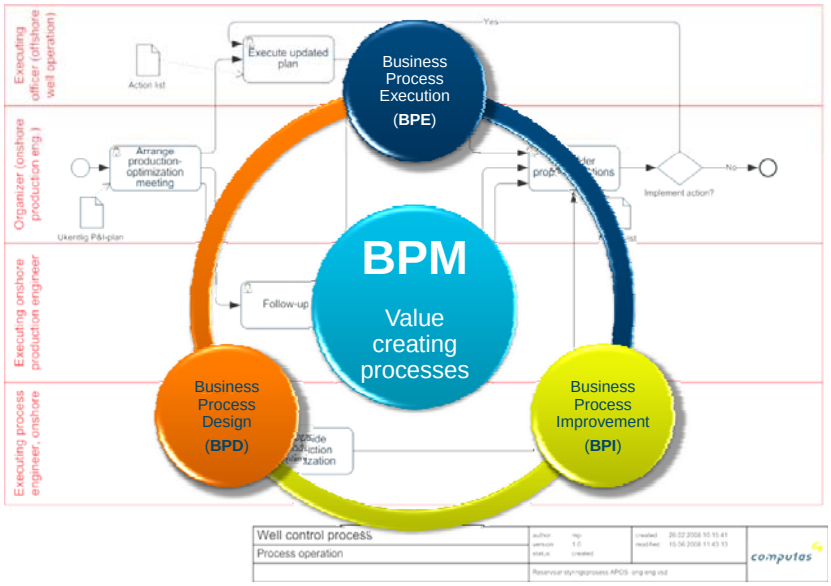
Work processes in IO - Challenges

- How to agree on, specify and efficiently deploy new IO work processes?
- How to optimize IO work processes for optimal value creation?
- How to ensure that the organization actually follows the new processes?
- How to provide management needed global view of status of all ongoing work processes in the organization?
- How to learn from experience and rapidly embed new knowledge in new/modified work process(es)?
- How to rapidly and safely change and (re-) deploy work processes as required?

BPM - An integrated view (APRIO)



Designing the process

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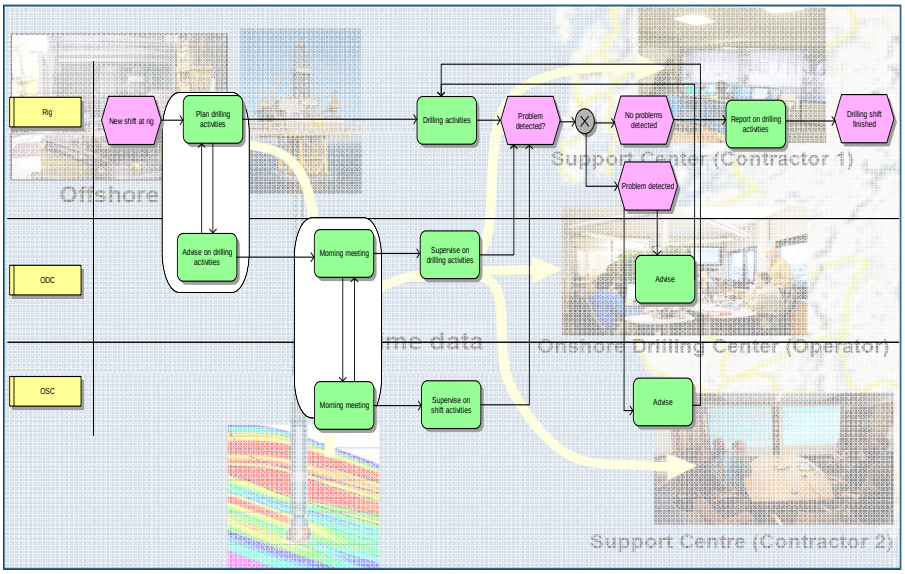

Executing the process – Supporting daily work tasks

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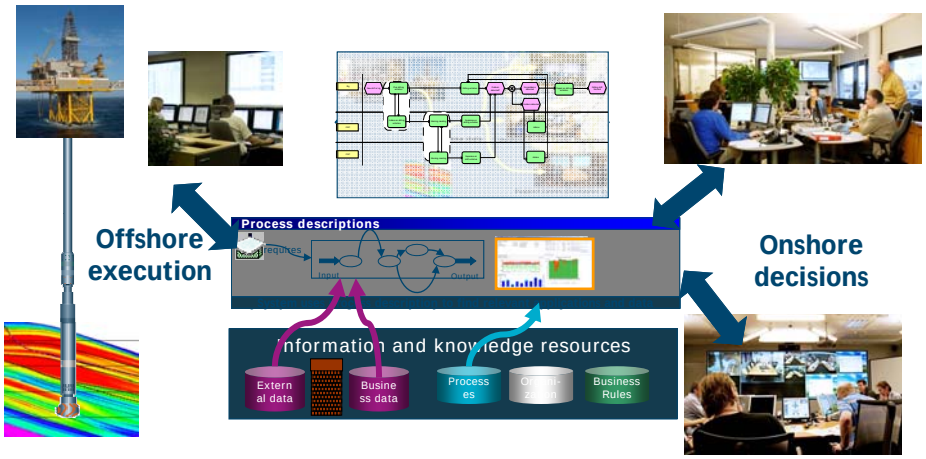

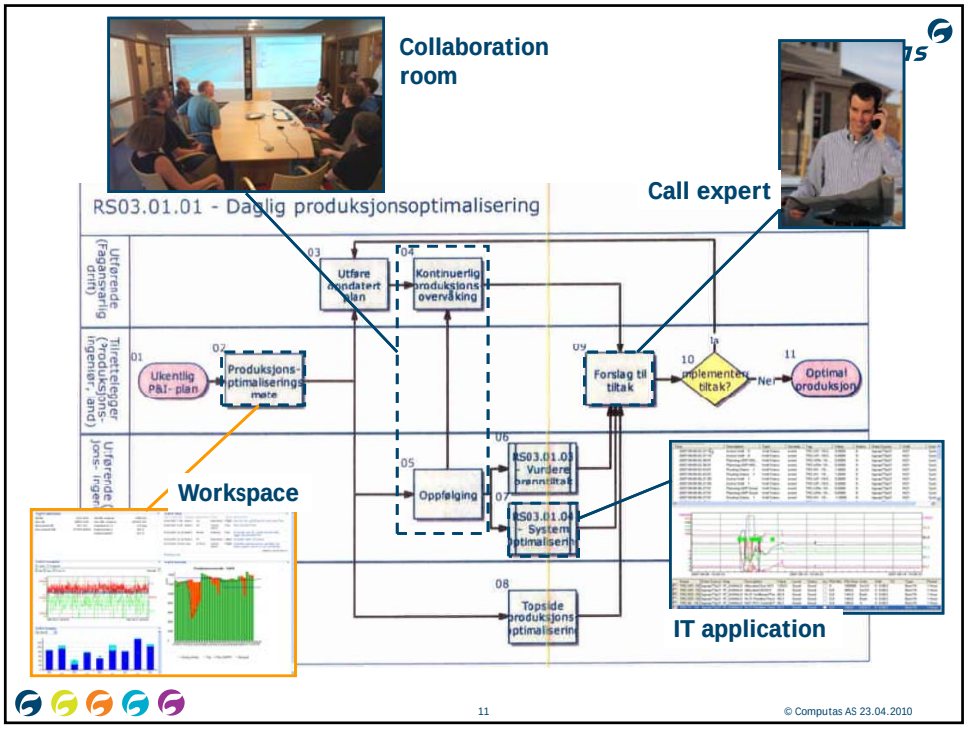
Collaboration room
Call expert
RS03.01.01 - Daglig produksjonsoptimalisering
Workspace
IT application
11
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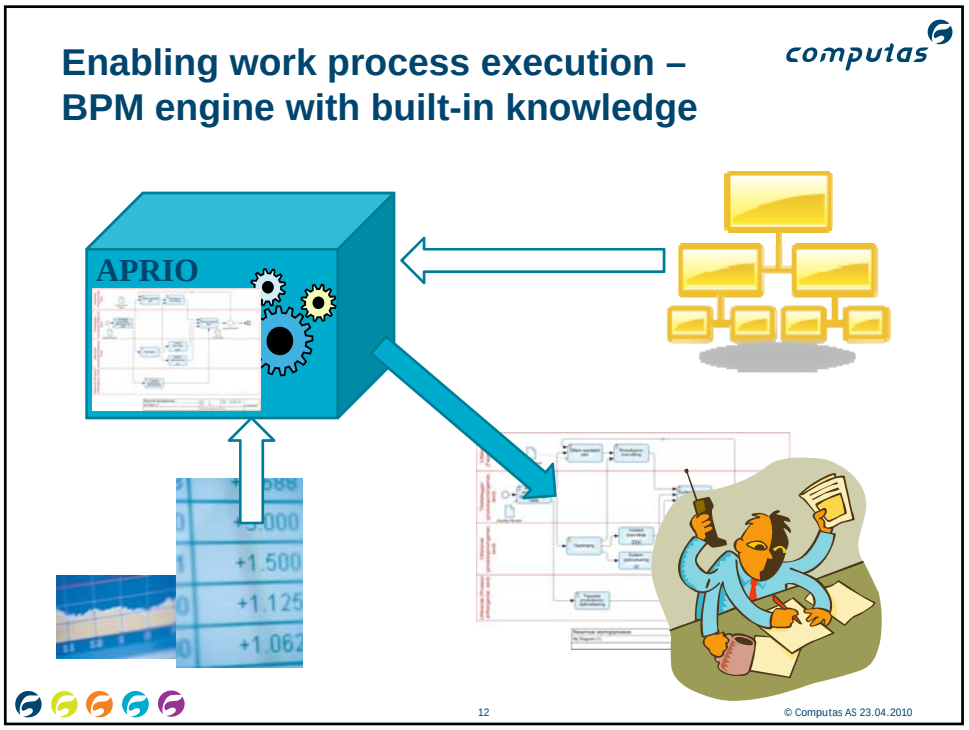
Enabling work process execution – BPM engine with built-in knowledge
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APRIO
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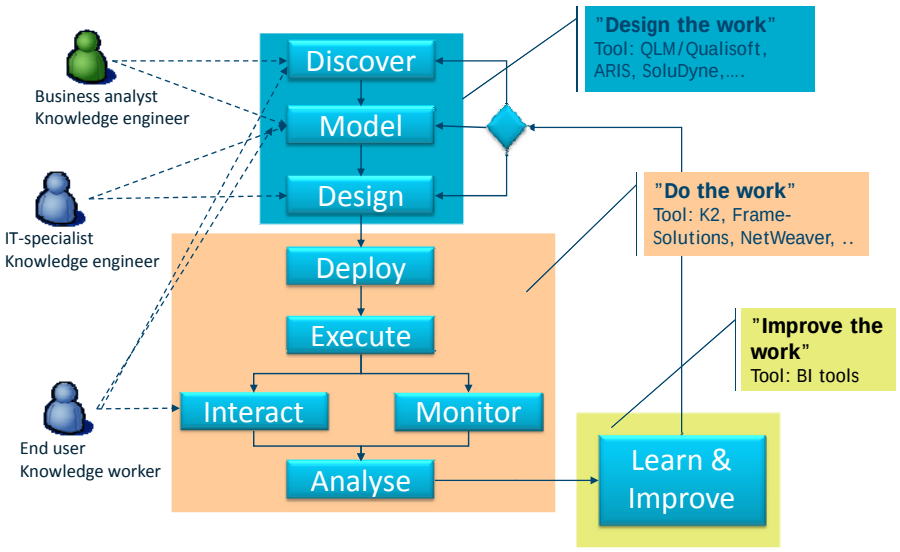
Work process life cycle - Detailed



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Process-enabled IO - Benefits

- Improved team communication and enforcement of roles and responsibilities
- Improved understandi[illegible]f processes, tasks and ensured as-agreed [illegible]execution
- Less time wast[illegible]earching for data, improved a[illegible]and visualization
- Improved s[illegible]ation awareness and preparedness for exceptional events
- Organizational learning from individual and collective experience

Compliance!

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Case 1 - Experience transfer in IO (AKSIO)

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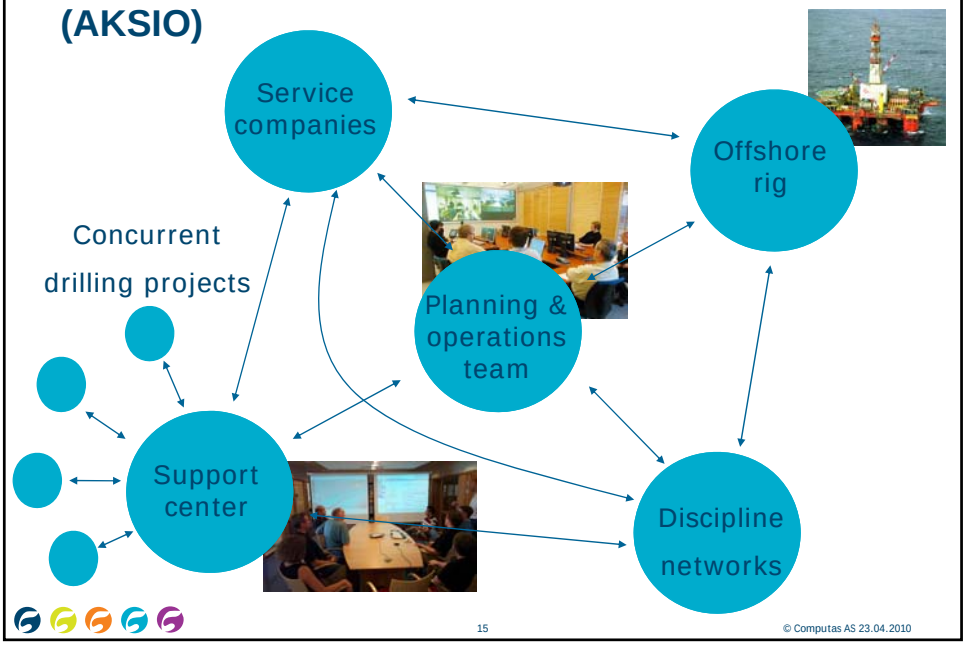

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Social transmission of knowledge

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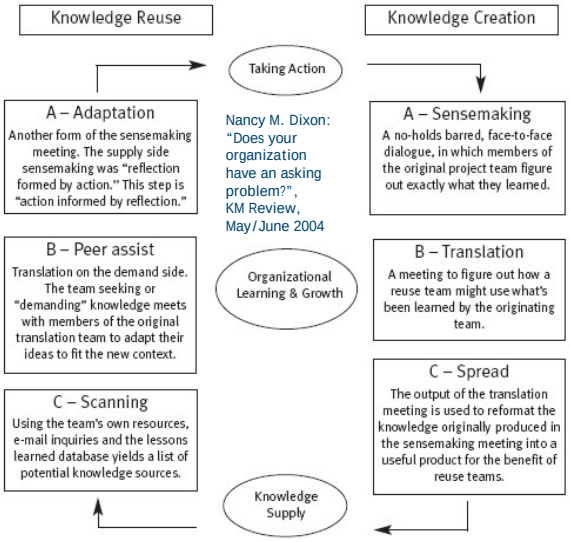
- Passive Lessons Learned data bases will not be used
- Knowledge sharing requires facilitation and incentives
- AKSIO approach: **Embed knowledge sharing in work processes**



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Process- and semantics-enabled experience transfer

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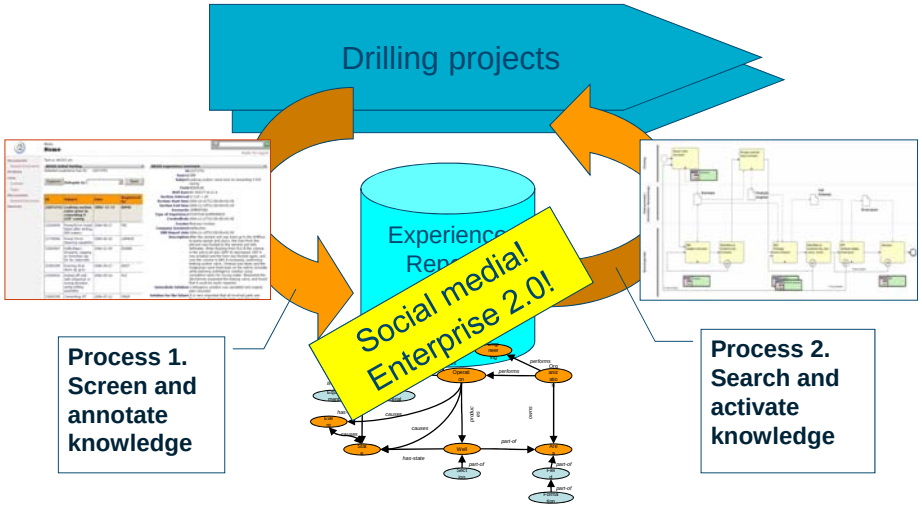

Case 2 - Decision making in drilling (CODIO)

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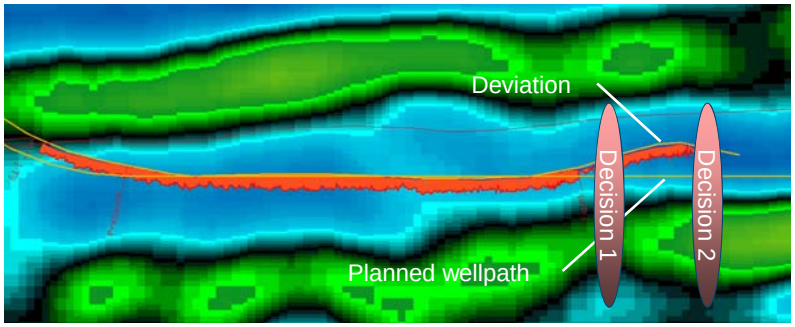
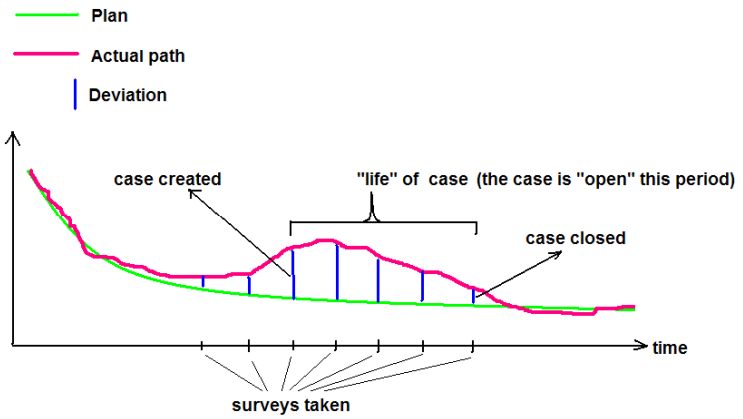


Geosteering:

- **Decision 1**: How to get to drilling target? (Update/change well path)
- **Decision 2**: How far to drill in the reservoir section? (Call target depth)

Decision points – “Case handling”

- Geometric or other types of deviations
- Successive decision points until case is resolved



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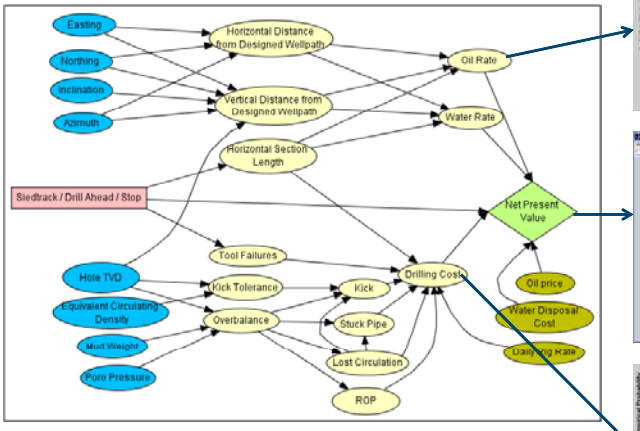
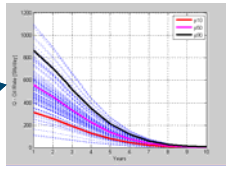
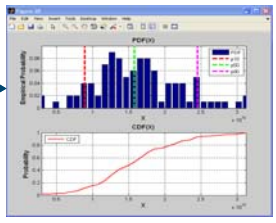
Decision models and results







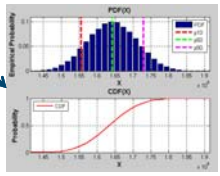


Diagram only used for illustration purpose, not used for numerical calculations, which are performed by Monte Carlo simulation

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Geosteering workflow

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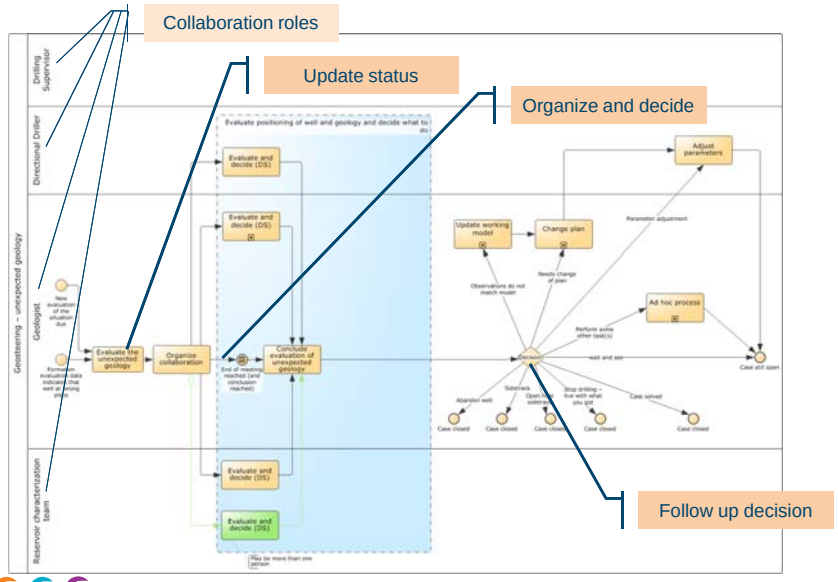

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Case - Shared information space

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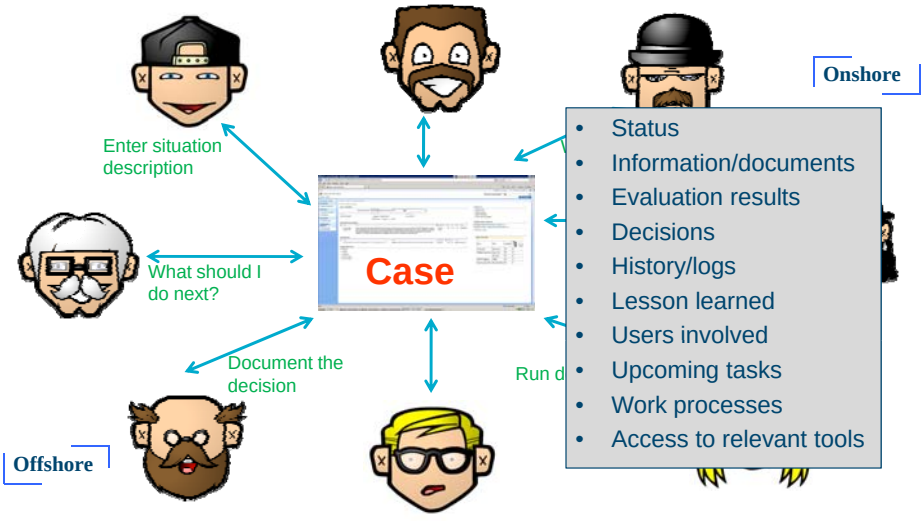

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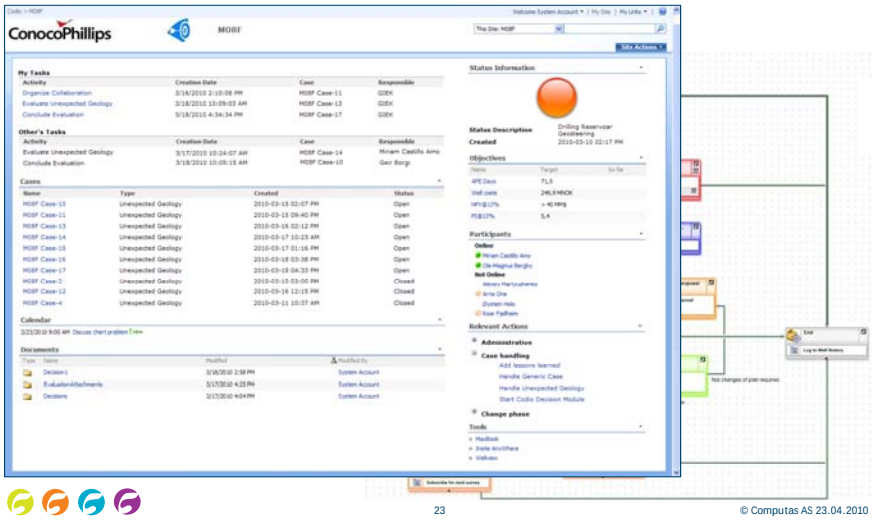
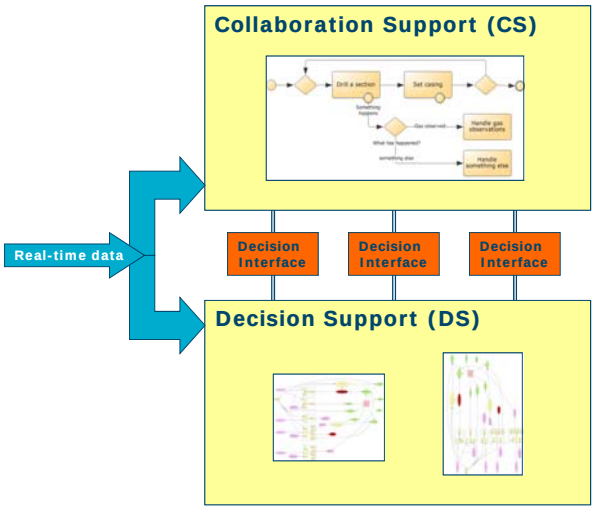
Implementation – Sharepoint and K2

- Industry-standard IT platform
- Executable workflow model

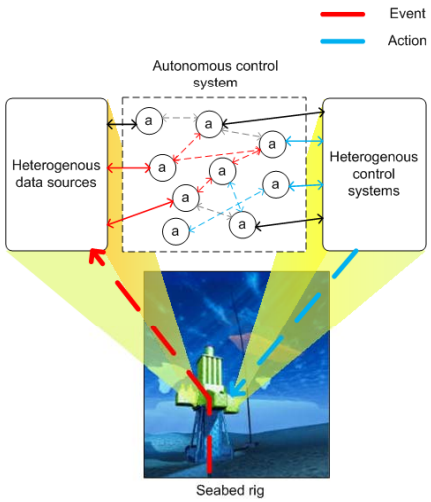


Service-Oriented Architecture (SOA)



- **Collaboration Support** implements the collaborative drilling work process and provides a useful service by itself
- **Decision Interfaces** link together CS and DS, and can be on-demand or proactive
- **Decision Support** implements specific decision models, from simple rule systems to Bayesian models

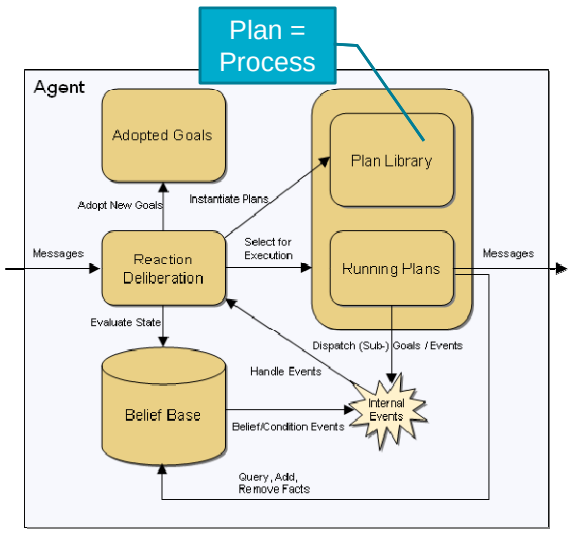
Case 3 – Autonomy in drilling operations (AutoConRig)

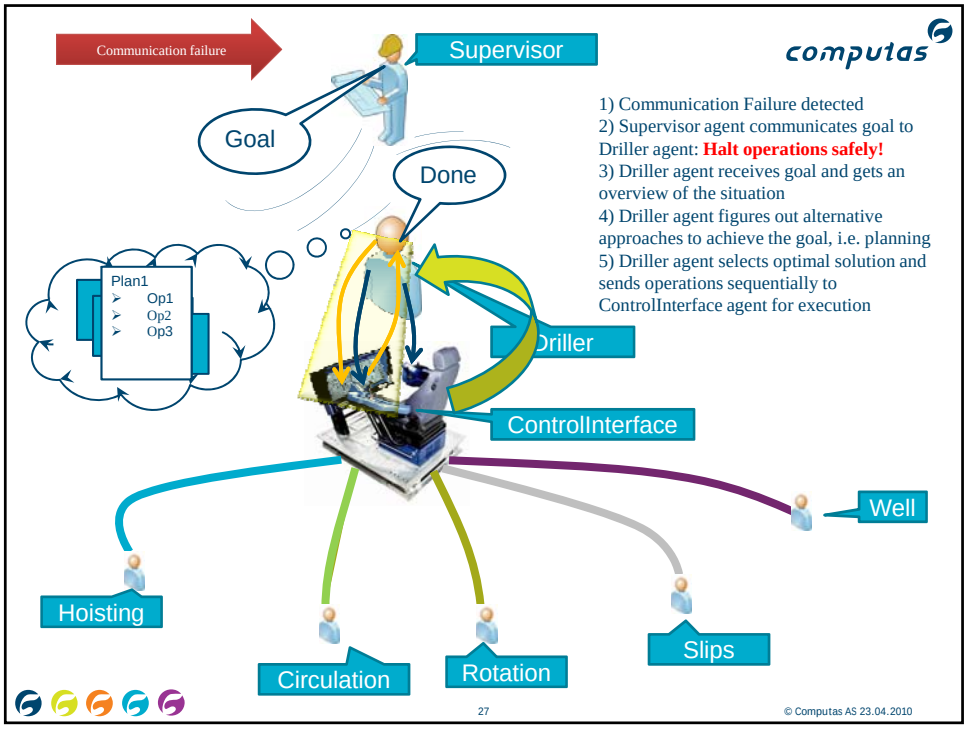


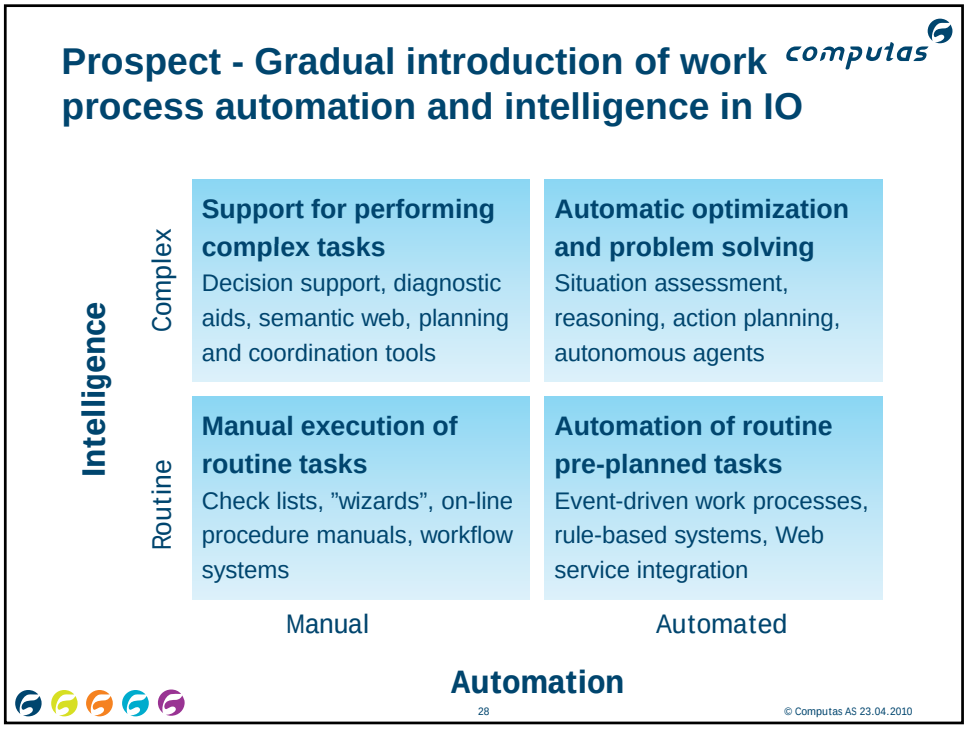
- Objective: Demonstrate Autonomous Control of a Drilling Rig
- Context: Future fully automatic unmanned subsea drilling rig in remote location, possibly under ice
- Pilot case: Perform safe "parking" of drillstring in case of communication failure
- AutoConRig approach: **Multi-agent system with autonomous behavior - manages its own goals and does planning**

Agent architecture – Belief, Desire, Intention (BDI)

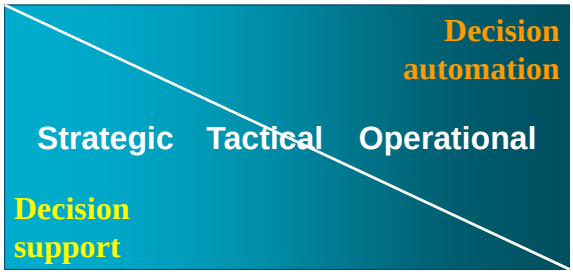
- An *agent* is a computer system that is capable of flexible autonomous action in dynamic, unpredictable environments
- An *agent oriented system* is a collection of communicating agents working towards a shared goal
- MAS – Multi-Agent Systems




Communication failure
Supervisor
computas
Goal
Done
1) Communication Failure detected
2) Supervisor agent communicates goal to Driller agent: Halt operations safely!
3) Driller agent receives goal and gets an overview of the situation
4) Driller agent figures out alternative approaches to achieve the goal, i.e. planning
5) Driller agent selects optimal solution and sends operations sequentially to ControlInterface agent for execution
Plan1
Op1
Op2
Op3
Driller
ControlInterface
Well
Hoisting
Circulation
Rotation
Slips
27
© Computas AS 23.04.2010


Prospect - Gradual introduction of work process automation and intelligence in IO
computas
Intelligence
Complex
Routine
Support for performing complex tasks
Decision support, diagnostic aids, semantic web, planning and coordination tools
Automatic optimization and problem solving
Situation assessment, reasoning, action planning, autonomous agents
Manual execution of routine tasks
Check lists, ”wizards”, on-line procedure manuals, workflow systems
Automation of routine pre-planned tasks
Event-driven work processes, rule-based systems, Web service integration
Manual
Automated
Automation
28
© Computas AS 23.04.2010

Supporting and automating decisions



- Relevance for and value of decision automation is highest on large-volume “routine” operational decisions
- “Smart (enough) systems”
- BDM – Business Decision Management
- BPM – Business Process Management

Summary

- Next generation IO systems will be firmly based on an integrated work process approach
- Effective support for integration, collaboration, decision making, and quality assurance
- Applied to production optimization, drilling, and operations and maintenance
- Based on advanced BPM (Business Process Management) methods and tools
- Open for gradual introduction of more work automation and system intelligence in IO

INVITASJON

Human Factors in Control

21-22 april
2 0 1 0

Fremtidige driftsformer og kontrollsystemer

24.mars

Kjære deltaker!
Vi vil med dette invitere til møte i HFC- forum (Human Factors in Control).

Møtet holdes onsdag 21. og torsdag 22.april 2010 i Halden på Park Hotel, Marcus Thranes gate 30, 1776 Halden. Vi starter kl 11:30 med lunsj og avslutter etter lunsj på torsdag.

Vi har reservert rom på Park Hotell. Frist for beskjed om rombestilling er 14.april, IFE bestiller rom for dere – kryss av på siste side. (De som vil bestille selv må ringe tlf 69 21 15 00, og oppgi IFE for å få beste pris).

Program
Tema for møtet vil være "Fremtidige driftsformer og kontrollsystemer" og vi vil bl.a. ha en paneldebatt mellom operatører og leverandører om dette temaet, fulgt av en workshop. Foredrag holdes bl.a. av Prof. M.Lind fra Danmarks Tekniske Universitet, se hjemmesiden http://www.iau.dtu.dk/~ml/ og mange andre sentrale ressurspersoner. Det blir besøk hos Borreggaard (Sarpsborg) hvor vi får se på kontrollrom og høre erfaringer fra de gjennomførte omorganiseringene.

Forumets visjon og hovedoppgave
HFC visjon: "Kompetanseforum for bruk av HF innen samhandling, styring og overvåkning i olje og gass virksomheten."
HFC hovedoppgave: "Å være et forum for erfaringsoverføring som bidrar til å videreutvikle HF metoder til bruk ved design og vurdering av driftskonsepter." (Om HFC, se: www.hfc.sintef.no)

Vi håper du har anledning til å delta, og ønsker at du fyller ut og returnerer det vedlagte registreringsskjemaet, senest 12.april. Vi ser frem til din deltakelse.

Vil minne om konferanse I regi av Human Factors and Ergonomics Society Europe, 13-15/10 - 2010 i Berlin – tema "Human Centred Automation". Se http://www.hfes-europe.org/.
Vi vil også benytte anledningen til å minne om kurset "MTO-Human factors" ved UiS som går høsten 2010, og NTNU kurset "Introduksjon til HF og integrerte operasjoner" - våren 2011.

Vennlig hilsen

Thor Inge Throndsen /StatoilHydro, Atoosa Tunem/IFE, M. Green/HCD, Håkon Fartum/DnV, Martin Relling/ ConocoPhillips, Stig Ole Johnsen; Camilla Tveiten; Irene Wærø/SINTEF.

Vær vennlig og returner registreringen innen 14.april 2010 til:
jannicke.neeb@hrp.no, IFE (FAX: 69 21 24 90)

HFC Møte

AGENDA

21 til 22 april
2 0 1 0

Fremtidige driftsformer og kontrollsystemer

Halden, IFE – Park Hotel, Marcus Thranes gate 30

Dag 1	Foredrag med spørsmål etter foredragene;	Ansvar/Beskrivelse
11:30-12:30	Registrering og lunsj	HFC/IFE
12:30-12:45	Velkommen til møtet – presentasjon av møtedeltakere	HFC
12:45-13:30	Fremtidige driftsformer og kontrollsystemer	Prof. M.Lind/ Danmarks Tekniske Universitet
13:30-13:45	Diskusjon	
13:45-14:00	Kaffe/Pause	HFC/IFE
14:00-14:30	"Important HF issues in future operations":	A.Balfour/HFS
14:30-15:00	"Utfordringer og erfaringer med omorganisering av Statoil i forhold til nye driftsformer":	Ø. Nilsen/Statoil
15:00-17:30	Kombinert besøk og presentasjon hos Borregaard, Sarpsborg- bl.a. erfaringer med omorganiseringer	HFC/IFE
17:30-	Transport tilbake	HFC/IFE
19:00	Middag inkl underholdning	HFC/IFE

Dag 2	Foredrag med spørsmål etter foredragene;	
08:15-08:30	Kaffe	HFC/IFE
08:30-09:30	Diskusjonspanel med deltakelse fra operatører (eks Statoil/ Øivind Nilsen) og leverandører (ABB, Kongsberg/ Olav Revheim)."Framtidens driftsformer – muligheter/ strategier og utfordringer"	Moderator A.Balfour/HFS
09:30-10:15	Workshop: HFC; organisert i to grupper i regi av seminarets hovedtema og paneldebatten - framtidens driftsformer – muligheter/ strategier og utfordringer.	HFC/IFE
10:15-10:30	Kaffe/Pause	HFC/IFE
10:30-11:00	Fremtidens interaktive teknologier for bruk i kontrollrom	H.Koskinen & L.Hurlen/VTT & IFE
11:00-11:30	Bemanningsstrategier i fremtidige høyautomatiserte verk	M. H. Rø Eitrheim /IFE
11:30-12:00	Intelligente løsninger for pålitelige arbeidsprosesser	R. Fjellheim/COMPUTAS
12:00-13:00	Lunsj	HFC/IFE

Neste møte i HFC forum er planlagt til 20-21 oktober 2010

Vær vennlig og returner registreringen innen 14.april 2010 til:
jannicke.neeb@hrp.no, IFE (FAX: 69 21 24 90)

REGISTRERING

Human Factors in Control

21. til 22. april 2010

Halden, IFE Park Hotel, Marcus Thranes gate 30

Fremtidige driftsformer og kontrollsystemer

Ja, jeg vil gjerne delta:

Navn: __ _____

Tittel / stilling: ____ _____

Organisasjon: ___ _____

Adresse: __ _____

Kryss av for:

__Lunsj 21/4, __Middag 21/4, __ Bestiller hotell 21/4 __ Lunsj 22/4

Tlf. : _____ Fax: _____

E-post: _____

Hvem faktureres (PO-Nr/Bestillingsnr/Referanse: nr:)_____

For å være med må man betale inn medlemsavgift eller møteavgift. Medlemsavgiften er pr år:

- 25.000 for bedrifter med mer enn 15 ansatte (dekker 3 deltakere)
- 12.500 for mindre enn 15 ansatte (dekker 2 deltakere)
- 6.500 kr pr møte for ikke medlemmer (og overskytende deltakere)

Medlemsavtale, informasjon og publikasjoner om HFC kan finnes på WEB-siden: http://www.hfc.sintef.no

Vær vennlig og returner registreringen innen 14.april 2010 til:

jannicke.neeb@hrp.no, IFE (FAX: 69 21 24 90)