HFC – forum for human factors in control

Postadresse: 7465 Trondheim
Besøksadresse: S P Andersens veg 5
7031 Trondheim
Telefon: 73 59 03 00
Telefaks: 73 59 03 30

RAPPORT

TITTEL

Human Factors i et internasjonalt perspektiv; resultater fra HFC forum, 9. til 10.mai 2012. (Møte nr 15)

FORFATTER/REDAKTØR

Stig Ole Johnsen

OPPDRAGSGIVER(E)

HFC forum

RAPPORTNR.	GRADERING	OPPDRAGSGIVER	
SINTEF A23271	Åpen	Arne Jarl Ringstad/Statoil ASA	
GRADER. DENNE SIDE	ISBN	PROSJEKTNR.	ANTALL SIDER OG BILAG
Åpen	978-82-14-05492-7	60S011	103
ELEKTRONISK ARKIVKODE		PROSJEKTLEDER (NAVN, SIGN.)	VERIFISERT AV (NAVN, SIGN.)
eRoom/civil/504017CRIOPUserGroup/0_2fd8c		Stig Ole Johnsen	Lars Bodsberg
ARKIVKODE	DATO	GODKJENT AV (NAVN, STILLING, SIGN.)	
	16/7-2012	Arne Jarl Ringstad/Statoil ASA	

SAMMENDRAG

Denne rapporten dokumenterer presentasjoner, relevante artikler, agenda og deltakerliste fra HFC forum møtet den 9. til 10.mai 2011 i Oslo. Det er møte nummer 15 i regi av HFC forum. De vedlagte presentasjonene er fra:

P. Hudson	Identifying the roles of individuals, organizations, company culture and regulators in accident prevention
G. Lamvik	Forholdet mellom kulturforskjeller, arbeidspraksis og sikkerhet. Eksempler fra offshore- og sjøfartsindustrien
J. Tharaldsen	Perspectives on safety: The impact of group membership, work factors and trust on safety performance in UK and Norway
T. Soma	Human and organisational factors - what can be learned from international shipping
Paneldiskusjon	HF across borders – Challenges to face
R. Miles	Managing risk – international lessons from the loss of the Deepwater Horizon platform
T. Sydnes	Cross-cultural communication at an offshore service vessel
T.G. Graven	Quick and dirty ethnography as basis for user-centered design in industry
L. Sørensen	England vs. Norway: HF across the North Sea

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 samlet oversikt over HFC møtet den 9.-10.mai i Olso med presentasjoner, relevante fagartikler (”papers”), oppsummering av evaluering fra deltakerne og liste over alle deltakere.

I det nedenstående har vi oppsummert fra de skriftlige evalueringene som deltakerne leverte inn.

1.2 Evalueringer

Valg av tematikk og foredragsholdere ble positivt mottatt, og balansen mellom diskusjon og presentasjoner synes å være bra. Seminaret ble vurdert til å være meget godt organisert.

De fleste forelesningene, paneldiskusjonen og muligheten for å diskutere i et fagnettverk ble trukket frem positivt. Det virker som om formen på møtene, dvs over to dager med hyppige pauser mellom forelesningene, fungerer bra. Studentene satte stor pris på å kunne delta. Foreleserne kom fra Europa, og det var forslag om at en kunne ha forsøkt å trukket inn andre regioner utenfor Europa også. Vi fikk kommentarer på at noen presentasjoner burde ha vært gjennomført på norsk.

Paneldiskusjonen fikk gode tilbakemeldinger, den kunne kanskje ha vart lengere.

Forumet er bredt med mange forskjellige deltakere, og utfordringen er å gi alle noe, både forskere, konsulenter og industrideltakere. Vi får derfor mange forskjellige innspill, men de er konstruktive og gode kommentarer som bidar til å påvirke møteform og møteinnhold.

1.3 Formen på HFC møtene

Tilbakemeldingene er generelt positive til formen på møtene. Det ble påpekt at det var viktig med tid til debatter, kanskje så korte innlegg som på 15 minutter og opphold mellom de forskjellige innleggene, slik at det blir tid til å utveksle erfaring med andre.

1.4 Samarbeid med HFN i Sverige

Det norske HFC forumet har et godt løpende samarbeid med human factors nettverket (HFN) i Sverige. Medlemmer fra HFN deltar aktivt på HFC møtene og de inviterer medlemmer i HFC til sine seminarer og møter. Aktuelle HFN samlinger i 2012 kan være:

- "Human Factors - metoder och tillämpningar ", i Lund, Sverige 10-11. september. Forelesere Clemens Weikert, Lunds universitet og Rogier Woltjer. For ytterligere informasjon se http://www.humanfactorsnetwork.se/indexcoursesWork.html.
- "HFN-CRM-seminarium", Linköpings universitet, Sverige 18-19. oktober. For ytterligere informasjon se http://www.humanfactorsnetwork.se

1.5 Tema og forelesere til de neste HFC møtene

Av tema som ble trukket frem som spesielt interessante til neste møte, kan nevnes:

- Mennesket som barriere og gjennomgang av Human Reliability Analysis (HRA). HRA kan bidra til å måle effekten av menneskelige faktorer på sikkerheten, og bør derfor diskuteres i HFC møter.
- Økt fokus på storulykker og hvordan en skal trene på å avverge/redusere storulykker – dvs. emergency preparedness.
- Utforming av interaksjon mellom menneske og maskin – Human Machine Interface (HMI). Spesielt fokus på utforming av informasjonssystemer og utforming av alarmer. (Kunne ha dratt til Sverige?).
- Ønsker mer om Human Factors (HF) i et kontrollrom. Hva bør en tenke på angående HF når man designer kontrollrom og styre/kontroll-systemer? Mye av forelesningene i det siste møtet handlet om HF i en organisasjon, og det er av og til ikke så relevant. Ønsker praktisk orienterte råd om hvordan vi skal gå frem.
- Ledelse og styring (etterlevelse av regelregime) – diskusjoner av flere dilemma knyttet til sikkerhet.
- Hvordan ulike disipliner tilnærmer seg oppgaven å designe for sikkerhetskritiske miljø, f.eks. disiplinene: Human factors, ingeniører og industridesignere.
- Trøtthet, uoppmerksomhet – "fatigue".
- Tema som går på tvers av teknologi og organisasjon – det blir ofte enten et rent teknisk perspektiv eller et psykologisk perspektiv.
- Human Factors i styring av sikkerhetsbarrierer – hva er en barriere egentlig? Kan mennesket være en barriere. Begrepsavklaring og konseptavklaring knyttet til barrierestyring.
- La SIEMENS arrangere møtet (slik som ABB gjorde), enten på våren eller høsten 2012.

Av nye forelesere ble følgende ønsket til neste møtet. (Listen inneholder navn som har vært trukket frem tidligere uten at de har fått plass):

- En operatør, eksempelvis en plattformsjef som presenterer sin hverdag.
- Fra Telenor eller DNV f.eks Nalini Suparamaniam-Kallerdahl fra DNV.
- Presentasjoner fra andre industrier
- E. Hollnagel, R. Woods, J. Reason, C. Weick, K. Haukelid, Cato Bjørkli, Frode Heldal eller Stig O. Johnsen (resultater fra PhD avhandling).
- Gary Klein, Gorry, (Decision Making)
- Ron Westrum - Two faces of resilience - requisite imagination & the human .issues.
- J.Frohm eller K.Gould (f.eks. automasjon eller lean production).
- R.Boring (igjen) – om HRA.
- M.Endsley (Situational awareness).
- G.R. Hockey fra Univ of Leeds, Mark Young.
- Fra miljøer som: Fraunhofer FKIE (Tyskland) eller MIT User Interface Design Group (USA).
- Interessant å utvide HF mot community of practice og praksisfellesskap som J.S.Brown, P.Duguide - eks. hvordan mobiliserer man et praksisfellesskap?

1.6 Kurs og forelesninger innen human factors

Ved UiS har de et kurstilbud innen MTO (Menneske, Teknologi, Organisasjon), se http://www.uis.no/kurs/evu/risikostyring_og_samfunnssikkerhet/mto-human-factors-videreutdanning-i-menneske-teknologi-organisasjon-article35526-6791.html

Ved NTNU arrangeres et innføringskurs innen human factors i vårsemesteret, se: videre.ntnu.no/link/nv12296

1.7 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: *www.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. Se *www.hfes.org*.

Refleksjoner knyttet til dårlig utforming (poor human factors) se *www.baddesigns.com*

The Energy Institute, har en human factors web-side med mye materiale av interesse – se www.energyinst.org/technical/human-and-organisational-factors
Der ligger det mange rapporter, retningslinjer, nyheter og diskusjonsforum som kan være av interesse. For de som er opptatt av sikkerhetskultur, se innslag om metoden "Hearts and mind" som brukes av Shell: www.eimicrosites.org/heartsandminds/

På www.uie.com ligger det mye informasjon om utforming av brukergrensesnitt (UIE – User Interface Engineering).

1.8 Noen bilder fra HFC møtet

Vedlagt følger noen bilder fra møtet, åpning av konferansen av Arne Jarl Ringstad, foredrag av Patric Hudson, Gunnar Lamvik og Rob Miles

2 Agenda og deltakerliste

2.1 Agenda for HFC møtet

Vedlagt ligger agenda for HFC møtet.

9. mai	Innlegg og diskusjon	Ansvar
11:00-12:00	Lunsj i 34.etg	SAS
12:00-12:30	Velkommen	HFC
12:30-13:15	Identifying the roles of individuals, organizations, company culture and regulators in accident prevention	P. Hudson/TU Delft
13:15-13:45	Diskusjon/Pause	
13:45-14:15	Forholdet mellom kulturforskjeller, arbeidspraksis og sikkerhet. Eksempler fra offshore- og sjøfartsindustrien.	G. Lamvik/Sintef
14:15-14:45	Perspectives on safety: The impact of group membership, work factors and trust on safety performance in UK and Norway	J. Tharaldsen /Ptil
14:45-15:30	Diskusjon/Pause	
15:30-16:00	Human and organisational factors - what can be learned from international shipping	T. Soma/Propel
16:00-16:15	Diskusjon/Pause	
16:15-17:00	HF across borders – Challenges to face - panel discussion (Chaired by M. Green)	Panel: P. Hudson, R. Miles, J. Tharaldsen og N. Suparamaniam-Kallerdahl.
18:30	Buss til middagen	
19:00	Middag på Ekebergrestauranten	

10. mai	Innlegg og diskusjon	Ansvar
08:30-09:00	Kaffe og noe å bite i	
09:00-09:45	Managing risk – international lessons from the loss of the Deepwater Horizon platform	R. Miles/HSE-UK
09:45-10:00	Diskusjon/Pause	
10:00-10:30	Cross-cultural communication at an offshore service vessel	T. Sydnes/HSH
10:30-10:45	Diskusjon/Pause	
10:45-11:15	Quick and dirty ethnography as basis for user-centered design in industry	T.G. Graven/ABB
11:15-11:30	Diskusjon/Pause	
11:30-12:00	England vs. Norway: HF across the North Sea	L. Sørensen/Scandpower
12:00-12:30	Avsluttning, oppsummering og evaluering	
12:30-13:30	Lunsj i 2.etg, Gaio/Lakata	

2.2 Påmeldte og deltakere

Nedenstående tabell lister opp påmeldte og deltakere i HFC møtet.

#	Etternavn	Fornavn	Bedrift	E-post
1	Graven	Tone Grete	ABB	tone-grete.graven@no.abb.com
2	Nolkrantz	Kasper	ABB Norway/Chalmers	nolkrant@student.chalmers.se
3	Piroux,	Grégoire	ABB Norway/Chalmers	gregoire.piroux@gmail.com
4	Husøy	Kristoffer	ABB	kristoffer.husoy@no.abb.com
5	Sætre	Tor Inge	Adept Solutions	toringe@adeptsolutions.co
6	Kristiansen	Helge	Arkitektur- og designhøgskolen	hkr@hials.no
7	Lurås	Sigrun	Arkitektur- og designhøgskolen	sigrun.luras@aho.no
8	Heber	Hilde	BG Norge	hilde.heber@bg-group.com
9	Fernander	Marius	Det Norske Veritas	marius.fernander@dnv.com
10	Hellesøy	Bjørn Tore	Det Norske Veritas	bjorn.tore.hellesoy@dnv.com
11	Keränen	Saara	Det Norske Veritas	saara.keraenen@dnv.se
12	Knutsen	Mona	Det Norske Veritas	mona.knutsen@dnv.com
13	Suparamaniam-Kallerdahl	Nalini	Det Norske Veritas	nalini.suparamaniam-kallerdahl.dnv.com
14	van de Merwe	Koen	Det Norske Veritas	koen.van.de.merwe@dnv.com
15	Nolén	Sixten	HFN	sixten.nolen@transportstyrelsen.se
16	Miles	Rob	HSE-UK	rob.miles@hse.gsi.gov.uk
17	Green	Marie	Human Centered Design	marie.green@hcd.no
18	Green	Mark	Human Centered Design	mark.green@hcd.no
19	Augensen	Håkon	Human Factors Solutions AS	hakon@hfs.no
20	Tillman	Barry	Human Factors Solutions AS	barry@hfs.no
21	Aaen-Stockdale	Craig	Høgskolen i Buskerud	signaldetection@yahoo.co.uk
22	Ferkingstad	John	Høgskolen Stord/Haugesund	john.ferkingstad@hsh.no
23	Sydnes	Tone	Høgskolen Stord/Haugesund	tone.sydnes@hsh.no
24	Bisio	Rossella	Institutt for energiteknikk	rossella.bisio@hrp.no
25	Bye	Andreas	Institutt for energiteknikk	andreas.bye@hrp.no
26	Massaiu	Salvatore	Institutt for energiteknikk	salvatore.massiu@hrp.no
27	Andersen	Heidi	National Oilwell Varco	heidi.andersen@nov.com
28	Stangeland	Elin	National Oilwell Varco	elin.stangeland@nov.com
29	Hogenboom	Sandra	NTNU	hogenboom@stud.ntnu.no
30	Khan	Sana A.	NTNU	sanaahsa@stud.ntnu.no
31	Lu	Yunjie	NTNU	yunjie@alumni.ntnu.no
32	Dahle	Irene B.	Petroleumstilsynet	ireneb.dahle@ptil.no
33	Lootz	Elisabeth	Petroleumstilsynet	elisabeth.lootz@ptil.no
34	Tharaldsen	Jorunn Elise	Petroleumstilsynet	jet@ptil.no
35	Soma	Torkel	Propel	torkel.soma@propel.no
36	Halvorsen	Hugo	Samarbeid for sikkerhet. SfS	hh@samarbeidforsikkerhet.no
37	Giskegjerde	Georg	Scandpower AS	ggi@scandpower.com
38	Sørensen	Linda	Scandpower AS	lso@scandpower.com
39	van Nes	Fenna	Scandpower AS	fvn@scandpower.com
40	Larsen	Reidun	Shell	reidun.larsen@shell.com
41	Stensvåg Eriksen	Solveig	Siemens	solveig.eriksen@siemens.com
42	Gundersen	Pål	Siemens	pgundersen@siemens.com
43	Lamvik	Gunnar	Sintef	gunnar.lamvik@sintef.no
44	Wærø	Irene	Sintef	irene.waro@sintef.no
45	Fröde	Anna Karin	Statoil ASA	annaf@statoil.com
46	Gould	Kristian	Statoil ASA	kgou@statoil.com

47	Ludvigsen	Jan Tore	Statoil ASA	jtl@statoil.com
48	Moltu	Berit	Statoil ASA	bmol@statoil.com
49	Ramberg Lilleby	Jasmine	Statoil ASA	jaslil@statoil.com
50	Ringstad	Arne Jarl	Statoil ASA	ajri@statoil.com
51	Hudson	Patrick	TU Delft	HUDSON@FSW.leideuniv.nl
52	Haukelid	Knut	Universitetet i Oslo	knut.haukelid@tik.uio.no
53	Alm	Helen	Vattenfall Research & Development	helen.alm@vattenfall.com

HFC

Identifying the roles of individuals, organizations, company culture and regulators in accident prevention.

Patrick Hudson, Delft University of Technology, Leiden University,
The Netherlands

Mere informasjon: (Papers 2010 -2007)

1. **Hudson, P.T.W.** (2010) Integrating Organizational Culture into Incident Analyses. Extending the Bowtie model. *Proceedings Working on Safety Conference 2010, Roros, Norway.*
2. **Hudson, P.T.W.** & Hudson, T.G.L. (2010) Moving from investigating to analyzing incidents: Supporting organizational learning. *Proceedings Working on Safety Conference 2010, Roros, Norway.*
3. **Hudson, P.T.W.** (2010) Rethinking Safety: It's not rocket science, it's much harder. The 1st Eric Wigglesworth Memorial Lecture. Melbourne, April 17th. Safety Institute of Australia, Melbourne, Australia. [CD-ROM]
4. **Hudson, P.T.W.** (2010) Integrating Organizational Culture into Incident Analyses. Extending the Bowtie model. *Proceedings of the 10th SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. Richardson, TX: Society of Petroleum Engineers. pp 12 [CD-ROM]
5. **Hudson, P.T.W.** & Hudson, T.G.L. (2010) Moving from investigating to analyzing incidents: Supporting organizational learning. *Proceedings of the 10th SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. Richardson, TX: Society of Petroleum Engineers. pp 12 [CD-ROM]
6. Van Beuzekom, M., Boer, F., Akerboom, S.P. & **Hudson, P.T.W.** (2010) Patient Safety: Latent Risk Factors. *British Journal of Anaesthesia,* **105**, 52-59.
7. **Hudson, P.T.W.** (2009) Process indicators: Managing safety by the numbers. *Safety Science*, **47**, 483-485.
8. **Hudson, P.T.W.** (2008) Safety reporting in aviation: Safety management and safety culture in interaction. *Journal of Aviation Management.* **9**, 27-48.
9. **Hudson. P.T.W.** & Hudson, T.G.L. (2008). Shell Group Fatal Accident Review 2002-2006 (Confidential).
10. **Hudson, P.T.W.,** Vuijk, M., Bryden, R., Biela, D. & Cowley, C. (2008) Meeting Expectations: A new model for a just and fair culture. *Proceedings of the 9th SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*. Richardson, TX: Society of Petroleum Engineers. pp 12 [CD-ROM]
11. **Hudson, P.T.W.** (2007) Implementing a safety culture in a major multi-national. *Safety Science*, **45**, 697-722.
12. **Hudson, P.T.W.** (2007) Winning Hearts and Minds. In Proceedings Safety in Action Conference, March 2007, Melbourne, Australia. pp 17. [CD ROM]

Identifying the roles of individuals, organizations, company culture and regulators in accident prevention

Patrick Hudson
Delft University of Technology
Leiden University
The Netherlands

Structure

- Organisational and cultural factors in incident causation
- The Bow Tie model and methodology
- Individual accountability
- Criticality and common mode failure
- Conclusion

The Problem

- Analyses of a number of major process accidents have identified company culture as a source of problems
  - Texas City, BP
  - Longford, Exxon-Mobil
  - Belle, DuPont
- In many cases the regulators have also been found wanting

Problem 2

- Personal safety performance has improved significantly in many major hazard industries
- Process safety performance, major accidents, have not improved nearly as much
- We appear to be missing several orders of magnitude in the risk assessments

Texas City

- A major landmark in the identification of cultural factors
- How do we integrate cultural and organisational factors into risk analyses?

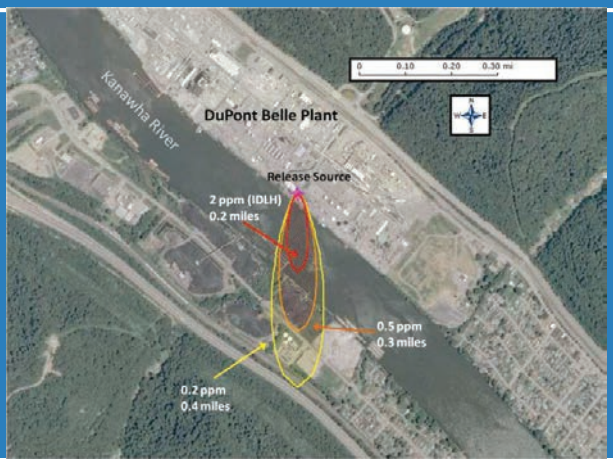
BP Deepwater Horizon

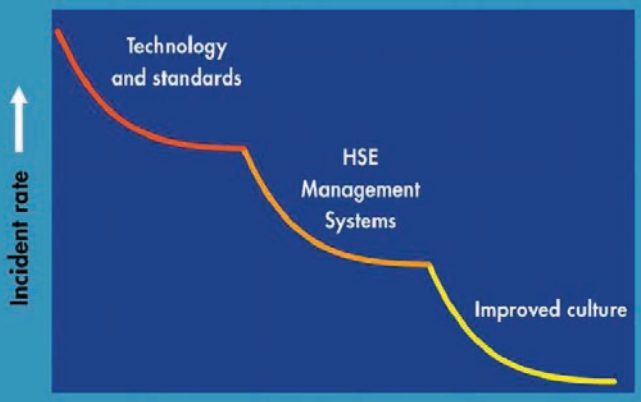
Belle West Virginia

- DuPont plant with 3 releases
  - Methyl Chloride
  - Oleum
  - Phosgene (1 fatality)
- Similarities to the later explosion at DuPont's Buffalo plant
  - Welding on tank with Vinyl Fluoride (1 fatality)
- CSB worries about a "shift" in the culture.

DuPont Buffalo

DuPont Belle

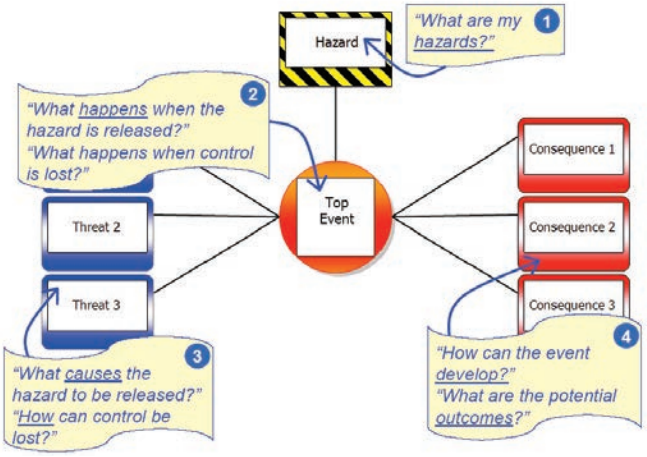


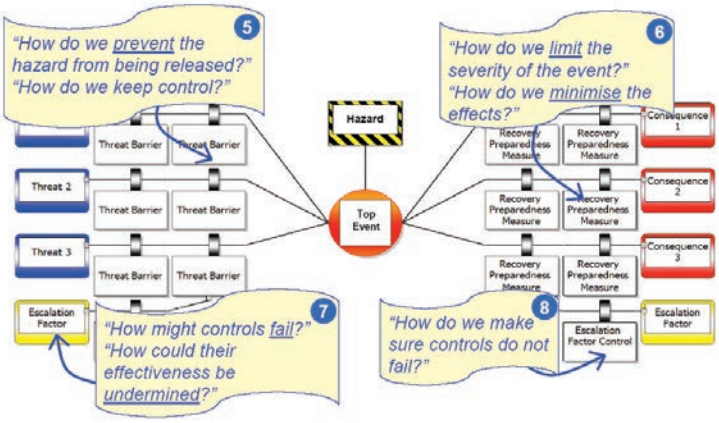


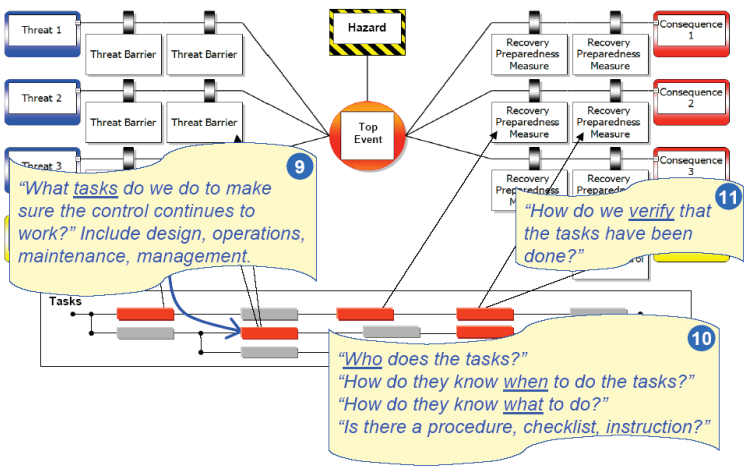
16 BUILDING BOW-TIES AND TASKS – SUMMARY

Follow steps 1 to 12 below to carry out a complete bow-tie analysis.

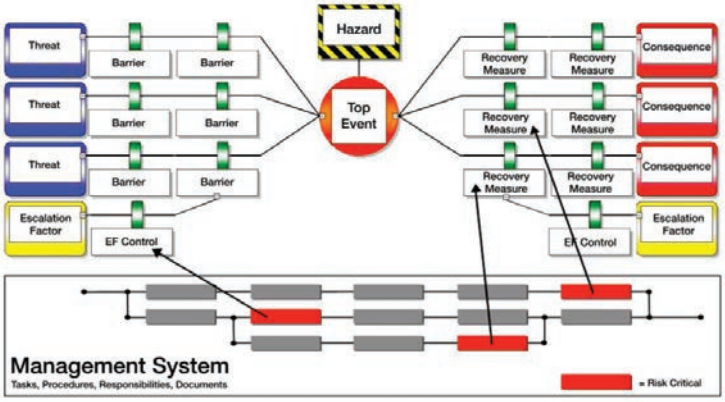
Source: Bow Tie XP Training Manual

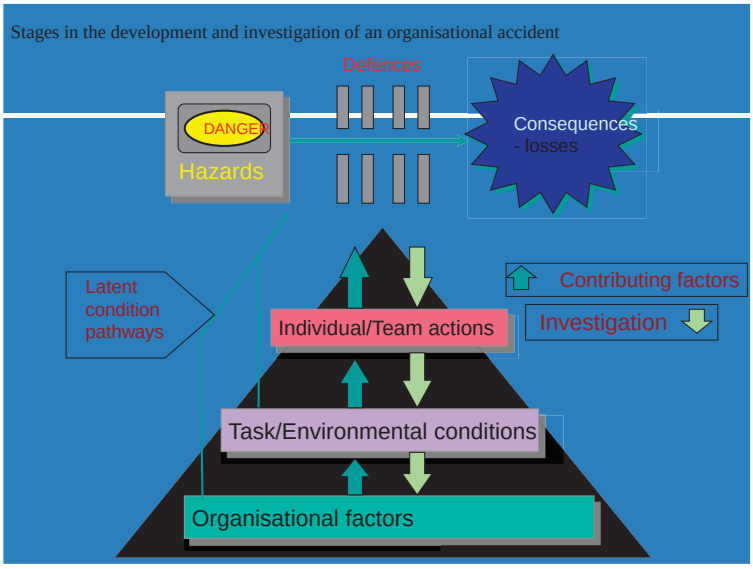






The Bow Tie





Cleaning up the Bow Tie

- There is confusion about barriers and escalating factors
- The barriers are slices of Swiss Cheese, always liable to have holes
- Organisational factors (training, procedures) seen as barriers between threats and the top event
- Culture is important but hard to place

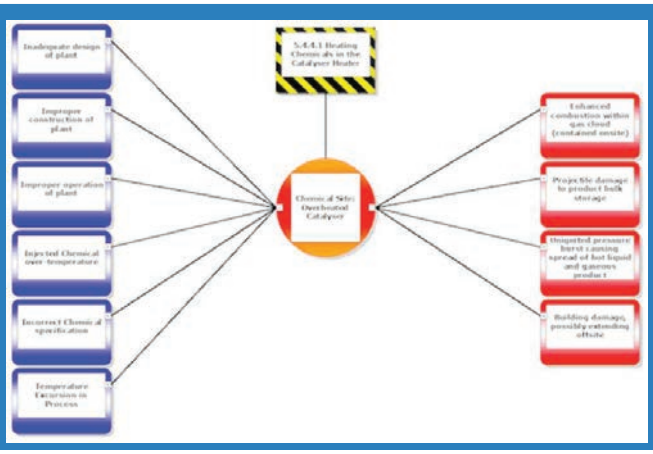
Proposal

- There are a number of levels that can be distinguished, with increasing escalation factors acting to put holes in barriers

Level 0

- Level 0 is the basic representation of threats, top event and consequences
  - The Risk environment
- We identify the possible threats and consequences
  - Both threats and consequences can have probabilities, unlike the risk assessment matrix
- No barriers yet
  - These are how we control the risks

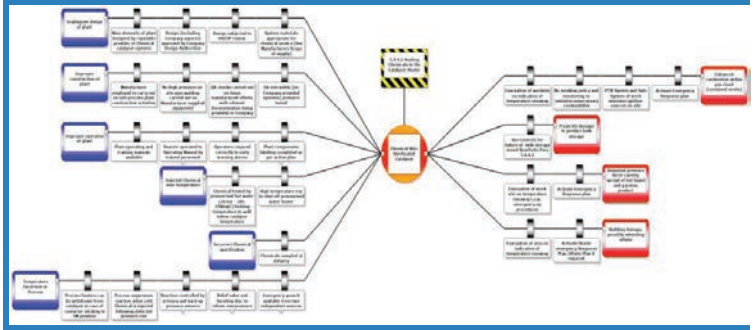
Level 0 – L_0



Level 1

- Level 1 adds the barriers and controls on the threats and before consequences
- L_1 barriers are *only* those that apply to prevent progress *at the time of the event*
- At L_1 operator error is a correct description of an incident (but …)

Level 1 – L_1



L_1 threats

- Production pressure
- Time pressure
- Weather
- Variability
- Specific local problems

- Problems that have to be resolved by front-line personnel

Constraints on L_1

- At Level 1 training and procedures are *not* barriers
- The barriers at this level are specific to the individuals at the time
  - what training delivers (a specific skill or knowledge) to prevent or minimise a problem
  - a specific procedure that should be followed
  - A design that controls a threat, provides information about problems etc

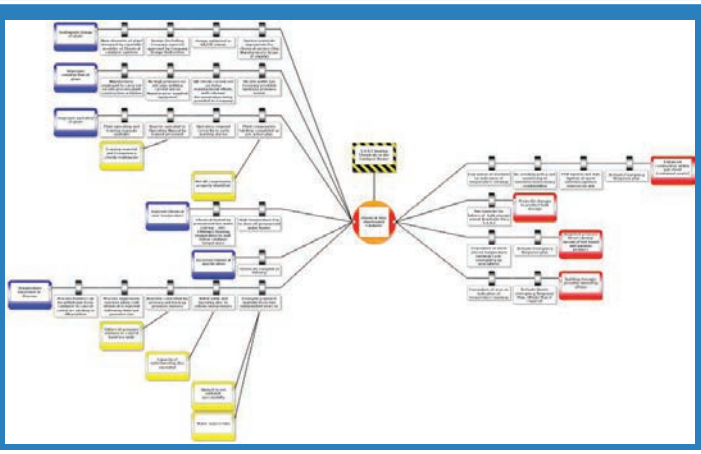
Level 2 – L_2

- Level 2 adds escalation factors and their associated defences
- These escalation factors are actually threats on the L_1 barriers
  - These are what put holes in the cheese
- L_2 escalation factor controls are organisational controls
  - Training programs, up-to-date procedures, human factored design

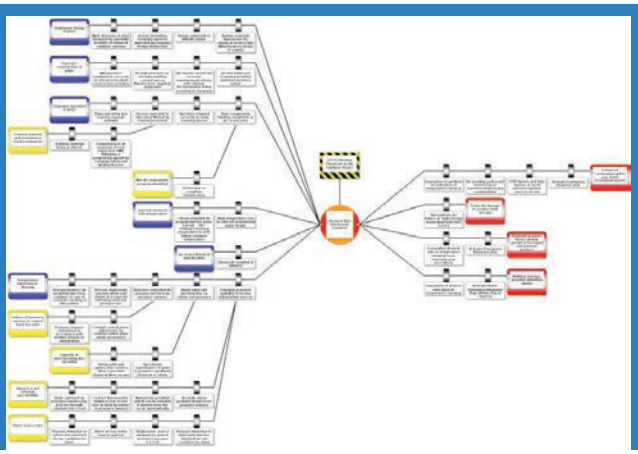
L_2 threats

- Poor design
- Inadequate procedures
- Procedures not being used
- Incompatible goals
- Poor communication within company
- Lack of appropriate training
- Inappropriate maintenance regime
  - The set of Basic Risk Factors (GFTs)

Level 2 – L_2



A full L_2 analysis



L_2 barriers

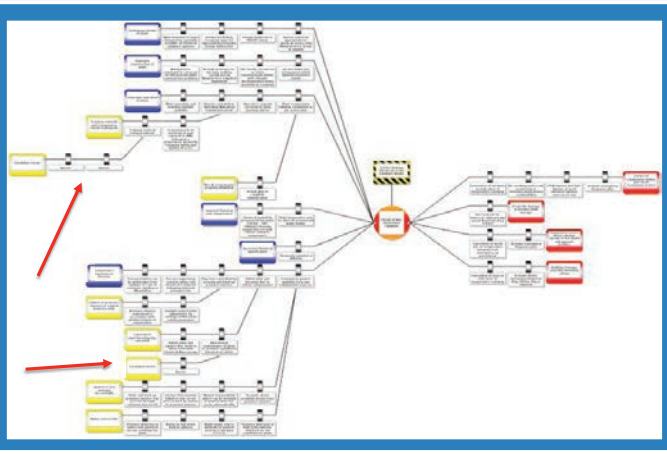
- Provision of training
- Correct procedures
- Planning
- Protocols for communications
- Journey management

- SMS activities performed by management

Why do L_2 barriers fail?

- There are threats on L2 barriers that make them fail
  - Maintenance delayed
  - No critical revision of procedures
  - Culture of non-compliance
  - HSE not No. 1 in organisational priorities
- This is the level at which cultural and regulatory factors operate
  - These make people do what they would rather not do

Level 3 – L_3



Threats and barriers

- This analysis shows that threats target a loss of control at all levels
- L_1 threats are managed by front-line operators
  - Pilots, drillers, drivers, maintenance engineers
- L_2 threats are managed by supervisors and line managers
  - They create the conditions under which people work

Level 3

- L_3 threats are managed by senior management and regulators
  - These threats put holes in the organisational support for L_2 barriers
- This is the organisational culture set by senior management
  - What we accept as normal 'round here'
- Regulators (or Head Office) can 'require'/force organisations to do the right things anyway

Accountability

- Each barrier at L_1 and L_2 is controlled by an identifiable individual
- These individuals can be defined as accountable
- At L_3 we can identify senior management in general as responsible for the organisational culture (plus regulatory responsibility)

Criticality

- Barriers that control more than one threat are critical
  - Criticality = n/N

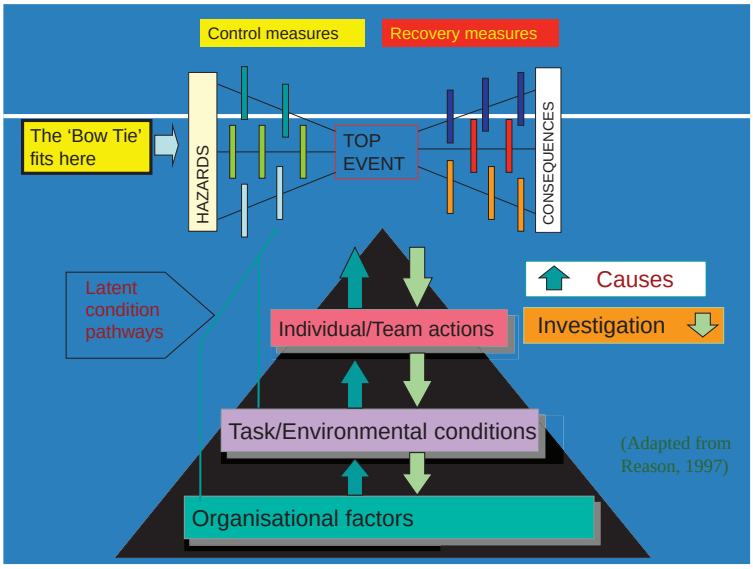
    n threats with barrier ÷ total N of threats
- High criticality barriers may provide control over novel/unidentified threats
- Criticality can be generalised to more than one top event

Common Mode Failure

- Barriers are assumed to be independent for maximum protection
  - p(fail) 1&2 = $p(fail)_1$. $p(fail)_2$
- Common mode failure occurs when a common factor impacts on more than one barrier on a threat
  - p(fail) 1&2 = Min($p(fail)_1$, $p(fail)_{2)}$
- If 2 barriers share 1 or more barriers on their escalation factors, there is a common mode

Causes of common modes

- Higher level escalation factors propagate to lower level barriers
- Single high level failure impacts multiple lower level barriers
- Not all of these failures appear to be related at first sight
  - So we assume independence
  - This can explain the missing orders of magnitude



Conclusion

- The bow tie can be defined rigorously to include individual, managerial and cultural factors at distinct levels
- Well constructed bow ties can also support audit and incident investigation and analysis as well as proactive risk management

HFC

Cultural variation, work practice and safety
- Illustrations from offshore and shipping industry
-

Gunnar M. Lamvik, SINTEF Technology and society

Mere informasjon:

Gunnar M. Lamvik, Rolf J. Bye & Hans Y. Torvatn. Safety Management and "Paperwork" – Offshore Managers, Reporting Practice, and HSE. Ninth International Probabilistic Safety Assessment and Management conference (PSAM 09), May 2008 Hong Kong, China

G.M. Lamvik, A.M. Wahl, M. Pettersen Buvik "Professional culture, work practice and reliable operations in shipping" In ESREL 2010 Reliability, Risk and Safety: Theory and Applications - Bris, Guedes Soares & Martore/1 (eds) © 2010 Taylor & Francis Group, London, ISBN 978-0-415-55509

Gunnar M. Lamvik "The Filipino Seafarer: A Life Between Sacrifice and Shopping", Anthropology in Action, 19, 1 (2012): 22-31 doi:10.3167/aia.2012.190104

Lamvik, G. M.; Bye R.: "Professional culture and risk perception: Coping with danger on board small fishing boats and offshore service vessels." Journal Reliability Engineering and System Safety (2007)

Bye, RJ.; Røyrvik, J; Lamvik G.M. "The significance of regulatory framework on safety climate" In ESREL 2011- Advances in Safety, Reliability and Risk Management, CRC Press (2012), ISBN 9780415683791

This presentation

- How national culture influence the work practice
  - In the sense that some seem to work in a relatively safer way than others – Southeast Asia vs. North Sea
  - Examples from the offshore sector
- How professional culture characterize a work practice
  - In the sense that deviation seems to coincide with a common work practice in an on board shipping organization – preferred vs. actual work practice
  - Illustrations from the shipping industry

Cultural variation, work practice and safety

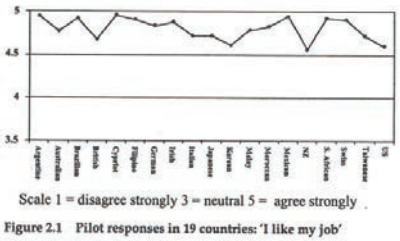
- Surprisingly scarce data and literature on this field
  - Despite phenomena as migration and globalization
- Hofstede and Trompenaars etc.
  - *Culture at work in Aviation and Medicine*, Helmreich and Merritt (1998)
  - Aviation - 1993-97, 15 000 pilots, 36 airlines and 23 countries
- To compare safety performance between South East Asia and the North sea, is of course a huge challenge
  - and led to a lot of interesting noise in the Norwegian oil and gas community!
  - Apples and pears – extremely difficult task (no statistics to rely on)

Cultural variation, work practice and safety – some definitions

- Safety
  - Health Environment *Safety*
  - Lost time incidents
- Work practice
  - The way that work is usually structured and organized in a particular company or organization
  - Any informal practice or custom which governs or influences the way employees behave at work

A useful split of the culture concept – national and professional

- National culture
  - In Anthropology the term hardly exist
  - To link culture to territory in one thing, but to give culture a political association is a challenge (culture and national state)
- Professional culture
  - Shared norms and values in a profession
  - Basic or taken-for-granted beliefs and assumptions, and proper or highly appreciated actions, shared within a group of professionals
- Can be a much stronger bond than both national and organization identity
- Professional culture in Aviation (in Helmreich & Merrit 1998)
  - 12 500 pilots in 19 countries



Scale 1 = disagree strongly 3 = neutral 5 = agree strongly

Figure 2.1 Pilot responses in 19 countries: 'I like my job'

Point of departure: Culture's influence on work practice


NO SMOKING

What do these different operations have in common?

- They take place in South East Asia
- Excellent HSE figures and performance
  - At least when it comes to personal injury
- Due to a long range of factors, such as:
  - Long contracts between the operator and the drilling contractor
  - Stable and experienced workforce - in the same position for years
  - Cultural background of the local employees – steady, slow and safe work pace
  - "Less paperwork" – that pave the way for……
- Strong presence and involvement in daily operations
  - Close supervision is expected from the local employees
  - The managers have enough time and space for management
- Hands-on supervision vs. "DSD-HB-4-004-D38"

Management and safe work practice

- That hands-on management will lead to a safe work practice
- That to guide, support, monitor and coordinate work performance will enhance and improve the individual safety awareness
- But this supposes that the manager:
  - is *able* to be out
  - knows what *to do*
  - knows what is going on
  - believes in it himself
  - has credibility
    - Need for a script
    - Walk-the-talk

Professional culture, work practice and deviation (1)

- Why do deviation occur?
- Why a gap between *preferred* and *actual* work practice?

- Deviation presupposes a correct or an ideal work practice
  - "A correct way, a wrong way and…."
- The correct or preferred work practice in shipping is defined by:
  - The land organization
    - Company policy and daily communication
  - The equipment manufacturers
    - Formal technical training

Professional culture, work practice and deviation (2)

- Lack of knowledge – perhaps the most obvious answer to the question about deviating practices
  - People act in accordance with the best of their (insufficient) knowledge
- Professional culture – perhaps not that obvious?
  - To act in a certain way may be incorrect – by definition - but it may also be reasonable and in accordance with the culture in the profession
- Preferred vs. actual work practice

Method

- Some interviews and observations onboard
- Quantitative survey among 112 Filipino officers
  - Positions covered in the survey: Master, Chief Mate, Chief Engineer, First Engineer, Second Engineer, Second Mate and Third Mate
- Topics covered in the survey:
  - Technical operations
  - Planned Maintenance System, Maintenance practice
  - Docking
  - Health and safety & Environmental issues
  - Work practice and experience transfer
  - Superintendent & Communication and management
  - Training
- Response rate (at least): 70%

Preferred vs. actual work practice

	Agree/ strongly agree
It is good operational practice to follow manuals and instructions given by the engine manufacturer on running of the:	
▫ main engine	100%
▫ auxiliary engine	100%
▫ cylinder lubrication oil	99%

It is good operational practice to follow routines and procedures established by my predecessor/colleagues regarding the operation/maintenance of the:	
▫ main engine	71%
▫ auxiliary engine	58%
▫ cylinder lubrication oil	51%

Professional culture

- Why do skilled Filipino officers, who know, in theory, the instructions for best practice, choose to solve their work tasks in a deviating manner?
- Professional culture:
  - Basic or taken-for-granted beliefs and assumptions, and proper or highly appreciated actions within a group of professionals
    - Subculture
    - Troubleshooting and improvisation

A shipping company – a series of subcultures

Life on board vs. on shore:

- A mutual lack of understanding
  - "they don't know our situation...."
  - different professions
  - different values and goals
- Give rise to subcultures
  - "us vs. them"
  - "they don't need to know of everything taking place on board"
  - "this place is different"

Subculture

	Agree/strongly agree
•There is too much attention from land organization on the consumption of cylinder lubrication oil	77%
• It's too much attention on documentation of the maintenance from the management ashore	78%
• The land organization pays too much attention towards our consumption of spare parts	76%
• Attention on environmental issues is too high	95%
• The superintendent pays too much attention on budget issues	80%

Troubleshooting and improvisation

- A highly appreciated behavior
  - personal initiative
  - masculinity
- A necessity
  - isolated from land based services
  - self contained with services on board
- Expected from the on shore organization
  - ”planners” vs. ”doers”
  - new tasks are (constantly) imposed on the staff on board

Improvisation and troubleshooting

Agree/strongly agree

- Ability to improvise is important for good operational practice ➢ 79%
- Our crew is good at quick fixing and improvisation ➢ 78%
- Maintenance should, as far as possible, be performed by own crew ➢ 73%

but…..

- The work pace is so intense that we have to “cut corners” to get the job done quickly enough ➢ 11%

Conclusion: Subculture + troubleshooting = a *potential* for deviance

- On one hand – ”we are different – us vs. them”
- On the other – ”we are used to and know how to handle everyday life on board”
- In sum:
  - “Silent deviation” – Tinnmannsvik 2008
  - “Practical drift” – Snook 2000
  - “Normalization to deviance” – Vaughan 1996
- The instructions, procedures and work practices are bit by bit adjusted or bended to be more in accordance to the professional culture in the occupation
- Deviance can be seen as the best, most efficient and proper way to handle the daily work on board, if we see it through the eyes and in the context of the seafarers themselves


Thank you!

HFC

Perspectives on safety: the impact of group membership on safety performance in UK and Norway

Jorunn Elise Tharaldsen, PhD Risk Management and Societal safety
Principal engineer (Work environment & Organisational Safety)
Petroleum Safety Authorities, Norway; jet@ptil.no

Mere informasjon:

Tharaldsen, J.E., Mearns, K.J., Knudsen, K., 2010. "*Perspectives on safety: the impact of group membership, work factors and trust on safety performance in UK and Norwegian drilling company employees*." Safety Science, 48, 1062-1072.

Tharaldsen, J.E., 2010. "*In Safety We Trust*". Safety, Risk and Trust in the Offshore Petroleum Industry. PhD dissertation. Available at: www.icrard.org/en/News1/Dissertation-Safety-Risk-and-Trust-in-the-Offshore-Petroleum-Industry/

The doctoral dissertation deals with the development of the safety level of Norwegian offshore activities during the period 2001 to 2005, and includes a study of employees on the Norwegian and UK shelves during 2007-2008.

Perspectives on safety: the impact of group membership on safety performance in UK and Norway

Human factors i et internasjonalt perspektiv
Meeting, Oslo, May 9th

Jorunn Elise Tharaldsen, PhD Risk Management and Societal safety
Principal engineer (Work environment & Organisational Safety)
Petroleum Safety Authorities, Norway
jet@ptil.no

Tharaldsen, J.E., Mearns, K.J., Knudsen, K., 2010. Perspectives on safety: the impact of group membership, work factors and trust on safety performance in UK and Norwegian drilling company employees. *Safety Science*, 48, 1062-1072.
Tharaldsen, J.E., 2010. "In Safety We Trust". Safety, Risk and Trust in the Offshore Petroleum Industry. PhD dissertation.

Background

- Funded by the Norwegian Research Council & Seawell (2007-2009)
- Research groups: IRIS, University of Stavanger and University of Aberdeen

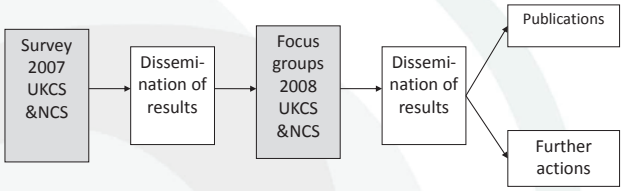
- **Research questions:**

1. Do safety climate perceptions and safety performance differ across shelves?
2. Are "nomadic" groups or employees that have more unpredictable shift rotations more exposed to accidents than others?
3. Is high trust and sound safety behavior enhancing good safety performance?
4. What are the boundary conditions under which too much trust may be harmful and distrust beneficiary?

Theoretical framework

- Organizational trust and distrust
- Trust in complex systems and High Reliability Organizations
- Safety culture, safety climate and safety performance
- The influence of culture on trust building and safety
- Distribution of risk

Combined method study



- Involves one offshore contractor company providing well services in platform drilling, engineering and well intervention on fixed installations on both Continental shelves
- The largest portion of employees is situated on the NCS
- Driller, drill floor, deck and technical teams
- Survey: N=791, UK=170 (3 platforms), No=621 (9 platforms). 67% response rate
- Focus groups: 30 participants – 15 in each country

Method – quantitative and qualitative

- Self-reported Safety Behavior:
  - Safety Compliance
  - Safety participation
- Trust dimensions:
  - Trust in Workmates
  - Trust in First Line Supervisor
- Globe dimensions:
  - Power Distance
  - Assertiveness
- Reporting & Intervention climate
- Safety performance measure: Involvement in incidents, near misses and being injured ('Yes' or 'No')

- Statistical techniques:
  - Confirmatory factor analysis (Lisrel)
  - Correlations
  - ANOVA
  - Five step logistic regression
- Focus group interviews:
  - Trust section – taped and transcribed
  - Written summaries
  - Comparative content analysis

Trust, distrust and safety

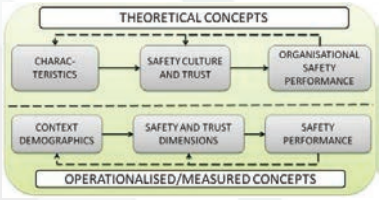
- Agreement among researchers on some aspects which trust involves:
  - Corner stone in the construction of social order
  - Reduces complexity
  - Reduces conflict
  - Involves vulnerability and risk
  - Expectations about others intentions and behaviour
  - Interdependence
  - Positive impact on various organisational aspects and safety
- BUT: Too high levels of trust or "blind trust" might lead to:
  - Overconfidence
  - Lack of initiative
  - Reduced flexibility
  - Lower ability to improvise
  - Lower alertness and responsibility
- Creative mistrust positive
- Highly complex systems need both trust and distrust
- Attack of the bipolar meaning of trust:
  - Trust positive and distrust negative
  - Does high trust - low risk

Hypotheses I & II

- ***H1 – Influence of cultural and group related factors:*** Both installation membership and Shelf will have an impact on Safety Performance. However, we anticipate that the effect of Shelf should mainly work indirectly, through installation membership, group identity, trust and self-reported safety behaviour
- ***H2 – Stability versus flexibility:*** Employees who are mostly or always working on the same installation and who have regular shift rotations will be less exposed to incident involvement than the nomadic ones and employees having unpredictable rotations

Hypotheses III & IV

- ***H3 – The influence of trust:*** Trust in workmates and (first line) supervisor commitment to safety will have a positive significant impact on safety performance
- ***H4 – Safety behaviour:*** Safety Compliance and Safety Participation will have a significant positive impact on safety performance



Results (1)

- A higher portion among UK employees report to have a nomadic work life: 43% on the UKCS work each tour on the same installation, against 69% on the NCS
- Different shift rotations: UKCS: 2+2, NCS: 2+4
- Most of the employees work fixed shift rotations – shift rotations vary for 13% (UKCS) and 11% (NCS). Norway 25% work 7days/ 7 nights (does not exist in the UK)
- Safety performance: significant differences across shelves and installations
- Reporting climate is generally high on both shelves, slightly (sig.) higher among No workers. No significant differences across installations
- Trust in workmates – slightly (not sig) higher among No respondents
- Trust in first line supervisor – reported sig higher among UK employees

Results (2)

- UK workers report sig higher safety compliance
- Safety participation is reported sig higher among No workers
- Power Distance: The tendency to question their boss when in disagreement is higher among the Norwegian workers and the social distance among superior and subordinate is found to be lower
- Assertiveness is rated as lower in the No than in the UK sample
- Differences across installations (ANOVA): Trust in supervisor commitment to safety, Safety compliance and Assertiveness

Results (3) correlations – UKCS above and NCS below

Dimensions	TCC	TSC	SC	SP	PD_1	PD_2	Ass
Trust in colleagues' commitment to saf	-	.518**	.450**	.397**	-.210**	-.037	-.110
Trust in supervisor's commitment to saf	.590**	-	.451**	.331**	-.323**	-.023	-.165*
Safety compliance	.372**	.436**	-	.125	-.160*	-.052	.104
Safety participation	.427**	.399**	.254**	-	-.282**	-.213**	-.054
PD1: Questioning boss when in disagreement	-.355**	-.313**	-.188**	-.237**	-	.175*	.221**
PD2: Soc distance - superior and subordinate	-.252**	-.295**	-.127**	-.200**	.347**	-	-.027
Assertiveness	-.305**	-.285**	-.142**	-.167**	.374**	.368**	-

[a] p≤0.001=***, p≤=0.01=**, p≤0.05*

- Weaker and some non-sig correlations on the UKCS. In NCS sample - all correlations are significant at a high level
- On the UKCS - Assertiveness is surprisingly positively related to Safety compliance

Results (4) Logistic regression

- Safety performance: Involvement in incidents
- First step: Shelf and installation membership
- Second step: Work area (discipline)
- Third step: Stability/flexibility (working mostly/always on the same installation or not) and shift rotation patterns
- Fourth step: Trust in colleagues commitment to safety and Trust in supervisor commitment to safety
- Fifth step: Safety compliance and Safety participation
- The total model explains 14,9% of employees' exposure to involvement in incidents

Results (5) Logistic regression

- The impact of **shelf membership** becomes gradually moderated by the introduction of work area, nomadic or stable position, rotation patterns and trust; finally Shelf membership loses its significance with the integration of Safety compliance and Safety participation dimensions
- Only two out of twelve installations are found to have significantly lower exposure than the others in the final model (NB: low number of respondents on some installations)
- Work area matters significantly – driller team show higher exposure to involvement in incidents compared to the other work teams
- Employees with more unstable shift rotations and "nomads" show surprisingly lower exposure
- Trust in workmates seems to make a "buffer" against exposure to incidents, the impact of Trust in supervisor commitment to safety is non-sig
- Safety behaviour scales: Only high safety compliance lowers employee exposure to incident involvement significantly

Results (6) Hypotheses

Hypothesis I is accepted: the effect of shelf on safety performance works indirectly, through installation membership, group characteristics, trust and self-reported safety behaviour

Hypotheses II has to be partly rejected. Stable or flexible work conditions matters for exposure to incidents, but in the opposite direction than expected

Hypothesis III is partly accepted, with trust in workmates showing a positive impact on safety performance, but a non-significant influence in supervisor trust

Hypothesis IV is also partly accepted, with safety compliance decreasing employee exposure to incident involvement significantly.

Qualitative results (1) Power distance, Assertiveness and Safety compliance

UK sample:

- *There used to be no trust in leaders and no cooperation. This has changed due to leader training and a great focus on values. Now we respect each other and that has increased mutual trust*.
- *There is no more bullying culture. Well, it is different from platform to platform. There is still shouting and screaming on Platform X*.
- *In Norway the leaders are easier going, and equal to workers. Here in UK we look more up to leaders. There is not such a gap in Norway*.

Norwegian sample:

- *They still follow the rules more in UK, and that is good in some situations*.
- *Maybe the Norwegians question their boss too much. They don't always do as they are told. It can go too far the other way in Norway. (…) In Norway they get sceptical when they are told. This is different from UK*.
- *Maybe UK leaders are more authoritarian, and this creates `hierarchy efficiency`. They* (the workers) *do as they are told and follow the rules and the procedures better than we do.*
- *There are different ways of talking to people. Sometimes I use: "We should do this." But when I say: "You have to!" They look at you, strange. Here the leader is one of the boys. It can be too much the other way, too. Sometimes they must just take an order. It is good and bad to be one of the boys.*

Qualitative results (2) Trust, distrust and safety

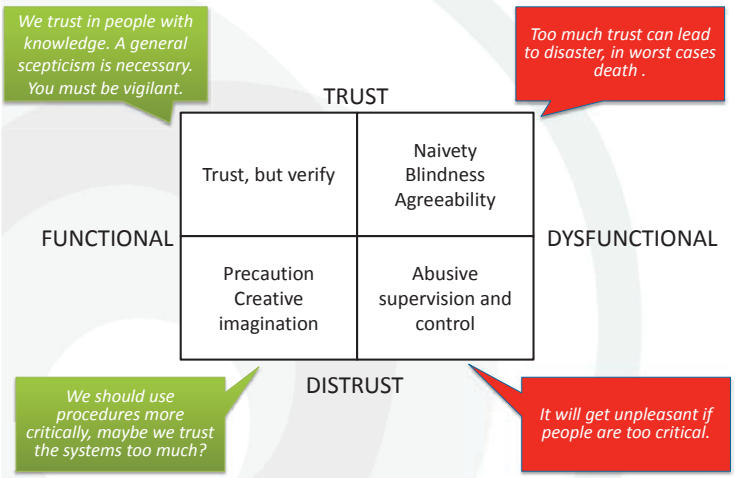
UK sample:

- *If there is too much trust, people are not doing what they are supposed to. Then they are taking a chance, a risk. It is abdication of responsibility.*
- *A downside to trust is to expect, make assumptions that it will work.*
- *If you have too much trust you can lean back too much and accidents will happen.*
- *The managers tell us that accidents are avoidable theoretically, but it is not possible to be mentally alert at all times, not even Tiger Woods is. You can not expect somebody to be alert for 12 hours, and to get everything right day after day. Everybody make mistakes. That is human. That is why it is important to check.*
- *I trusted someone too much once, and it caused an accident because I didn't check. I was taking over for someone, and all I had to do was to press that button. I didn't check. I trusted him. It caused basically a spill. I always did check myself, but for some reason I just trusted him on that occasion.*

Norwegian sample:

- *Too much trust can lead to disaster, in worst cases death*.
- *The downside to trust is if you admire someone. Then you can lean back too much, you are not alert.*
- *If you trust experienced people too much, you don't question. You think he knows what he is doing and you don't pay attention.*
- *You should always have a proactive attitude.*
- *It is important to ask critical questions.*
- *There must be some distrust, we must check, and double-check.*
- *A general scepticism is necessary. You must be vigilant.*
- *We should use procedures more critically, like the "SJA"* (Safe Job Analysis). *We have a tendency to trust the systems too much, or when we have performed a SJA we tend not to question this.*

Functional and dysfunctional aspects of trust and distrust



Some problems to be considered

- Why do employees with flexible work demands show less exposure to incident involvement?
- From the focus groups: Nomads (contractors) experience a high degree of (often tiring) control from client companies – may this explain something?
- May a nomadic, contractor position enhance both personal and organizational alertness?
- May shifting work demands lead to workers becoming more flexible and "careful navigators"?
- When may such shifting conditions become dysfunctional – increasing the risk level?
- May colleague trust be especially important for nomadic workers?

- Performing approximately the same tasks across shelves, but higher degree of automation on Norwegian platforms
- An overall higher fatal accident rate on the UK shelf than on the NCS
- Different national regulations of payment during sick leave

Thank you for your attention

Mean scores and test of differences on Trust, Safety behaviour, Power distance items and Assertiveness across shelves

Shelf	UKCS			NCS		
Descriptives	N	Mean	StD	N	Mean	StD
Trust in colleague commitment to safety	169	4,28	0.67	603	4,24	0.61
Trust in supervisor commitment to safety**	165	4,36	0.75	604	4,18	0.74
Safety compliance***	170	4,73	0.55	611	4,39	0.65
Safety participation**	170	4,08	0.87	611	4,30	0.64
Company climate of questioning or obeying boss**	179	3,09	1.91	616	2,62	1.71
Social distance between superior and subordinate***	167	3,82	1,40	611	3,35	1.41
Assertiveness (Aggressiveness and Dominance)***	170	4,12	0.72	618	3,55	0.81

[a] p≤0.001=***, p≤=0.01=**, p≤0.05*

e istic re ressi it v ve e t i ici e ts s epe e t v ri e[a]

	Model 1[b]			Model 2[b]			Model 3[b]			Model 4[b]			Model 5[b]		
	ariable		C (95)	ariable		C (95)	ariable		C (95)	ariable		C (95)	ariable		C (95)
	Constant	0,91		Constant	1,2		Constant	2,5		Constant	15,3		Constant	23,3	
S elf[c]	CS	0,20***	0,1 – 0,5	CS	0,3**	0,1 – 0,7	CS	0,3*	0,1 – 0,8	CS	0,4*	0,1 – 0,9	CS	0,5	0,2 – 1,2
nstallation[d]	nst1	0,8	0,4 – 1,5	nst1	1,1	0,6 – 2,0	nst1	0,7	0,3 – 1,4	nst1	0,7	0,4 – 1,4	nst1	0,7	0,3 – 1,4
	nst2	0,6	0,3 – 1,1	nst2	0,8	0,4 – 1,4	nst2	0,5*	0,2 0,9	nst2	0,5*	0,2 – 1,0	nst2	0,5*	0,2 – 1,0
	nst3	0,7	0,4 – 1,4	nst3	0,9	0,5 – 1,7	nst3	0,6	0,3 – 1,1	nst3	0,6	0,3 – 1,1	nst3	0,6	0,3 – 1,1
	nst4	0,7	0,4 – 1,3	nst4	0,9	0,5 – 1,6	nst4	0,5	0,3 – 1,1	nst4	0,6	0,3 – 1,2	nst4	0,7	0,3 – 1,4
	nst5	0,5	0,2 – 1,5	nst5	0,7	0,2 – 2,0	nst5	0,6	0,2 – 1,8	nst5	0,6	0,2 – 1,7	nst5	0,5	0,2 – 1,6
	nst6	0,3**	0,2 – 0,7	nst6	0,5	0,2 – 1,1	nst6	0,4*	0,2 – 0,9	nst6	0,4	0,2 – 1,0	nst6	0,4	0,2 – 1,1
	nst7	0,4	0,2 – 1,0	nst7	0,6	0,2 – 1,6	nst7	0,4	0,2 – 1,1	nst7	0,4	0,2 – 1,2	nst7	0,4	0,1 – 1,1
	nst8	0,3**	0,1 – 0,7	nst8	0,4*	0,2 – 1,0	nst8	0,3**	0,1 – 0,6	nst8	0,3**	0,1 – 0,7	nst8	0,3**	0,1 – 0,7
	nst9	2,1	0,7 – 6,2	nst9	1,7	0,6 – 5,1	nst9	1,0	0,3 – 1,1	nst9	0,9	0,3 – 3,0	nst9	0,9	0,3 – 3,1
	nst10	2,9*	1,1 – 7,8	nst10	2,6	0,9 – 7,1	nst10	1,7	0,6 – 4,7	nst10	1,6	0,5 – 4,6	nst10	1,6	0,5 – 4,7
	nst11	0,8	0,2 – 2,6	nst11	0,7	0,2 – 2,2	nst11	0,4	0,1 – 1,3	nst11	0,3	0,1 – 1,2	nst11	0,3	0,1 – 1,0
or Area[e]				Drill l	0,7	0,5 – 1,0	Drill l	0,5**	0,3 – 0,9	Drill l	0,5**	0,3 – 0,8	Drill l	0,5***	0,3 – 0,7
				Dec	0,4***	0,3 – 0,7	Dec	0,3***	0,2 – 0,6	Dec	0,3***	0,2 – 0,6	Dec	0,3***	0,2 – 0,6
				Tec n	0,3***	0,3 – 0,4	Tec n	0,2***	0,1 – 0,3	Tec n	0,2***	0,1 – 0,3	Tec n	0,2***	0,1 – 0,3
nst elonging[f]							Nomad	0,6	0,4 – 1,1	Nomad	0,6	0,3 – 1,0	Nomad	0,6*	0,3 – 1,0
S ift rotations[g]							Day N ary	0,7 0,4**	0,4 – 1,3 0,2 – 0,8	Day N ary	0,7 0,4**	0,4 – 1,2 0,2 – 0,8	Day N ary	0,8 0,4*	0,4 – 1,3 0,2 – 0,8
Trust in wm										T M	0,7*	0,5 – 0,9	T M	0,7*	0,5 – 0,9
Trust in sv										TS	0,9	0,7 – 1,2	TS	1,0	0,8 – 1,4
Safety compl													Compl	0,6***	0,4 – 0,8
Safety part													artic	1,5**	1,1 – 2,1

^{a} p≤0.001 ***, p≤0.01 **, p≤0.05*

^{b} Square (Co Snell) Model 1 0,51***. Model 2 0,93***. Model 3 0,110**. Model 4 0,122**. Model 5 0,149***.

^{c} Reference category: 'NCS' having the ig est portion of involvement in incidents.

^{d} eference category T e installation wit t e ig est portion of involvement in incidents. 12 installations in total.

^{e} Reference category: 'Driller Team' having the highest portion of involvement in incidents. t ers Drill floor, Dec and Tec nical team.

^{f} eference category ermanent mployees wor ing mostly or always on t e same installation aving t e ig est portion of involvement in incidents. t er Nomadic.

^{g} eference category i ed rotations – day nig t every second tour aving t e ig est portion of involvement in incidents. t ers Day nig t s ift permanent and S ift vary.

HFC

Human and organisational factors
- what can be learned from international shipping

Torkel Soma
PROPEL

Mere informasjon:

http://www.propel.no/

PhD Torkel Soma, "Blue-Chip or Sub-Standard? - A data interrogation approach to identify safety characteristics of shipping organisations." (2004) ISBN 82-471-6483-3 (electronic ver.) found at: *ntnu.diva-portal.org/smash/get/diva2:220030/FULLTEXT01*

Soma T., Øie S. "Best Practice Framework for Safety Culture Improvement Programs" (2010); 10th International Probabilistic Safety Assessment & Management Conference, PSAM2010,

The Bow Mariner, 28th Feb 2004

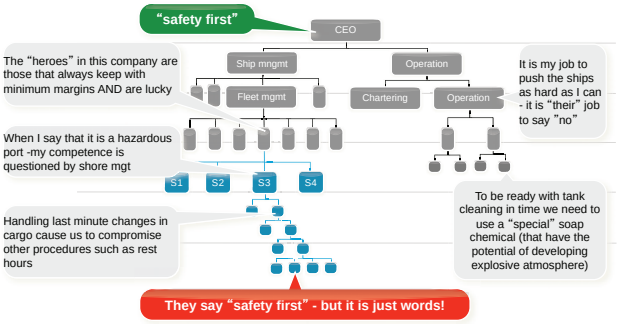
Shipping is…

- Large in volume
- Relatively uniform org. set-ups
- Truly international
- Extremely hierarchal
- A multicultural workplace
- A "non-routine" workplace
- High risk

… the place to be for the ones having passion for human and organisational factors

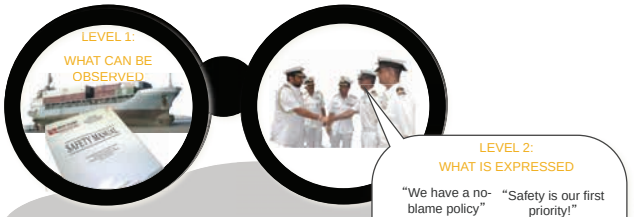
Shipping has shown a good trend for minor accidents - but the serious accident frequency is on the wrong path despite of safety management

In-depth interviews reveal that individual managers see their role isolated from the overall organisational goals - making it difficult to set priorities



PROPEL
MARITIME MANAGEMENT CONSULTING

Organizational culture must be understood on three different levels



LEVEL 3: WHAT DETERMINES BEHAVIOR

"To stop the job is not an option"

"If the captain says no – he will be fired"

"To speak up is an offense to the person in charge"

"If I report that I have failed, I will be sanctioned"

"The procedures are to reduce shore management responsibility"

PROPEL
MARITIME MANAGEMENT CONSULTING

What role do you choose to help a client?

Gislefoss

Role:
Messenger

Helskog
Rikets tilstand

Role:
Critical independent view

Helstrøm rydder opp

Role:
Expert view

Marthe Jakten på kjærlighet

Role:
Process approach

PROPEL
MARITIME MANAGEMENT CONSULTING

What role do you choose to help a client?

NBC Weather
Samantha Davies

Role:
Messenger

BBC HARDtalk
Stephen Sackur

Role:
Critical independent view

Kitchen nightmares
Gordon Ramsay

Role:
Expert view

Dr.Phil
Phil McGraw

Role:
Process pproach

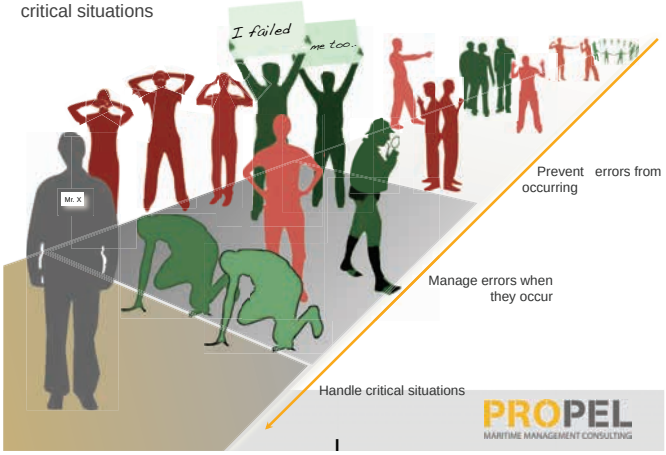
PROPEL
MARITIME MANAGEMENT CONSULTING

We use a four level cultural maturity scale as a basis for the diagnosis and implementation

You need a sound reference to know where you are, where you should go and why

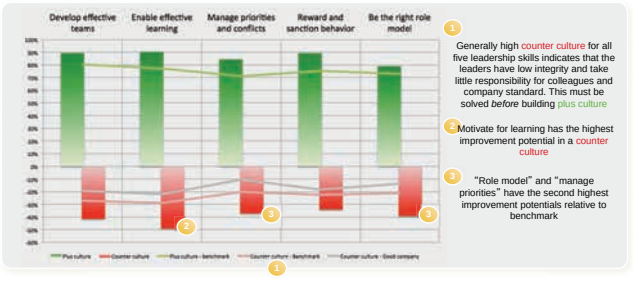
PROPEL
MARITIME MANAGEMENT CONSULTING

All companies have elements of a counter culture and a plus culture that impact on prevention of errors, correction of errors and the ability to handle critical situations



PROPEL
MARITIME MANAGEMENT CONSULTING

Example of results: Benchmarking used to identify strengths and weaknesses of the existing organisational culture

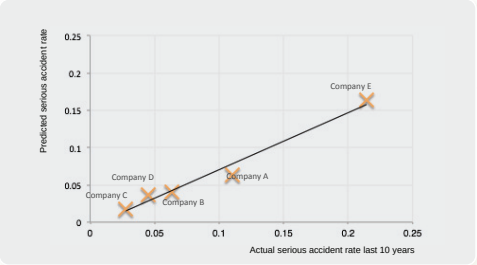


To improve leadership the key is to set the right direction and address the right things in the right order

* Counter culture is a culture governed by cover-up and/or lacking responsibility for safety performance (laissez-faire) see slide 6

PROPEL
MARITIME MANAGEMENT CONSULTING

The diagnosis explains your company´s actual safety performance on serious accidents



To improve performance, the key is culture!

Some experience on how to improve human and organisational factors in an international workplace

- Link need for change to actual performance - not compliance, best practice, etc.
- Ensure commitment and ownership in the line of management
- Base your approach on a process consultancy
- Make a diagnosis that is easily understood
- Incorporate changes into daily work – not projects, training, etc.
- Monitor changes and track benefits

We have seen 50% reduction in serious accident risk by improving safety leadership

PROPEL
MARITIME MANAGEMENT CONSULTING

By Dr. Torkel Soma, Partner in Propel

Safety has never been more business critical. If your company experience a major accident, it would not only put human lives at risk, but it would harm your company commercially in terms of increased costs, reduced production, canceled contracts and loss of reputation. In a low conjecture market with excess of suppliers few companies can afford such a setback.

Furthermore, given this criticality, it is also a concern that the commonly used strategies for prevention of major accidents demonstrate insufficiencies related to incorporation of human and organizational aspects. This article presents some of these insufficiencies and outline alternative strategies for prevention of major accidents pinpointing the roles of regulators and top-level managers.

Prevention of major accidents

where do we go from here?

PROPEL
MARITIME MANAGEMENT CONSULTING

We look for the wrong symptoms

In 1931 an insurance superintendent named Herbert Heinrich[1] published the accident ratio study demonstrating that there is a large number of minor injuries and deviations behind every major one. The accident ratio study has over the last 80 years developed into a cornerstone of safety management, and is the reason why several safety inspectors line up to inspect your company to pinpoint what is often minor deviations. The belief is that by mitigating minor deviations, you also prevent the major accidents. But is it really so that the absence of minor injuries in the galley give indications of the ship´s risk of a major grounding?

It was the investigation of the BP Texas City refinery accident in 2005, that induced the end of the use of the accident ratio study[2]. This accident was among the worst US industrial accidents since the 1980s, killing 15 people and injuring 170. Prior to the accident, the plant had fairly good results on smaller deviations and injuries. Consequently, the top management were mislead to believe that the risk of accidents was under control. The investigation did not only express concern about KPIs for major accident risk, but also pinpointed that safety culture should be given more attention in safety management in general.

We look for the wrong causes

Then in 2010, the Macondo blowout caused 11 fatalities, injured 17 and resulted in the largest accidental marine oil spill in the history of the petroleum industry. Among the first questions asked was: can this happen somewhere else? Companies, investigators, regulators and researchers started to revise other´s practices, rules and procedures. After this review the answer from the North Sea, was that such an accident could not happen in the Norwegian sector. The problem is however, that if they did the same revision on the Macondo prospect, prior to the disaster, the results would probably be the same: it could not happen here as well. So, what fundamental problems are we missing?

And we have done it a long time

If we look back in time, to 15th April 1912, the Titanic was on her maiden voyage across the Atlantic. The ship had received reports of icebergs in the area, but still, in an attempt to make a cross-Atlantic speed record little was done to reduce the risk. Titanic was after all in harsh competition with other companies and was referred to as “the unsinkable ship”. Her collision with an iceberg and the subsequent sinking resulted in 1517 fatalities.

In the aftermath a range of new safety measures were initiated covering operational procedures and technical requirements. The strange thing is that none of these initiatives addressed captain Smith´s dilemma: *Reducing speed (or change course) would for sure have significant negative effects business wise, and the risk of hitting an iceberg was perceived as relatively small. So why not maintain full speed?* It is all about the human decision making process and how the organization as such make sure that safety is sufficiently prioritized in situations where safety is in conflict with other organizational goals (and especially in non-routine situations).

So, in short our present safety management practices have a tendency to look for the wrong signs and overlook that high risk technologies are not governed by procedures but are operated by real persons – persons that may cover-up their own mistakes and that may take unnecessary chances - especially if you as a regulator or top-level manager make unfavorable operational premises.

In this document the focus is safety seen in a shipping perspective. This does not mean that the text is irrelevant for other industries. There is much that can be learned from shipping, because there are thousands of companies that work under the same regulation and similar technology and work environment. Therefore, the factors that make a difference can more easily be isolated relative to companies working under special national regulations and unique technology.

[1] Heinrich, H., Industrial accident prevention, McGraw-Hill, 1931

[2] Baker Panel report (link)

Is the general safety level sufficient?

Let us consider the world fleet of cargo ships, large enough to be involved in international commercial trade. If we look at accidents resulting in total loss of the ship, there has been a good development in shipping over the last century. This trend seems to continue also in recent years. Also the frequency of serious fires, foundering hull and machinery seems to be stable. The type of accidents that specifically involves human and organizational factors has a rising trend. The frequency of serious collisions[3], contact accidents and groundings has doubled over the last eight years.

The doubling in navigational accident frequency in figure 1 is neither a result of more sailing ships nor less under-reporting of accidents. The reporting of such accidents is done through a third party and has been steadily high, built on experience and practices going back more than a century. The data provider LloydsFairplay also states that they have not changed their reporting practices over the last years. The plot resembles frequency "per ship" (accidents / number of ships in fleet). The term serious accidents describe a marine casualty to a ship, which results in:

a) Structural damage, rendering the ship unseaworthy, such as penetration of hull underwater, immobilization of main engines, extensive damage etc.
b) Breakdown
c) Actual total loss
d) Any other undefined situation resulting in a damage or financial loss which is considered to be serious.

Similarly as that frequency of serious accidents has doubled, there are clear indications that the frequency of minor injuries has been developing the right direction[4]. This independent development of major accidents relative to minor injuries further supports the invalidity of the accident ratio study. The interesting thing is that the same developments are seen in other industries such as the Norwegian offshore industry.

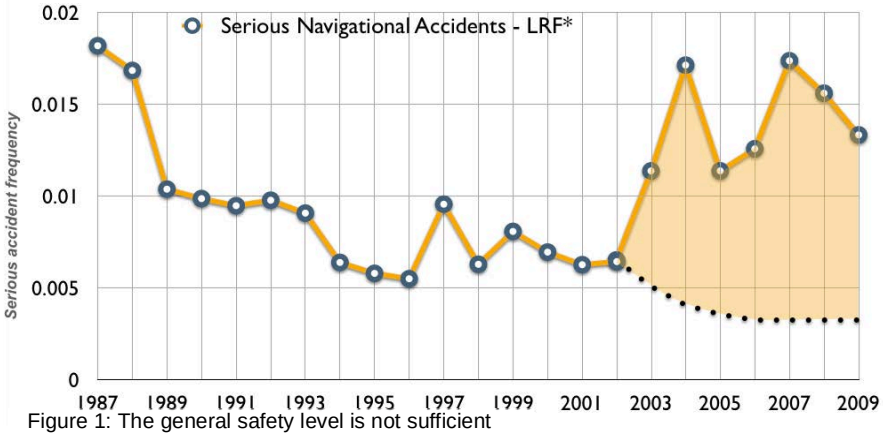


Figure 1: The general safety level is not sufficient for arctic ship safety

So, what does this tell us? It means that our current safety management approach does not sufficiently address major accident risk.

About the author

*Dr. Torkel Soma is partner in Propel AS where his main area of responsibility is corporate culture and adaptation. He has written his doctoral thesis on "Blue-Chip or Sub-Standard?**. Following work and project experience has revealed that the underlying reasons for strong safety performance also holds for corporate culture and high reliability in general.*

During his career, Dr. Soma has written a range of articles and is a widely recognized and known expert in his field by various maritime stakeholders. His special fields of interest includes organizational safety, post merger integration, implementation, leadership in multicultural and global organizations - covering innovation, customer orientation, quality, efficiency and corporate public trust.

Contact: Torkel.Soma@propel.no.

Published by Propel AS, Munkedamsveien 53b, 0250 Oslo.
For contact details see: http://propel.no

[3] Number of serious collision, contact and grounding accidents / number of ships in service extracted from the Loydds Fairplay database. The considered fleet is Crude oil tankers over 100,000 dwt, Chemical tankers over 10,000 dwt, Container over 20,000 dwt, RoRo cargo over 10,000 dwt and Bulk over 50,000 dwt. Source Lloyds Fairpaly database / SeaWeb

[4] The Norwegian Maritime Directorate - Sjøsikkerhetskonferansen 2011 (link)

What is the profile of the key accident cause?

Most serious accidents in shipping involve one or more human errors. The profile of the person causing accidents, let us call him Mr. X, is that he a typical guy – working onboard or ashore. But, when you look closer into why this person becomes Mr. X, then a more interesting pattern emerging.

Mr. X believes that he work in line with company expectations (5 figure 2). In many cases he is aware that he shortcut company rules, but he assumes this is ok - either because he believes it is in the company´s best interest or that it is "safe enough" to make the shortcuts. If he had not believed that it was ok – he may have done things differently and more safe.

The next characteristic (6) is that it is not the task itself that trigger MR. X to make an error but the work situation he is in [9]. Most Mr. X´s have several years of education and experience in conducting his tasks e.g. maneuvering, welding or stowing cargo. But then, one day the work situation trigger Mr. X to do things slightly different or pay less attention. He may feel a pressure to cut down sailing time, to use only one tug instead of waiting for the second or to take slightly more cargo than allowed. Mr. X may also be unfamiliar with the ship, the equipment, the company, or colleague. - Or he may simply be fatigued or carried away. The point is that it is the situation we must give significant attention. It will not help much to send Mr. X on task related training, modify task procedures or replace him.

The next characteristic (7) is that nobody has ever successfully convinced Mr. X to do things differently to be better prepared in critical situations. Convincing Mr. X is difficult: He must be guided to see that his current practices are unsafe and then be convinced that alternative practices can replace his old. Mr. X will not listen to anybody – it must be his close managers or the colleagues that he believes in. And therefore the most challenging part is that the person that convinces Mr. X must do it in a way that don´t damage the personal relationship between the two of them.

In summary Mr. X is a good man with good intentions but he does not see the potential consequences of his behavior. To change behavior he is dependent upon the ones that matter for him in work. It is all about care, involvement and leadership.

As a leader you must understand Mr. X. First you must consider how you yourselves do not end up as a Mr. X – and how you don´t cause somebody else to be a Mr. X. It is your job to understand Mr. X´s assumptions and work situations and improve it. Start asking your colleagues about the one thing they believe would improve safety. Listen and ask yourselves if the answers you get are truly what would improve safety performance- or are your colleagues having wrong assumptions? Furthermore, ask your colleagues why they do their job the way they do. Then you put yourselves in in a better position to identify potential critical situations and also closer for convincement of changes in behavior.

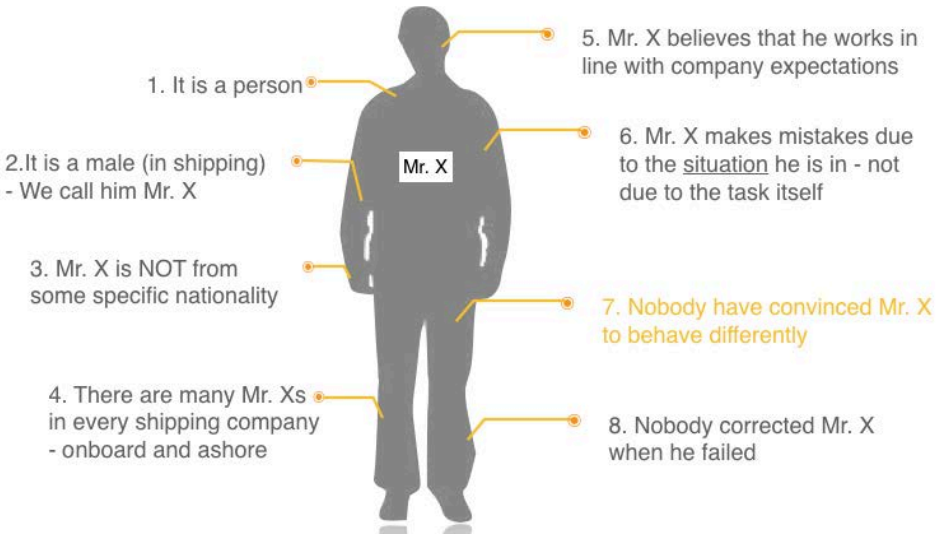


Figure 2: Mr. X - The profile of the key accident cause in shipping

What is the problem?

As a response to many serious accidents in the late 1980s and early 1990s the International Safety Management (ISM) code entered into force in 2002. The ISM code defines key functions and responsibilities of the shipping companies´ safety management system. In 1998 a study was done to assess the expectations to the preventive effects of the ISM code on navigational accidents[5]. The results revealed high expectations. It was believed that a full implementation of the code would have a potential of reducing the navigational accident frequency by 50% (dotted line in figure 1). For the ship segments represented in the graph in figure 1, the difference between the expectations and the actual results are 600 serious navigational ship accidents (shaded area). This justifies asking some critical questions about how the key principles of the ISM code have been implemented in shipping.

The keystone of the ISM code is the Plan-Do-Check-Act (PDCA) loop fronted by Deming[6] within total quality management based on successful results in the manufacturing industry and introduced to loss prevention by Bird[7] (1969). Their thought leadership has been the basis for management system principles applied in the ISO 9000 series and the International Safety Rating System (ISRS). First of all the PDCA loop suggests that all key shipboard operations should be Planned, implying that they should be described in written procedures. Secondly, the crew should DO the job according to the procedures. Thirdly, there should be an audit and reporting system to Check for deviations between the Plans and how the work is actually Done. And at last such deviations should be Acted upon. The PDCA-loop seems intuitively reasonable, but as for everything else, it´s success depends upon several prerequisites, that might not be found in shipping.

Can stable management systems alone handle the uncertainties in shipping?

When you think of it, the PDCA-loops it is in sharp contrast to the words of wisdom from Churchill ("Plans are of little importance, but planning is essential") and Eisenhower ("Plans are nothing; planning is everything"), that basically ignore the DCA elements of the PDCA loop. On the battlefield the goal is to confound the enemy through decentralized teams operating in a complex and unpredictable environment. In meeting the unforeseen you need to prepare the people involved and have a clear common goal, but task orientation, procedures and task auditing give no added value. This implies that the Deming´s principle would be inappropriate for managing a battlefield situation. One of the major differences between a battlefield and a manufacturing plant is the working environment. While the battlefield environment is unpredictable, the manufacturing environment is predictable and stable. In comparison, the shipping environment lies somewhere in between unpredictable and stable.

Are Plans for routine operations most effective in risk mitigation?

We human beings apply different modes of control for different tasks. In routine tasks we will over time develop skills to do the tasks in an almost automatic and unconscious mental mode. It is like driving a car. When you have been driving for some years you don´t think of how you do it, you just drive. This is sharp contrast to novel tasks, where we need to use our knowledge very consciously to arrive at the best approach[8]. Like when you plan a docking, or a large maintenance job. Such tasks involves much uncertainty and it is easy to do something wrong. Therefore one should assume that shipping would be better off if the management supported their professional seafarers with aids in these novel non-routine tasks. There are many examples of situations where the seafarers need support beyond their professional skills. Such situations are to assess sufficient under water clearance for wide ships or during swell, the need of extra tugs in windy weather, to assess if the weather is too poor, the suitability of the port and how to be a good leader for a multicultural crew.

5 Kristiansen, S., Soma, T., Effectiveness of safety measures in maritime operations. 16.th ESReDA Seminar : Safety and Reliability in Transport. Oslo 20 – 21 May. European Safety, Reliability & Data Association, 1999

6 Deming, W.E., Out of the crisis, Press Syndicate of the University of Cambridge, USA, 1982, 1986, 1991

7 Bird Jr., F. E. and G. L.Germain, Practical loss control leadership, 1969

8 Reason, J. Managing the Risks of Organizational Accidents. England: Ashgate Publishing Limited, 1997

What if Mr. X just don´t Do it?

Cross industry research[9] has identified some general factors that increase the likelihood of violating behaviour. Examples of such factors are perceived low likelihood of detection, inconvenient to follow procedures, status to violate and being male. Many of these factors are typical for shipping. Furthermore, seafarers are practical people. They like learning by doing and not by reading. When asked, almost all seafarers will state that procedures are important, but they will also admit that they operating practices are mostly learned from colleagues onboard[10]. This implies that procedures have relatively low direct influence on how the seafarers do their work relative to the influence from their superiors and colleagues.

A recent study[11] presented some interesting insight into how often seafarers break procedures. 12 000 seafarers were part of a questionnaire survey aimed to assess the onboard safety climate. All responses were anonymous and all onboard ranks responded. The survey demonstrates that roughly only half of the crew (54%) claimed that they complied with procedures on a regular basis. 46% of the respondents report that they frequently break procedures (the two left pieces in Figure 3). The study showed that procedures for high-risk operations had somewhat higher compliance. There were similar variations between companies, nationalities and ranks. But the major factor that influences the responded compliance was however none of these factors. By carrying out the questionnaire surveys over time for the same companies, it can be showed that when the seafarers build trust in the survey, they replies that they break procedures significantly more often than the figure illustrates. The question is then, given that procedures not govern how the seafarers actually Do their work, is it then wise to give so much attention to the PDCA-loop principles?

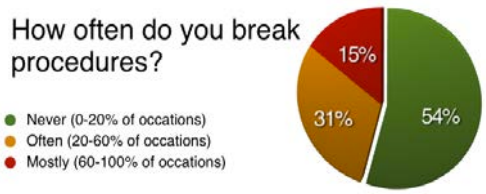


Figure 3: Distribution of questionnaire responses representing non-compliance

What does a Check tell you?

Under the regime of the ISM code there are requirements of audits to be conducted both by the company itself and by representatives of the flag of registry. These audits identify several non-conformities that must be acted upon and closed within certain time limits. There are some questions that need to be asked. If the seafarers don´t follow the procedures to the extent presented above, is it then of any value to carry out an audit or to update the procedures? And, given the volume of violations, does a non-conformity tell something about the operation or does it say something about the person doing the audit?

Can we expect shipping companies to Act upon a non-conformity?

Changes are expensive and risky. If a top manager of a company having a 50 ship fleet really wants to change onboard behavior he or she must expect the costs to be high. It is not enough to change a procedure or send an e-mail. If the costs are half a million dollar or three millions depends upon the challenge. But such huge investments need a solid business case. Based on the examples above, it is fair to assume that the main problem behind lacking safety improvements are linked to the uncertain quality of the current practices in the maritime safety management processes.

9 Williams, J., HEART: a proposed method for assessing and reducing human error, ninth Advances in Reliability Technology Symposium, University of Bradford, 1986

10 Lamvik, G., Wahl, A., Buvik, M., Professional culture, Work practice and reliable operations in shipping, Reliability, Risk and Safety: Theory and applications, Taylor and Francis group, 2010

11 Gronbrekk, W., Soma, T., Lowering reputational Risk in Developing Markets through Hands-on Safety leadership, Hydro 2010, Lisbon, Sept., 2010

What must be addressed to improve safety?

The focus on technology and management systems has resulted in extensive regimes for inspections and audits carried out by flag states, port states, classification societies and cargo owners. It is generally acknowledged that the deficiencies and non-conformities often are symptoms of more underlying fundamental problems (figure 4 I). The intention behind these regimes is that the companies themselves should be able to find cures (II) that mitigate (III) the core fundamental problem.

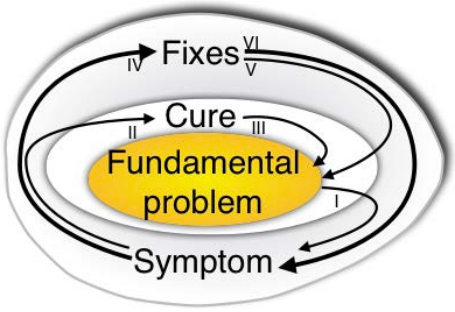


Figure 4: Interaction between fundamental problems, symptoms and fixes

But the inspection and audit regimes have some side effects that are not sufficiently recognized. Three of these side effects are that they misguide the companies to focus on fixes, that the fixes may enlarge the fundamental problem and that fixes nurture more fixes. In sum these side effect makes a protective "shell" that cover-up the core fundamental problems, preventing them to be identified and addressed.

Symptoms promote fixes

Because of the extensive inspection and audit regimes, shipping companies frequent receive non-conformities and deficiencies (symptoms) with a specified due date for closing. A side effect is then, that the shipping companies´ attention is moved towards fixes (IV) that mitigate the symptom (VI) instead of mitigating the fundamental problem (V). This misguidance is a side effect, as the fundamental problems receive less focus relative to their symptoms.

Fixes promote new symptoms

The second side effect is that the focus on fixes promotes a need for more fixes. It is like a downward spiral. When a company has sufficiently comprehensive volume of procedures, some sort of violation can explain most incidents. Violations of procedures result in new (IV) fixes, such as new and stricter procedures, which results in more procedures to violate. Therefore, the results will be more violations (VI) requiring additional fixes (IV). The end result is even more attention to symptoms relative to the fundamental problem.

Fixes enlarge the fundamental problems[12] [13]

The third side effect is that fixes enlarge the fundamental problem (V). A simple example of this side effect is related to compliance with procedures. A common fundamental problem is that the crew assume that the procedures and audits are implemented just to "protect the back" of shore management and not truly to improve operational performance. The symptom of this assumption is routine violation of procedures. Then, after an accident the violations are revealed and trigger new fixes such as additional procedures. This in turn, confirms the crews´ assumptions and thereby further increases the fundamental problem (V).

The lesson learned is that It is not enough for an organization to have good management systems, because performance is determined by how organizations actually 'live' or 'act out' their systems and mitigate the fundamental problems (V). There are good reasons to target safety culture as part of an integrated approach to improve safety performance. Behind a navigational accident there are in average 21 causes whereof several are caused by Mr. X[14]. In fact, Mr Xs now contribute to more than 90% of all accidents[15] [16] [17] It is widely recognized that a positive organizational culture is a key ingredient when it comes to guiding organizations towards levels of optimal safety performance.

12 Wilde, G., Target Risk 2: A new psychology of safety and health, PDE publications, Canada, 2001

13 C. Argyris, "Overcoming Organizational Defenses: Facilitating Organizational Learning", Prentice Hall, 2000

14 W. Wagenaar, and J. Groeneweg, "Accidents at sea: Multiple causes and impossible consrequences", Int Journal Man-Machine Studies (1987)

15 Soma, T., What are the causes of ship accidents?, paper presented at the Maritime Transportation conference, Barcelona, 2003

16 H.W. Heinrich, "Industrial accident prevention", McGraw-Hill, 1959, New York.

17 J. Gardenier, "Towards a science of marine safety" Symposium of marine traffic safety, Netherlands (1976).

Why is culture relevant?

A common way of describing organizational culture is how things are really done in the company, and why they are done as they are. How the things are really done can be understood on three levels[18]. First it is key to understand the observable side of how things are done (level 1 figure 5). Examples are observable artifacts such as practices, procedures, dress codes and the physical workplace.

The next level is what people tell you about how things are done in the company (level 2). These descriptions often describe how things ought to be and not always how they are. This does not necessary mean that the actual way of working is intentionally covered up, but rather manifest that the employees truly believe that things are as they should be. Without noticing, our behavior and thinking are governed by our underlying assumptions (level 3). These underlying assumptions are learned over time in daily life from childhood, education[19] and at work[20]. We all tend to take these underlying assumptions for granted. Therefore it is difficult to identify them and challenge them. To illustrate the importance of the underlying assumptions we can consider some examples (see figure 5).

Figure 5: The three levels of organizational culture

The underlying assumptions of a seafarer are typically that the shore management will instinctively dismiss officers that do not carry out orders, that the procedures are implemented to cover the shore managements back and that reporting of errors may endanger their career. These are underlying assumptions which can explain why some captains are willing to be in charge of unseaworthy ships, why it is perceived acceptable not follow the procedures and that few errors are reported. The shore management, on the other side, has underlying assumptions often suggesting that the seafarers are complacent or incompetent as they do not follow procedures and do not report failures. As these are underlying assumptions, it cannot be expected that the seafarers or managers to be aware of them themselves. When asked directly, they will all express what ought to be correct; that the captain has overriding authority, that compliance to procedures is important and that they will report errors (level 2 figure 5).

The underlying assumptions (level 3, figure 5) are patterns of beliefs that are learned over time and have showed to be true and successful. It is difficult for shore management to effectively supervise and communicate with the onboard crew. As a result, officers that get the job done, independent of how they do it, easily become the heroes in the eyes of shore management. Hence, seafarers knowing that these "heroes" constantly brake procedures to get the job done, learn that shore management has a double set of morals. Furthermore, most accidents result in additional procedures aimed at the seafarers despite that the root causes of the accidents often are related to shore management. At last, reported errors do in fact often result in some sort of sanctioning of the involved people at sea, such as interrogation, verbal another position or additional training.

Because the underlying assumptions govern behavior, we jeopardize the success of the safety initiatives, if we ignore them. If for instance, a management team design a safety initiative to address the seafarers described above, it needs to address the lack of trust in shore management so that it is seen as just a new step to cover the their own back. This example may seem a bit trivial, but it addresses an important and general issue; that management often has a biased view of the real challenge and own influence when it comes to organizational culture.

In summary, safe behavior is dependent on many factors. Typical non-safety related aspects such as promotion, responsibilities and loyalty influence heavily on how safety is included as a natural ingredient in daily work. In that respect safety culture is not a distinct part of the organizational culture but must be understood as how the organizational culture affects safety performance.

18 Schein E. Schein, "Organizational culture and leadership, 3rd edition", Josey-Bass, 2004, San-Francisco

19 C. Argyris, "Overcoming Organizational Defenses: Facilitating Organizational Learning", Prentice Hall, 2000

20 Kegan R., Lahey, L., Immunity to change, Hardward business press, Boston, 2009

What is the variance in safety performance?

In order to assess if a ship has a good safety performance, it is necessary to know the variance in performance for the world fleet. In order to describe this norm analogies are drawn to the measurement of IQ. As the distribution of intelligence for a population can be represented by a gaussian distribution, the skewed distribution in figure 6 is estimated to represent the distribution in accident rate for the world fleet. The assumption is that every ship has a specific- but unknown- accident rate. As the figure shows the density of ships having a relatively low accident rate is much higher than for ships having a higher accident rate. This distribution was developed both for total loss accidents and serious accident, but both had a similar shape.

Based on this estimated distribution of the accident rate[21] it was concluded that the ships being among the 25% having the highest accident rate (C) experience roughly seven times as many accidents as the group of ships 25% having the lowest accident rate (A). Consequently, the safest ships (A) only experience 7% of all accidents, while the most substandard (C) are involved in more than 50% all accidents.

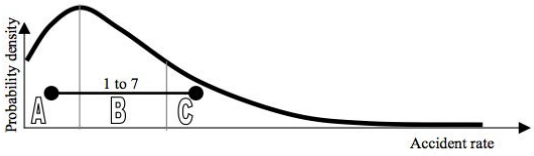


Figure 6: Estimated variance of accident rate in the world fleet

At a task level, the variance in safety level is much larger than at a ship level. A rough calculation shows that a navigational officer is as much as 1000 times more likely to make an error doing an unfamiliar task performed under an un-ideal organizational context with time pressure, unclear communication or goals, relative to a highly practiced routine task performed by motivated and experienced personnel[22].

Table 1: Safety culture stereotypes

Stereotype	Characteristics
Excellence culture	People are oriented towards performance and acknowledge that performance is dependent of how things are done in daily work. Much cooperation. Risks are shared. If you fail, it is seen as an opportunity to learn. Bridging between departments is encouraged.
Normative culture	People are oriented towards tasks and compliance with rules and see safety as something they have (or don´t have). If you fail, it is seen as either a need to improve procedures or to enforce compliance. Bridging between departments is tolerated.
Cover-up culture	People oriented towards power and use safety as an argument in negotiations or to assure power, avoid conflicts or distribute blame. The responsibilities seem as a lock for changes. Little cooperation and bridging between departments is discouraged. If you fail, you might be seen as an idiot or scapegoat.
Laissez-faire culture	People and leaders pay little attention to safety. If you fail, or try to bridge between departments, probably nobody will care or notice. Responsibilities are not advocated.

The whole idea of working to improve culture is the belief that some cultures are better suited. There are also done several attempts to describe the variance in maturity level[23] [24] [25] for the safety cultures[26]. The Table 1 outlines some typical cultural stereotypes. There are few, if any, shipping companies at the safety excellence level. As a rule of thumb, if a company has a Task culture has one accident, the same company with a Laissez-faire culture would have 10 accidents, with a Cover-up culture 5 accidents and with an Performance culture zero accidents.

Can safety culture be measured?

Safety culture cannot be measured directly. But based on the combination of insight gained from various methods addressing all three levels in figure 6, such as questionnaires, interviews, observations and data review, an overall maturity level of the culture can be decided upon. This approach of combining two or more methods is called method

21 Soma, T., Blue-chip or Sub-standard, Doctoral thesis Norwegian University of Science and technology, 2004

22 Williams, J., HEART: a proposed method for assessing and reducing human error, ninth Advances in Reliability Technology Symposium, University of Bradford, 1986

23 Westrum, R., Organisational dynamics and safety, In N McDonald, N, Johnson and R. Fuller (eds.) Applications of Psychology to the Aviation System (Aldershot: Avebury), 1995

24 Keil Centre, Safety culture maturity model, Helalth and safety executives., Off shore technology report 200/049, 2001

25 Reason, J. Managing the Risks of Organizational Accidents. England: Ashgate Publishing Limited, 1997

26 F. W. Guldenmund, "The nature of safety culture: a review of theory and research". Safety Science, 34: 215-257 (2000)

triangulation. It is extremely difficult (if not impossible) for an auditor or inspector only addressing level one and two to develop a sound understanding of the safety culture.

To assist the assessment of the safety culture maturity a specialized questionnaire has been developed based upon the maturity levels (table 1). Fist a comprehensive set of questions was developed and used for data collection. Thereafter, a statistical analysis was conducted in order to select the most suitable questions for the questionnaire. When developing the set of questions, certain criteria should be used:

Questions are linked to leadership: It is leaders that develop culture and therefore leadership skills are the cornerstone of both safety challenges and improvements.

Questions must distinguish between companies: Discriminating those companies with high safety maturity from those that are less mature.

Questions must describe Excellence: The HRO characteristics gives provide even the best shipping companies something to work towards

Questions must address common tacit assumptions: Items form the lower maturity levels (Cover-up and Laissez-faire) are formulated on the basis of safety assumptions and practices that are taken for granted and revealed through in-depth interviews with key personnel in more than 20 companies.

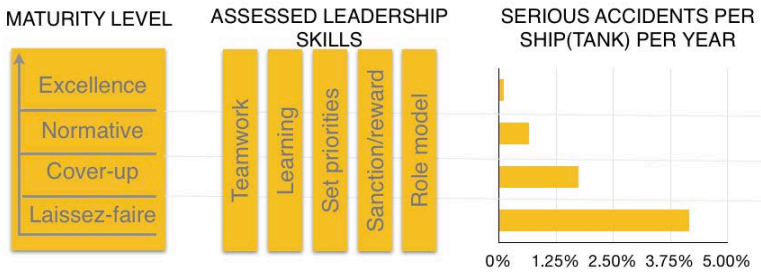


Figure 7: Relationship between maturity levels and major/serious accident ratios[21]

The respondents´ answers to the questions are used to determine the most dominant trait of the work environment (see figure 7).

Because the distribution of accident rate is already estimated (figure 6), an estimate (KPI) of the accident rate for major accidents can be established. In this way the questionnaire responses can provide you with your major accident risk before you actually experience it. In Figure 8 (left side) the KPI of major accident risk estimated for five different companies are plotted against their actual historical serious accident rate for the last 10 years. As a result of the design criteria used for the questionnaire, it is possible to identify solutions to mitigate major accident risk for all five companies.

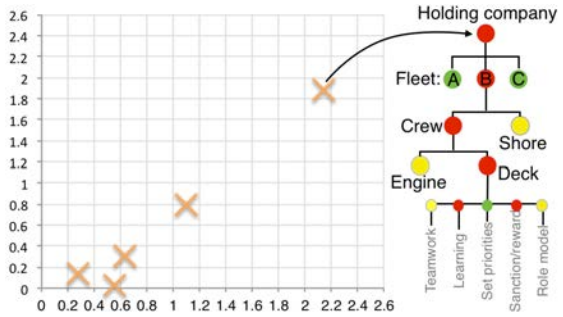


Figure 8: The KPI scores for major accident risk have a strong relationship to actual major accident performance

A KPI is of little value if it does not provide information about why the score is what it is. Therefore there must be an unambiguous way to drill down into the data in order to understand the score, and to delegate responsibility for improvements. In the case of the low performing company in figure 6, the most important contributor to low scores are deck officers in fleet B, that do not sufficiently facilitate learning for their colleagues, and also the way they recognize (reward and sanction) safety related behavior (right side in figure 8).

What are the characteristics of excellence?

Good sustainable safety performance is not achieved by chance. Something has to be actively done differently to reach a higher safety performance. In principle this difference can either be improved quality of resources, such as more professional navigators, or alternatively use the same resources more efficient. Because Mr. Xs (page 4) may indeed be very professional the key is to use the resources more efficiently.

The description of how to prevent and manage errors is based on the acknowledgement that no matter how hard we work to prevent errors, some errors will occur anyway. Therefore the main principle is that we can not only focus on preventing errors, but we also need to look at what we can do to handle them and diminish their consequence[27] [28] [29] [30] [31] [32]. This principle comprises a three-layered approach[33] on the ability to:

1. Preventing errors from occurring: Assess and prepare based on potential threats

2. Preventing errors from developing into a critical situation: Search for and correct errors

3. Handling critical situations: Emergency and recovery actions

There are several challenges in carrying out this principle in daily work. Each of these layers requires different types of organizational behavior. The ability to prevent errors from occurring requires a high loyalty and respect for the structures (procedures, hierarchy, decisions, etc.) and at a same time a social environment where it is ok to speak openly about concerns and potential treats.

Cross-industry research[27] has shown that companies that operate with high reliability in environments of rapid change and high-risk exposure have five common characteristics[28]. These five characteristics combined create a strong situational and risk awareness, a rapid response capability and efficient learning, which are seen as the key to their high reliability. The five characteristics, and signs of shipping companies[33] that not satisfy the characteristics, are the described in the following text:

Preoccupation with failure

The whole organization works under the hypothesis that errors, deviations and non-conformities are symptoms of underlying weakness, even though they seem to be isolated problems. Shipping companies that do not satisfy this characteristic have an evident focus on quick fixes, gap closing and corrections. People involved in issues may be sanctioned or dismissed (see figure 4).

Sensitivity to operations

The full line of management has a clear awareness and understanding of the daily work situation on board, and of its limitations and challenges. Managers are specially aware of their relationship to the seafarers because they know how difficult it can be to speak up about ideas and concerns. Operational insight improves decision making and the management of conflicting goals. Shipping companies that do not satisfy this characteristic openly express statements such as “Our procedures are ok, the problem is the crew who don´t follow them”, “100% of our seafarers follow the procedures all the time” and “we always give safety the highest priority”. Another sign is that onboard operations are interpreted through a few performance indicators, missing the total picture.

Reluctance to simplify

When we make a mistake ourselves we can easily pinpoint the external factors that influenced our beliefs or acts. However, we have a human tendency to simplify how we judge other people through stereotypes and assuming that actions are determined by personal traits. If you simplify less, you will see more. Shipping companies that do not satisfy this characteristic have a tendency to group people as either an expert or an idiot, asking questions such as “What is the best

27 T. LaPorte and P. Consolini, “Working in practice but not theory: Theoretical challenges of High Reliabiltiy Organisations”, Journal of Public Administration Research and Theory, 1 (1), pp. 19-47 (1991).

28 Weick, K. E., & Sutcliffe, K. M. “Managing the Unexpected”. , 2001, San Francisco: Jossey- Bass.

29 International Civil Aviation Organization, “Threat and Error Management (TEM) in Air Traffic Control”. ICAO Preliminary Unedited Version – 6 October 2005.

30 Helmreich, R. L., Klinect, J. R. & Wilhelm, J. A.“Models of Threat, Error, and CRM in Flight Operations”. Proceedings of the Tenth International Symposium on Aviation Psychology, 677-682., (1999).

31 J. Reason, “Human Contribution Unsafe Acts, Accidents and Heroic Recoveries”, Ashgate Publishing Limited, 2008

32 E. Hollnagel, D. Woods, N. Leveson, “Resilience Engineering Concepts and Precepts”, Ashgate Publishing Limited, 2006

33 Salvesen, B., Soma, T., Behavior-Oriented Risk Management, Maritime Transport Conference, Barcelona, 2009

choice – a Pilipino, Indian or Russian crew?" and make judgments like "Complacency is the reason for all of our problems". "

Commitment to resilience

In order to manage the unforeseen you need to be prepared both as an individual and as a team. Resilience is achieved through a three-level commitment. The ability to prevent something unfortunate from happening, the ability to prevent it from escalating, and the ability to recover once it has happened. Shipping companies that do not satisfy this characteristic have typically too much focus on the last level: recognition is based on stress-management capabilities and success in fire fighting.

Seeking the expertise

The most efficient way of working during normal operations is to follow the established rules of responsibility and decision-making. However, this may not prove correct when the situation deviates from normal. Experience or rank does not guarantee the needed expertise. The captain or CEO may not possess the necessary expertise or be in a position to make the best decisions. Therefore, the needs of the situation should determine who should undertake the action or make the decision. Shipping companies that do not satisfy this characteristic typically have a rigid decision-making processes, lack of diversity, authoritarian leadership and disempowered subordinates onboard and/or ashore.

What can top-level managers do?

A range of studies has been conducted to understand what distinguishes safe and highly reliable companies from others. The conclusions are consistent: *leadership commitment* and *corporate culture* are the crucial differentiators. Leadership is strongly interlinked with corporate culture - leadership nurtures culture (and vice versa).

Excellence does not happen by chance

Many believe that the key is recruitment, staff training and supporting pay-for-performance incentive schemes. But, if you want excellence to be a part of your company culture, you must make it an integral part of how your people conduct their daily work through the line of management.

Leadership is social influence to achieve a common goal. Hence leaders must both think about how they achieve the personal status needed to influence others and how they actually use this status. A necessity for efficient leadership is to be oriented not only towards tasks, but also towards Mr. X and the changes (page 4). There are typically five leadership skills that are needed to progress towards excellent performance: to develop teams; to facilitate learning; to set priorities; to manage rewards/ sanctions; and to be a good role model. These skills should be part of a company specific managers code of conduct.

Set priorities

The first thing is to define (1) clear safety goals (see page 11) that are harmonized with other organizational goals such as production and environment. What many top-level managers forget is to give the rational that explicitly explain *why* (2) there is a need to focus on safety. It is taken for grated that everybody, including Mr. X, gives safety sufficient priority. But in real life this is not the case partly because other goals are so much explicit, partly assumes that what they do it is safe enough.

The second thing is to also help potential Mr. Xs to *justify* (3) decisions that gives safety the highest priority. When a captain takes the ship out of operation (offhire) to wait for an extra tug, he put him selves in a vulnerable situation where it is easy for others to relate his decision to his own incapability instead of safety. This is the reason why it is difficult to make such a decision. It is the top-level managers responsibility to make it easier for the captain to justify such decision through the use of company risk assessments, examples, etc.

Develop teamwork

To have a good safety performance everybody from top-level management to ratings (shop-floor workers) must take responsibility and cooperate efficiently. In that respect safety is a result of teamwork where everybody work towards the same goals. To develop good teamwork throughout the company the top level managers needs to give this sufficient attention. The leaders must make sure that their leadership team cooperate efficiently and that the members of the leadership team pass on these skills to the next level of management.

Facilitate Learning

Learning is much more than reporting. The major task for a leader is to make sure that the working environment supports the “cure” rather than the “fix” in figure 4. This cannot be done through a system or procedure, but rather from a common mindset for all staff. This mindset involved the traits of Excellence (see page 11) where everybody is empowered to be critical to the way things are done today, and feel responsible to move the company forward.

Manage rewards and sanctions

In shipping, with large distances, multicultural environment and many hierarchal levels it is easy for top-level managers to give much focus on results relative to how the results are achieved. It is easy to praise staff that gets the job done in time and within budgets. It is seldom asked if the job was done in correspondence with company priorities and rules. The result is that unwanted behavior is praised. Similarly, when somebody reports a failure, it is easy to confront the person reporting, even though the wanted behavior is to report failures. To recognize good behavior is extremely important for leaders, but it requires mindfulness to make sure that the rewards and sanctions support arrow II in Figure 4 and not arrow IV.

Be good role models

In order to implement the leadership skills it is key that managers are good role models and walk the talk and lead by example. This means that they must live the company code of conduct and that they are interested in their people and like face-to-face situations.

What can regulators do?

Regulators are put in a difficult situation[34]. Figure 1 illustrates how hard it is to predict the effect of operational safety measures. They mission is to improve safety, but their watchdog role prevents them from getting access to the underlying assumptions (level 3 in figure 5) and directly influence the fundamental problems of safety (figure 4). But there are off course several things regulators can do to influence safety culture.

Make safety business critical

The most important thing is to make safety business critical. If safety is only seen as a frame condition, it will not create a drive for excellent performance. Regulators can make safety more business critical by stricter enforcement of their duties. When a company obviously does not meet the requirements of the code[35], they should lose their ISM Documents of Compliance (DOC). In 2008 a Danish shipping company lost their DOC after a series of meeting and audits. The consequence is that the company no longer can continue operating their vessels.

Engage top level management

Furthermore, an approach to stimulate the safety culture of a company is to engage top management by asking them to make a self-assessment, or a presentation, of how the company works to prevent serious accidents and mitigate fundamental problems. Such engagement is most efficient if it is developed in such as way that it creates new cross department discussions in the companies (director, CEO, fleet manager, purchasing manager, safety manager, crewing manager, commercial operations and charterer).

Share intelligence

There are several other less drastic ways that the regulators can stimulate the companies' safety culture. One way is to help the companies to interpret their non-conformities and help companies to gain insight into how to develop preventive measures (curers figure 4) based on these non-conformities (symptom figure 4) (ISM section 9,11,12).

Promote characteristics of excellence

Rethink how ISM code (especially section 3, 4, 5, 6) are followed up in practice to promote the five characteristics of excellence outlined in this chapter in roles, responsibilities and activities.

Promote principles for handling the non-routine

Section 7 of the ISM code outlined requirements for plans for key shipboard operations. Because the intention of the code is to promote safety these plans should focus on the risk factors influencing a job. The most important risk factors are not related to the tasks themselves, but rather guidance in handling uncertainties in the context of the task such as fatigue and stress, multicultural crew, judge wind effects and swell effects etc.

Increase transparency on initiatives to cure fundamental problems

Another initiative is to increase transparency and benchmarking of how safety work (curers figure 4) is done to mitigate fundamental problems. It is worth stressing that is not the same as transparency and benchmarking of incidents, non-conformities and inspection findings that are only symptoms of the fundamental problems. Such transparency may results in more fixes (figure 4)

[34] Reason, J. Managing the Risks of Organizational Accidents. England: Ashgate Publishing Limited, 1997

[35] Anderson, P., ISM code : a practical guide to the legal and insurance, LLP, London, 1998.

What can stakeholders do?

In a world of increased outsourcing, consolidation and partnerships between companies having different ethical values there is an increasing need for stakeholders to influence the safety performance of other companies. Typical stakeholders of a shipping company (target) are:

- Customers e.g cargo owner
- Suppliers e.g insurance
- NGOs
- Holding companies
- Partners

The toolbox for how you can influence on safety depending on what kind of stakeholder you are. A holding company may influence the recruitment of suitable top-level managers (page 13). Customers (like cargo owners) may use more of the toolbox for regulators (page 14). Tools beyond the ones for top-level mangers and regulators are presented in the following text.

Be clear on you own expectations

Invite yourselves to a dialogue with the top-level management of the target company. Explain *why* safety is important for your company and how this is affected by the safety performance of the target company? State what your company expects from business partners in terms of Corporate Responsibility and triple bottom line. In this dialogue you must also be open on how your own company work with safety - what fundamental problems do you see and what cures do you choose (page 7)?

Be relevant - understand Mr. X

As a stakeholder you have less direct power to influence the safety performance of the target company compared to their top-level mangers or regulators. Therefore you must make yourselves relevant. One way of being relevant is to understand the target company's Mr. X (page 4). Does your own company contribute to the situations influencing Mr. X through contractual clauses, time limits, responsibilities, pressures etc.? If so, how can you harmonize these influences?

Share intelligence

When you understand Mr. X you may be in a position to gather information about such situations across several of the companies you are cooperating with. Assess how you can share your understanding of this situations - or even better: the cure for these situations. To further increase the impact you have on a target company you share your understanding of Mr. X by arranging:

- Seminars / workshops
- Best practices
- Benchmarking
- Lessons-learned
- Self assessment and tests

Choose your role

Based on where you believe the target company is on the maturity scale (Table 1) you can choose your own role. You are less likely to be successful in promoting Excellence to a Cover-up company relative to promoting Norms (standards, code of conduct, etc). But independent of what kind of stakeholder you are – you need to see yourselves more as an honest well-meaning friend than a watchdog if you really want to have an impact on the target company (figure 4).

When the going gets tough…

But what do you do when you understand that the management of the target company do not meet your expectations e.g. have no intention of developing an efficient cure (page 7). Do you accept that "In Rome you act as romans" with a lower safety performance? If not, you should evaluate if you should pull out of the relationship with clear references to why you intend do so. If you don´t pull out you need to review your options:

- Can you join forces with other stakeholders to increase your influence or power?
- Can you influence the composition of the target company´s management team?
- Can you influence the lower level management or officers?

HFC

Panel discussion

HF across borders – Challenges to face
Chair M. Green

Participants: P. Hudson, R. Miles, J. Tharaldsen & N. Suparamaniam-Kallerdahl.

Mere informasjon:
www.energyinst.org/technical/human-and-organisational-factors

"Hearts and mind": www.eimicrosites.org/heartsandminds/

HFC

Managing risk – lessons from the Deepwater Horizon

Rob Miles, Leads on the topic of Human and Organisational Factors for the Offshore division of the HSE. **rob_miles@talktalk.net;** Rob.Miles@hse.gsi.gov.uk

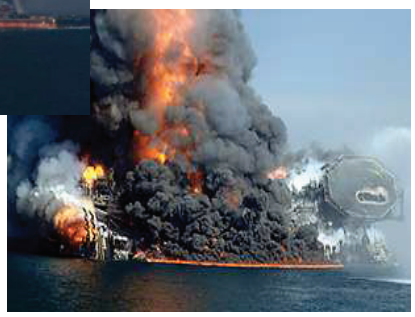
Mere informasjon:

Human Factors web site and blog
www.energyinst.org/technical/human-and-organisational-factors

Managing risk – lessons from the Deepwater Horizon

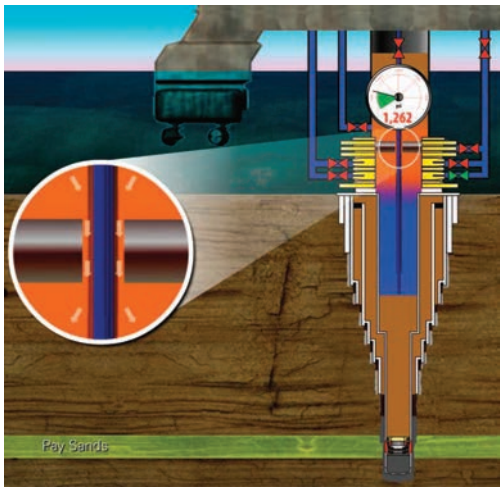
Rob Miles
rob_miles@talktalk.net

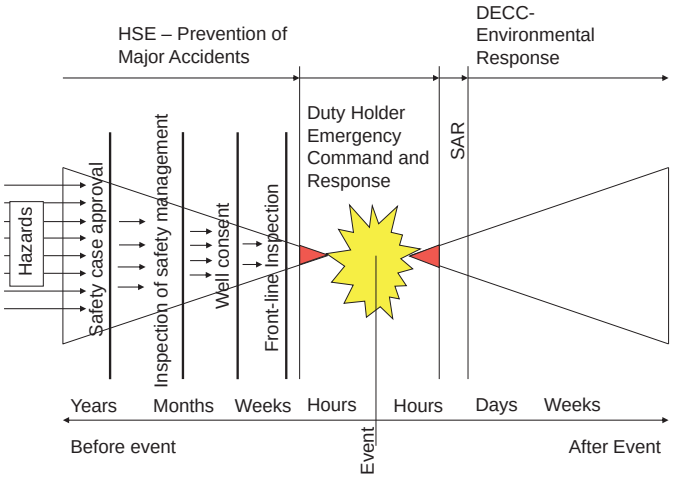
3 Days



The loss of the Deepwater Horizon

- Flagship of the Transocean fleet
- Modern, built to latest standards, capable of drilling in very deep water – 2 miles.
- Would cost you between $250,000 and $400,000 per day to hire.
- Was about to be awarded a safety prize for over 300 days without an LTI (Lost Time Injury)
- The crew had made a safety film about hand and glove safety. Not all of those in the survived.
- 11 crew lost their lives.



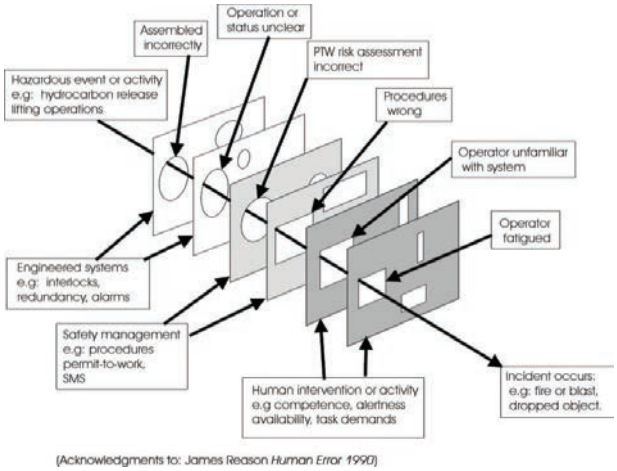


For the accident and its aftermath to have occurred, the following critical factors had to have been in place:

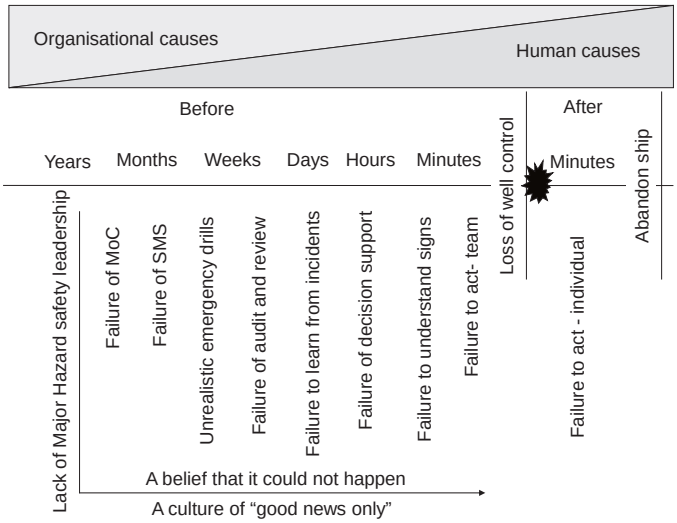
- *f*Well integrity was not established or failed.
- *f*Hydrocarbons entered the well undetected and well control was lost.
- *f*Hydrocarbons ignited on *Deepwater Horizon*.
- *f*The blowout preventer (BOP) did not seal the well.

- And: *The Vessel did not move off station*

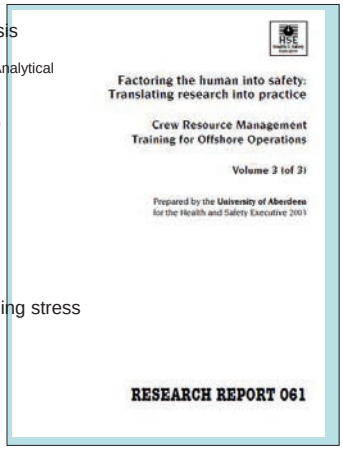
How to stay alive...

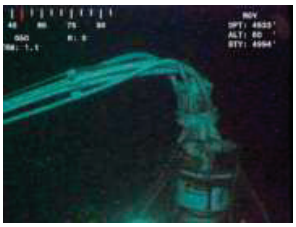


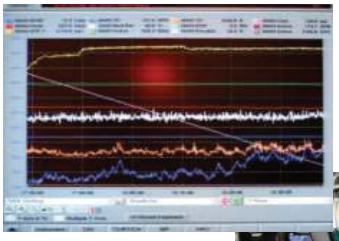
(Acknowledgments to: James Reason *Human Error 1990*)

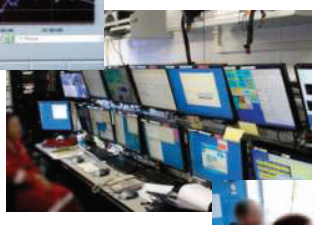


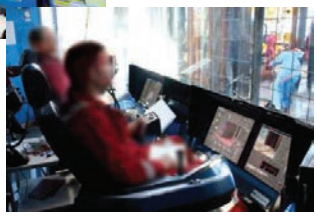
- ***Situation Awareness*** Plant status awareness
  - Environmental awareness
  - Anticipation
  - Concentration/avoiding distraction
  - Shared mental models
- ***Decision Making*** Problem definition/diagnosis
  - Risk and time assessment
  - Recognition Primed Decision Making /Procedures/Analytical
  - Option generation/choice
  - Outcome review
- ***Communication*** Assertiveness/speaking up
  - Asking questions
  - Listening
  - Giving appropriate feedback
  - Attending to non-verbal signals
- ***Team Working*** Maintaining team focus
  - Considering others
  - Supporting others
  - Team decision making
  - Conflict solving
- ***Personal Resources*** Identifying and managing stress
  - Reducing/coping with fatigue
  - Physical and mental fitness
- ***Supervision/Leadership***
  - Use of authority/assertiveness
  - Maintaining standards
  - Planning and co-ordination
  - Workload management

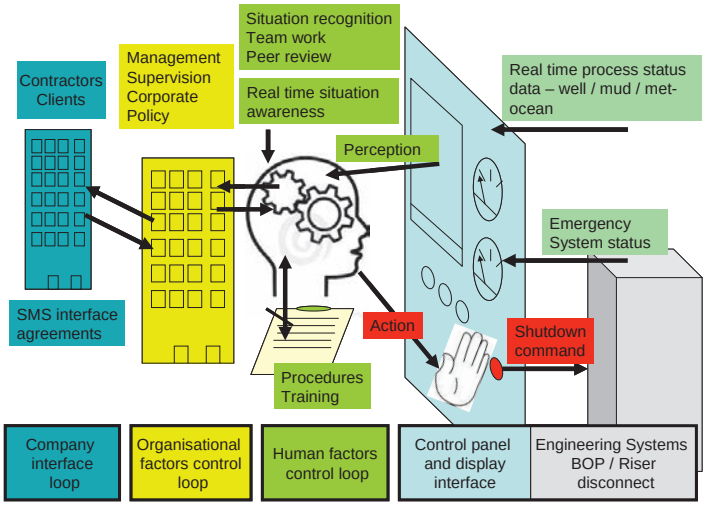












Post Deepwater Horizon – HOF Audit for NSOAF

Author: Rob Miles OSD 4.8
Date: 9 February 2012

Issue	Date	Reason	Author	
1	11 Jan 12	First draft	RWM	
1b	26 Jan 12	Draft for NSOAF comments	RWM	
1c	9 Feb 12	Minor typos corrected, issue table	RWM	

Section 1.01 Background

The safe and successful drilling of a well on an offshore installation is achieved by a complex interaction of man and machine. The crew monitor displays and other information and make decisions and take actions based on how they interpret that information.

All this activity takes place within a wider system of plans, objectives, monitoring and the relationship between individuals in a team, teams and management and between organisations; clients and contractors. When things do not progress as expected or planned these technical and human elements must all function as a single system to prevent a disaster.

The relationship between the actors (the people and the organisations) must be clear so that everyone knows and understands their role and can deliver it competently. The displays and other monitoring equipment must present to the crew the most accurate representation of the situation possible. The operators must perceive and interpret that information correctly and achieve the most accurate awareness of the situation that they can. They must then interpret that situational awareness and understand the implications it contains for the future. They must then make decisions and take the correct actions to ensure that this future is controlled and safe.

This document focuses specifically on those parts of this socio-technical system in which the human element is the key component. In a loss of well control event the most critical human element is the operator's hand that presses the BOP and emergency riser disconnect controls. No amount of improvements to the BOP capability can overcome the situation in which no one presses that shut-down control until it is too late. The riser disconnect may be even more challenging; whereas the operation of the BOP will occur shortly after the decision to shutdown, the riser disconnect may require a number of tasks that need to be completed before action can be taken. The decision to initiate these actions has to be taken in good time.

The issue to be addressed by the human and organisational factors programme is to ensure that the final human element (the “hand on the button”) is a reliable component in the emergency control (and avoidance) system.

(a) Working back from the action of “pressing the button”:

1. They must know and agree who is to take the action
2. They must know and agree when to take the action
3. They must be confident that they have the full support of those above them in the action they take.
4. They must be empowered to take the action in the time available.

(b) They must be confident that they are taking the right action.

To achieve the required level of confidence to shutdown or disconnect the person taking that action must have the best possible understanding of the situation along with the range likely outcomes and options available. This requires training and experience, pre-planned and rehearsed scenarios that they can draw on to help them interpret the situation and procedures to guide them through that interpretation.

(c) They must have situational awareness.

To achieve the required situational awareness they need accurate and timely information from the displays and other equipment around them. The design of these displays should help them to rapidly assimilate the information and their training and procedures should help them reach an accurate situational awareness.

Before any activity is undertaken that could result in a situation that has the potential to become a major incident there must be in place the organisational foundations to create a safe and organised workplace. This will be the supervision, training, drills, procedures and equipment to ensure readiness. The equipment must function as intended and so this organisational preparedness includes monitoring, testing, verification, auditing, management of change and inspection. These safety management systems should be working “behind the scenes” to deliver the equipment, information and procedures well in advance of any requirement along with the appropriate level of independent audit and verification.

(d) They must be in an effective organisation.

Drilling is an activity that usually requires the coming together of a number of organisations: the driller, the client, specialist contractors. These organisations must agree their roles and responsibilities and those of their staff. They need to agree what information is shared, when and how and who is responsible for taking action, when and what. This cannot be done once problems occur, it must be done well in advance. These roles and responsibilities are usually set out in management interface documents and contracts and these must be sufficiently specific to provide

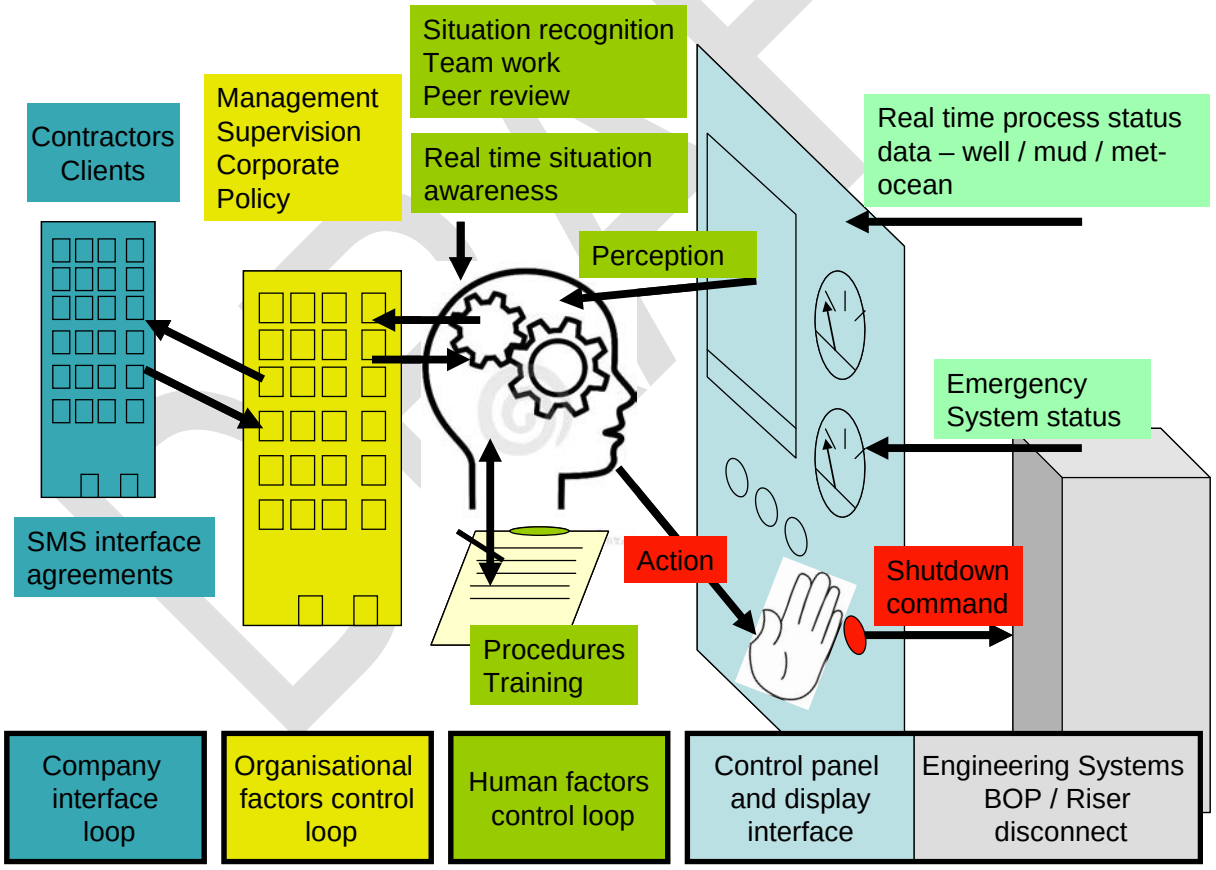
guidance that can be followed without further clarification in the event of an emergency.

(e) Like every other critical element, the management interfaces should be tested and verified.

When wells are planned and the key stages agreed and rehearsed, for example when “drilling the well on paper”, these safety management interface documents and other arrangements should also be included in these exercises and tested for a range of realistic scenarios as “desk top” exercises. Any gaps and other area of confusion or conflict should be corrected and the new “verified” documents used as a basis for training and collaboration.

Section 1.02 The key control loops

The process can be represented as a number of control loops:



(a) The Engineering System / Control Panel Control Loop.

- The display of data about the well and the reservoir,
- Information about the environmental conditions – weather

- Status information about the equipment including emergency systems and “time to operate”.
- Controls to operate the equipment.
- Emergency shutdown controls

(b) The Human Factors Loop.

- A competent person or persons to monitor the control panel with the authorisation to shut down in an emergency
- The perception of the information and comprehension of the information
- The availability and use of prepared procedures and task aids (for example checklists and decision flow charts) to aid the operator in processing information, reaching decisions and taking appropriate action.
- The integration of a number of information flows into a real time situational awareness that includes forward prediction of at least the “time to operate” for emergency systems.
- Emergency situation recognition that will result in human action to initiate the correct emergency protection equipment.
- Team working and peer to peer monitoring and review to support these processes.

(c) The Organisational Factors Loop.

- Management and oversight of the operator to support their activities and provide additional early warning of problems.
- The management of competence and training delivery.
- The audit and review of the safety management systems including procedures, check-lists and other decision and action support procedures.
- Safety leadership that empowers the operator to act when necessary
- Systems to gather and disseminate learning opportunities (i.e. near misses)

(d) The Company Interface Loop.

- The safety management systems (SMS) interface documents and other agreements that specify who does what in normal, escalating and emergency situations.
- The provision of joint training in emergency scenarios to validate company interface arrangements.
- The monitoring and auditing of contractors at both a individual (for example competence) and organisational level (for example contractor safety management systems.
- The access to specialist services and advice.
- The contractual “environment” (deadlines, penalty clauses) in which the activity takes place that could influence the Human Factors loop.

Section 1.03 The audit items

These audit items are structured around each of the four “control loops” identified above:

(a) The Engineering System / Control Panel control loop:

1. How is the necessary data about the well and the reservoir clearly displayed to the operator who requires it?
2. How is this data presented in a manner that enables them to establish and maintain effective situational awareness?
3. How is other real-time information such as weather and met-ocean conditions that influence the judgment on when to initiate shutdown action presented to the operator and in a clear and usable format?
4. How is information that describes the status and readiness of emergency systems including “time to operate” presented to the operator?
5. Are the controls to operate the equipment clearly labelled and functional?
6. Are the *emergency* controls clearly indentified and functional, i.e. not locked?
7. If there are multiple shutdown controls and/or levels of shutdown, are these clearly indentified?

(b) The Human Factors Loop.

1. How does the organisation ensure that there is always a competent person or persons with the responsibility to monitor the situation, including the control panel, and with the authorisation to shut down in an emergency?
2. How does the competence of this person enable them to fully understand the full range of the information presented to them and understand its importance?
3. Are there validated procedures and task aids (for example checklists and decision flow charts) to aid the operator in processing information, reaching decisions and taking appropriate action.
4. How does the competent operator integrate of all of the appropriate information flows into a real time situational awareness?
5. Does this situational awareness include forward prediction that, at least matches, but should exceed, the “time to operate” for emergency systems?
6. Can the operator demonstrate that they can recognise the early indications of an emergency situation and explain when this must result in action to initiate the correct emergency protection equipment?
7. Is it absolutely clear who takes this emergency action and are they provided with the necessary procedures and other decision aids to facilitate their action?
8. Are they given the authority to take this action in the time available?

9. Is the operator supported by team working and peer to peer monitoring and review?

(c) The Organisational Factors Loop.

1. What management systems are in place to support the operator responsible for monitoring the situation and making the shutdown action?
2. What are the management systems in place to provide oversight of operations and additional early warning of problems?
3. What is done to ensure the competence of operators including competence assurance and training delivery?
4. How does audit and review verify the safety management systems including procedures, check-lists and other decision and action support procedures?
5. How does safety leadership effectively empower the operator to act when necessary?
6. How does the organisation gather and disseminate learning opportunities from events, for example near misses, that occur within the organisation and elsewhere in the oil industry?
7. What evidence is there that learning information from events is influencing operations?

(d) The Company Interface Loop.

1. Are there in place agreed safety management systems (SMS) interface documents and other agreements that specify who does what in normal, escalating and emergency situations?
2. How are all those involved in emergency decisions made aware of these arrangements?
3. How have these interface arrangements and any other external joint actions tested and verified?
4. What processes are there for the monitoring and auditing of contractors at both an individual (for example competence) and organisational level (for example contractor safety management systems) and are these shared?
5. How does the company provide access to specialist services, information and advice when it is needed?
6. Are there any contractual issues that could negatively influence the Human Factors loop, for example dead-lines and/or penalty clauses that apply to the activity, and how are these potentially negative influences managed?

End.

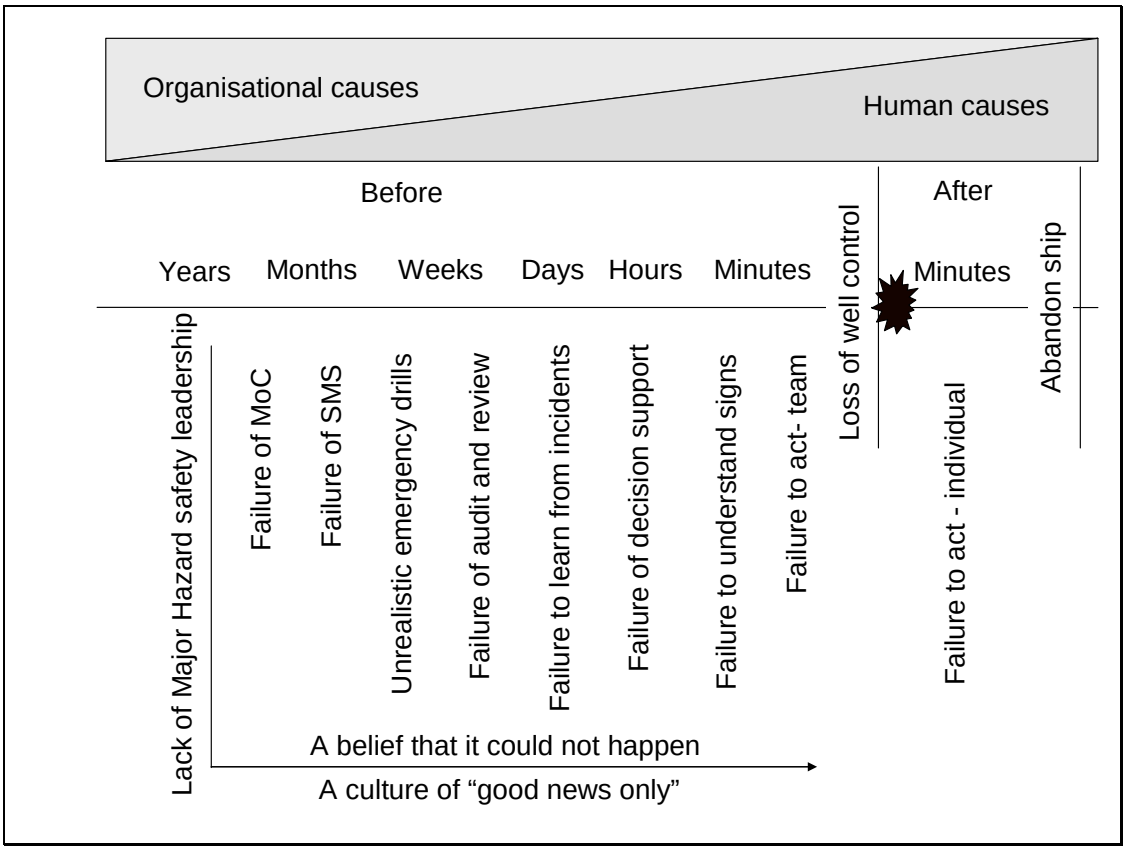
Human and organisational factors – lessons from the loss of the Deepwater Horizon

Rob Miles

Introduction

This paper does not set out to reinvestigate the loss of the Deepwater Horizon, a number of very capable investigation reports have now been published. What is attempted here is to set out how effective consideration of human and organisational processes could have significantly reduced the likely hood of this and similar incidents occurring.

For this analysis the organisational and human factors have been combined. The contributory failures so far identified by a number of sources span an considerable period prior to and a short period just after, the loss of well control. The factors some time before the event are primarily organisational in nature but change to become predominantly human by the time of event, however this is not an exact analysis and most factors have both organisational and human elements. An attempt has been made to set this out schematically below:



Lack of major accident hazard safety leadership

It is not the case that safety was not lead; senior managers from both Transocean and BP were about to award the Deepwater Horizon crew for their safety performance. The problem was that the measures used to determine safety performance were almost exclusively focussed on occupational or individual safety, there was a lack of emphasis on major accident hazard (MAH). This organisational blindness to MAH created a climate that a major event "could not happen" with the result that any uncomfortable messages to the contrary were suppressed creating a "good news only" culture. This lack of leadership for MAH sets the scene for all the subsequent organisational failures that, in turn create the context for the human failures.

Failure of MoC

Over a period that could extend to years before the event a number of changes were made that were not subject to a suitable and sufficient MoC process that would include:

- HAZOPS
- Risk Assessment
- Recording of changes
- Revision of procedures

Significant examples of changes that were not subject to MoC were:

- The decision to operate the BOP beyond its design service interval
- The decision to modify the BOP control packs in a manner that disabled the recovery in service for battery replacement
- Modifications made to the BOP hydraulic pipe work that impacted on the ability to intervene using a ROV.

There are indications that changes were made to the well design nearer to the event that were also not subjected to the necessary MoC analyses.

Failure of the SMS

Both the Transocean and BP SMS specify roles and responsibilities for normal and emergency operations. It is therefore normal practice when two organisations work together in a hazardous activity that arrangements are in place for the interfacing of the two management systems. This is usually done by means of an SMS interfacing document agreed by both parties and such a document is a legal requirement in the UK. BP's corporate SMS specifies the need for an SMS interface document on drilling contracts.

The SMS interface document would have set out who had overall responsibility for a range of decisions including emergency scenarios. There is no evidence that there was any such document in place and some evidence (Bly) that no such document

existed. As the situation worsened key decisions were delayed or not taken in part because of a lack of agreement as to who was responsible.

It is now common practice in the drilling community to “drill the well on paper” - that is work the well and drill plan as a desk top exercise and confirm and agree the key stages. There is a growing trend to then “drill the well in the simulator” during which key indications and trigger points for action can be agreed, (see also CRM below) but the new development that has tremendous potential is to “drill the well through the bridging document” – that is to run the most challenging scenarios from the earlier exercises using the SMS interface document as the guide.

Failure of emergency drills

Emergency drills did take place on the DWH (NY Times report of staff testimony) but these did not include scenarios in which control of the well was lost and high pressure gas release occurred. There is evidence that when drills were undertaken they served to reinforce the need to avoid pressing the high level emergency shutdowns such as the marine emergency, shear rams, riser disconnect and engine shutdown. The evidence so far is that a number of staff either refused or delayed operating a range of emergency controls in time for them to be effective. This situation is compounded by evidence that a number of these systems may not have worked, but had there been realistic drills with a focus on these systems then any faults should have come to light and been rectified earlier.

Failure of audit and review

Both BP and Transocean operate routine management reviews and audits of their SMS. These were either not effective or did not take place. Had effective audits been undertaken by either BP or Transocean they should have identified the failure to follow MoC procedures, the missing SMS interface agreements and the lack of realism in the emergency response drills. There is every possibility that had effective audits identified these (and other) organisational failings and had the necessary remedial action been taken, then the subsequent disaster could have been averted.

Failure to learn from incidents

There is evidence that there was a loss of well control “close call” some weeks prior to the disaster. There had also been an event with many similar features in the Timor Sea. Both BP and Transocean claim to investigate and learn from incidents and yet the evidence here is that when incidents occurred learning did not, even when the lessons were close to hand.

Failure of decision support

As the situation deteriorated over the hours prior to the event there were many occasions where staff referred to the procedures to determine what action they should take. The evidence is (Bly) that the procedures were of little or no use as they did not specify in detail when to act, what to do and who to turn to for advice or approval. This left staff discussing what to do or who should do it at a time when urgent action was needed. Decision support aids, for example Trigger Response Action Plans (or TARPs) could and should have been in place that specified exactly what readings on what parameters must result in action and what action should be taken by whom.

Failure to understand signs

Over the days and hours prior to the disaster many readings were monitored to establish a number of conditions, for example:

- The BOP control pack battery condition
- The well cement condition
- The effectiveness of the shutting in of the reservoir

In every case the evidence (Bly) is that the readings were ambiguous or contained elements of uncertainty. In every case these “weak signals” that things were not as intended were not pursued to the point of certainty. When uncertainties were recognised the reported discussions (Bly) centred on why the situation should be considered safe, not what precautions should be put in place as a matter of urgency in the event that it was unsafe. The full testimonies of the crew have yet to become available; however at present there is no evidence to support early media claims of dissent; with those arguing caution being overruled. The evidence so far is not of dissent but of agreement that all was well founded on a failure to recognise the hazard.

Failure to act as a team

If disaster was to be averted it was vital that in the final hours and minutes the crew worked as a team with clear communications, clear authority and instructions. The evidence from the testimonies presented to the Congressional Inquiry is that the opposite occurred; key information was not communicated to those who needed it, there was not agreement on who had authority and decisions were not taken and orders given when they should have been.

We have reviewed practice in the aviation and marine industries and conclude that the offshore industry must adopt Crew Resource Management Training (CRM). This uses the “no-techs” syllabus developed from aviation. We believe this to be a key way forward as effective CRM training would bring to the surface the need for pre-agreed checklists, trigger action plans and responsibilities. It would also focus attention on the need for effective situational awareness based upon shared and

correct interpretation of gauge indications and other readings. One of the key issues to be resolved with the introduction of CRM into drilling will be “who is in the room” – the drill crew, the client, the specialist contractors, the onshore management?

Failure to act individually

While there are many instances of individual courage once the fire and explosions had begun, there are equally a number of instances where key individuals did not take emergency actions; for example shutting down systems, when they should have done. There may be a number of reasons for this: inadequate training and rehearsal, inadequate procedures or a fear of the consequences of acting in error. Regardless of the causes, in an emergency situation it is vital that each person discharges their emergency duties to the best of their abilities and without delay.

What constitutes a “demonstration” of readiness?

One emerging challenge for any regulator is what constitutes a “demonstration” that a crew are truly “emergency ready”. It is now clear that a demonstration by an organisation that it’s crew would recognise when to shutdown and would shutdown in an escalating event is a requirement. Historically a documentary demonstration (competence records, records of drills and procedures) would be sufficient. We must now take the view that the demonstration will need to provide a higher level of confidence and will require a more “real world” approach with the crew being “walked” much closer to the shut-down in more realistic scenarios.

end

HFC

Cross-cultural communication at an offshore service vessel

T. Sydnes, Høgskolen Stord/Haugesund; Assistant professor at Petro-Maritime Research Team; Assistant professor at Stord/Haugesund University College

Mere informasjon:

Seljestad, Heidi Westerheim; Ferkingstad, John; Sydnes, Tone; Kleppe, Gisle; Frette, Vidar. "Measuring behavior in complex maritime operations".(2010) Proceedings of Measuring Behavior 2010. 7th International Conference on Methods and Techniques in Behavioral Research (Eindhoven, The Netherlands, August 24-27, 2010). : Noldus Information Technology 2010 ISBN 978-90-74821-86-5. s. 382-384

Measuring behaviour in maritime operations

We have focused on bridge systems, in particular those that incorporate equipment for dynamic positioning (DP).

Main study

- The main study has been conducted in a simulator center which is connected to our maritime education.
- Qualitative and quantitative methods were employed.

Dynamical Positioning

- DP is a method to keep ships and semi submersible rigs in a fixed position using the propulsion systems instead of anchors.
- Like an autopilot on a plane, DP may operate without human interaction.
- Global Positioning System (GPS).

Cross cultural communication at an offshore sevice vessel

- Field study
- Through observation and interviews while the vessel carried out operations at a seabed oil installation, some of the requirements imposed on the operators were scrutinized.

The vessel

- Is designed for inspection, maintenance and repair (IMR).
- There were 3 DP operator stations.
- The vessel had 6 ROVs (Remotely Operated underwater Vehicles).
- During the field study, the vessel, owned and run by a Norwegian shipping company, was located at a large gas field on the Norwegian continental shelf, situated about 100 km off the coast of Norway and at 800-1100 m depth.

Personnel on the vessel

- 88 personnel on board
- 70 % English speaking
- Many actors and many companies involved, and thus good cooperation was essential.
- Marine officers: The captain, two chief officers-one British, one Norwegian.
- Two Fillipino DP operators and mates

Cross cultural cooperation

- Captain: *"All in all it is quite all right. On this vessel there has been about 12-13 nations represented at the same time. That is, the crew in general, not just the maritime personnel. You get used to it little by little. We depend on foreigners today, there are not enough norwegian sailors."*

Communication

- First officer:*"We are happy with the Phillipinos on board. Communication can be a challenge, though. The Phillipinos have an enourmous respect for the superior officers, and they do not always dare to tell you if they do not understand what you are saying".*
- *"Their English is good, but the grasp of the language may differ somewhat. We are very content with the Philippinos we have on board at the moment. But sometimes we get those on board who do not speakEnglish very well."*

Communication

- First officer. *"When you try to explain things to them, they nod and agree but they have not really grasped the essential point. This happens a lot. This is a challenge."*
- *"They do have a different culture and an enorumous respect for the superiors. Instead of asking what the captain really said, they do the opposite of what he has told them. They are so afraid of getting scolded which they are used to in their own more authoritarian culture."*

Communication

- The captain:*"Norwegians are different in this respect, they treat people more like equals."*
- *"It is a bit of a challenge if a foreigner should have a higher rank than the norwegians. We norwegians are a bit strange in this way. Norwegians want to be masters of their own ships."*
- *"It is difficult for Norwegians to be bossed around by Phillipinos. I do not mean this in a bad way. But this is the way it is."*

Communication

- Captain."*Personally I think people are worth what they know and can do. We have Phillipions, Japanese and other nationalities. I think we should work together."*
- *"I believe it is wrong to attack the Asians. We must separate job and culture. In general it works out ok. Asians are the most polite people in the world. They are not as loud mouthed as for instance Americans."*
- *"But we must be careful to take them aside if there is a problem we need to discuss with them. They demand that you do that. You must remember they work 3 months on."*

Act as mediators

- Captain:"*Then we officers on the bridge must act as mediators in the situation. The Phillipinos have a softer culture. They are more tender skinned than us. The Norwegians have more guts to fight back."*
- *"We have to protect the Phillipinos so that they do not get bullied around. I must tell them that* ***you*** *are in command of the ship and the maneuvering and watch them so they do not get outmaneuvered."*

Phillipino DPOs

- Overall content.
- Differences in contract and in schedule perceived by one as ”fair enough”.
- The other found this unfair.

Why exchange Norwegians with foreigners?

- A question of price.
- The recruitment positions disappear.
- Future uncertain for Norwegian sailors.

Differences in the British-Norwegian culture

- First officer: *”There is quite a difference culturally between us. If you had been on board here for some weeks to observe and then made a comparison with a ship with only Norwegians you would have noticed a big difference. There are a lot of English and Scottish people here. Mostly it is ok, but I do find the Norwegians to be more flexible.”*

Language

- First officer. *"I would actually prefer to work in a more Norwegian atmosphere, not least because of the language. I do struggle occasionally to find the right words in English, but all in all we get along fine."*

Control and interfering

- Captain: "*Really it gets to be too much control and interfering from the client's part when it comes to telling us how to run our DP operations, how to enter the 500 meter zone. I think what is in the contract to begin with takes care of the IMO(International Maritime Organization) demands and regulations. It frustrates us when the various clients introduce other demands almost on a whim."*

Proper guidelines

- Captain: "*One day like this and the next day like that. It is no problem if they want to raise the standard above the IMO regulations, but give us proper guidelines to begin with. If anything can get me stressed….We have had some heated discussions about these questions."*

Making decisions

- First officer: ”*They are afraid to make decisions independently. If something happens that are not according to procedure, they will want new revision of the procedures. Then we may stop the work 4-5 hours while they write new procedures. The Norwegians have a lot more flexibility.”*
- *”They are to a great extent managed from the top, they are too afraid to make decisions independently.”*

Conclusions

- Communication a challenge with the Phillipino DPOs due to language, cultural aspects like respect for authorities, a more humble approach to coworkers on the bridge.
- The Phillipino DPO’s overall content with being on this vessel. One DP resented the fact that they should have a different contract than the rest of the crew.
- The British clients perceived as bureaucratic and inflexible. A feeling of not cooperating well and working toward the same goal.

Nationality culture and work practice

- Implications for future research focusing on safety questions.
- Last year’s conference on Maritime safety focused on accidents on the Norwegian continental shelf.
- ”There are too many collisions and near misses on the Norwegian continental shelf ” Morten Meinich, leader of Maritime operations in Statoil.

Earlier studies

- Hansen et al (2002) discovered that foreigners (mainly) Phillipinos employed on board Danish merchant ships have a considerably lower recorded rate of accidents than their Danish colleagues on board.
- Gunnar Martin Lamvik and Rolf Bye (2006) compared the occupational accidents among Phillipinos and the Norwegian seafaring professional. The concept of national culture and work practice was used to explain the difference between the two groups.

Earlier studies

- Hansen et al (2002) discovered that foreigners (mainly) Phillipinos employed on board Danish merchant ships have a considerably lower recorded rate of accidents than their Danish colleagues on board.
- Gunnar Martin Lamvik and Rolf Bye (2006) compared the occupational accidents among Phillipinos and the Norwegian seafaring professional. The concept of national culture and work practice was used to explain the difference between the two groups.

HFC

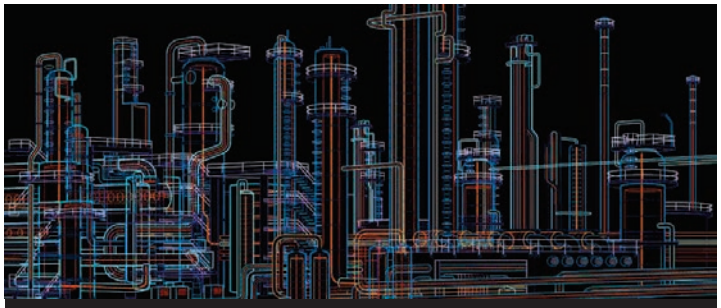
Quick and Dirty Ethnography as basis for User-Centered Design in Industry

Tone Grete Graven, ABB AS

Mere informasjon:
For brukergrensesnitt, se www.uie.com

Ellers – se:
"Vigilant Operators in Complex Environments: Ethnographic Study of Oil and Gas Operation" - K. Husøy, T.G. Graven, T. Enkerud - ABB Strategic R & D for Oil, Gas & Petrochemicals, Oslo, Norway, (e-mail: kristoffer.husoy, tone-grete.graven, torgeir.enkerud@ no.abb.com)

Abstract: This paper presents the results of a multi-site ethnographic study of control room operation practices in oil and gas plants. The study was conducted to obtain a better understanding of the real-life constraints and working conditions for the operators, and through this identify research areas to increase operator effectiveness. We found that the operators at all sites spend a large amount of cognitive effort on memorizing and mentally integrating information from various sources. The operators struggle to maintain their situation awareness, and this often results in trial-and-error methods for problem solving. Operational decisions are often based on immediate symptoms and heuristics, with little focus on rigorous exploration of alternatives. Based on our finding, we find several areas where better solutions are needed for information access and visualization.



Tone Grete Graven, ABB AS, HFC Forum 9-10 May 2012

Quick and Dirty Ethnography as basis for User-Centered Design in Industry

Agenda

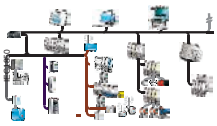
- Who are we?
- Why 'Ethnography'?
- Example obervations and analysis

+ India vs. Norway – some food for thought…

UCD @ T&I ABB OGP
Who are we?

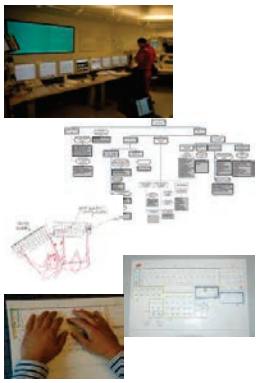
- User-Centered Design Group at Technology & Innovation, ABB Oil, Gas and Petrochemicals
- Activities:
  - Research & Innovation
    - Human-Machine Interaction and Information Visualization
    - Operational effectiveness; control room and IO support
  - User-Centered Design in product development
  - Best practice guidelines and styleguides, HMI and LSD specs and philosophies
  - & more….

UCD @ T&I ABB OGP
Why use Ethnography?



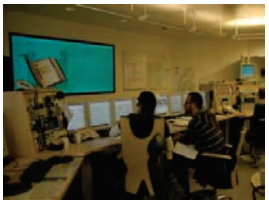
- Applying user-centered design methods helps make the product safe, efficient and easy to use.
- As basis for innovation we need knowledge about:
  - the domain
  - the system
  - the user
  - the business

UCD @ T&I ABB OGP
Methods



- *Field studies; 'quick & dirty ethnography'*
- Task Analysis
- Requirement Analysis
- Focus Groups/Workshops
- Expert Interviews
- Heuristic Evaluation
- Prototyping
- User tests
- & more….

Field Studies



- Performed by designers and system/domain experts
- *When teams have the right information, the job of designing a powerful, intuitive, easy-to-use interface becomes tremendously easier.**
- *The most powerful tool in the toolbox is the 'field study'. Field studies get the team immersed in the environment of their users and allow them to observe critical details for which there is no other way of discovering.**

* from User Interface Engineering http://www.uie.com/

Field Studies 2007-2009
Goal

- Goal:
  - To generate new ideas and prioritize areas of focus for future research and development on human-system interaction for industrial process control.
- Focus of study:
  - Learn how operators use, and interact with, the control system
  - Learn about their information need during daily operation as well as during plant upsets
  - Learn about differences between different types of production sites and different cultures

Field Studies 2007-2009
Data Collection

- 3 sites in Norway, 2 in India
- Offshore oil production, refinery and gas processing plants
- Participant observation and interviews
- 3-4 days on each site
- Focus on control room operators
- Focus on normal operation (not on maintenance or safety/emergency)
- Aimed to follow 3 different shifts at each site (sometimes only managed two)

Observations
Situation Awareness and Detection of Abnormal Situations

- Alarm system important, however, most alarms are known, or due to on going work at plant
  - “Is somebody working on X?”…
- Continuous browsing through graphics, looking for changes, but graphics are not design to support detection of changes
- Mental comparison with normal values and constraints set by production plan

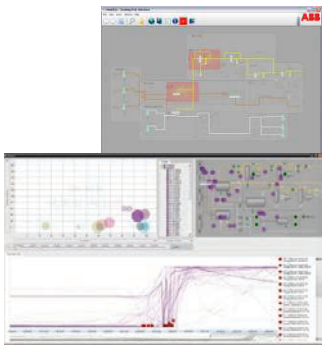
Observations
Cognitive Load

- Experience from field important
- Operators memorize large amounts of reference values, tag numbers, location in plant, maintenance status etc.
- Ability to memorize increase with experience; less experience operators use various memory aids
- Multi-tasking & prioritization of tasks
- Log book (or shift log) and production plan (‘the bible’) are very important sources of information

Observations
Collaboration and Decision Making

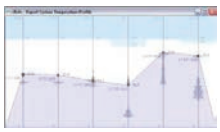
- Highly collaborative work
- Drilled response or based on experience:
  1. Have I experienced something similar before
  2. Ask others
  3. Trial-and-error or Investigate
- Focus on symptoms; finding root cause of limited interest
- Reactive operation

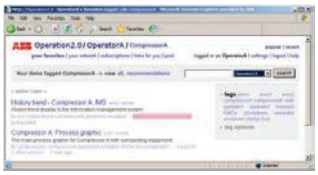
Discussion
Maintaining Situation Awareness



- Visualization methods that support detection of changes are needed
- Better integration of alarm and process information
- Information of on going field work integrated in graphics

Discussion
Decision Making

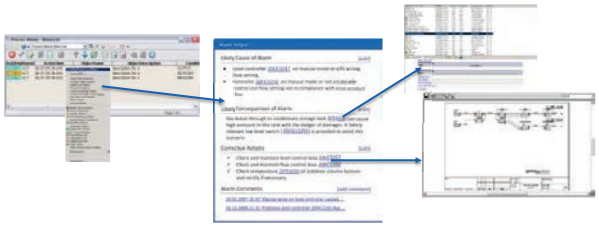




- How can we ensure operators base decisions on full understanding the situation and not on ‘best guesses’?
  - Process knowledge is vital.
  - Visualization of interrelations in process
  - Knowledge sharing solutions and procedural support integrated in workplace.
  - Abstract overviews of plant information; is this really the future?

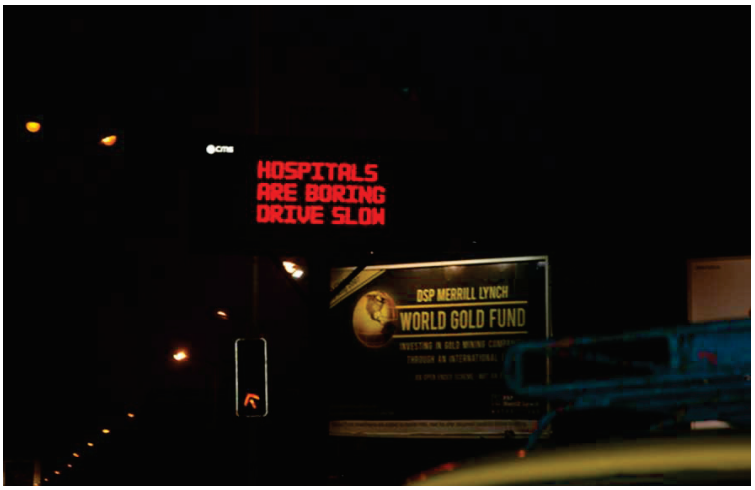
Discussion
Cognitive Load

- Can memory load be reduced by externalizing more of the information in the operator user interface?
- Integrate information from production plan, references values, process constraints and procedural information in the process graphics.



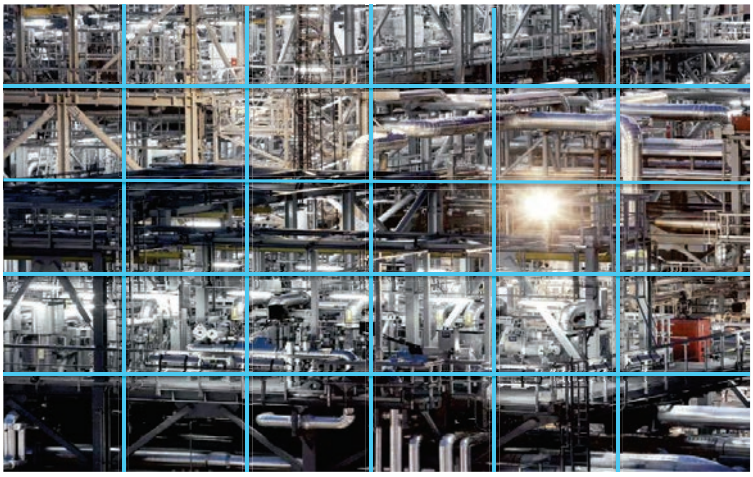
Norway vs. India

Building a Safety Culture



Automatic or Manual Control?

Areas of responsibility



Power and productivity
for a better world™

HFC

Human Factors across the North Sea

Presented by: Linda J. Sørensen, Consultant, Human Factors and Ergonomics Scandpower AS

Mere informasjon:

- Sorensen, Stanton and Walker (2010), Studies and Models of Command and Control, HFI DTC, BAE Systems, Aldershot.

- Stanton, Walker and Sorensen (2012) It's a small world after all: contrasting hierarchical and edge networks in a simulated intelligence analysis task. Ergonomics, 55, 3, p. 265-281.

- Walker, Stanton, Salmon, Jenkins, Rafferty and Bessell (2009). Beyond NEC. HFI DTC, BAE Systems, Aldershot.

Overview

- ”Preaching to the choire”
- It’s a small world – teams and team organisation
- Implications of team dynamics
- Conclusions

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

Scandpower representation

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

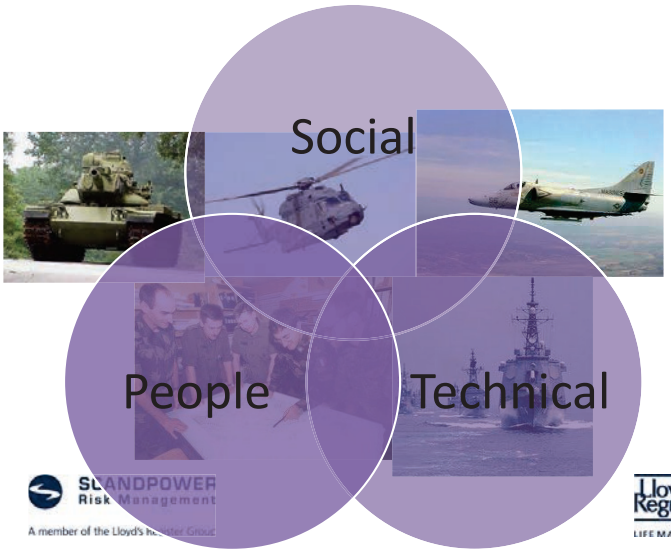
Preaching to the choire

What is human factors?

- HF discovers and applies information about human behaviour, abilities, limitations, and other characteristics to the design of tools, machines, tasks, jobs, and environments (Sanders and McCormick, 1993)
- HF is that branch of science which seeks to turn human-machine antagonism into human-machine synergy (Hancock, 1997)
- HF strives to improve the safety and usability of systems, tools, products and environment for human use (Cooke and Salas, 2007)

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

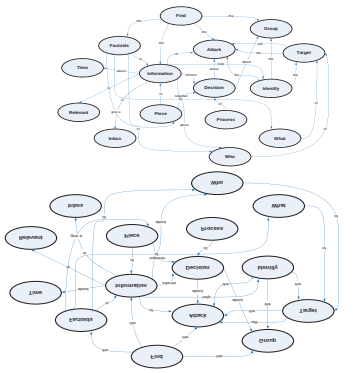


Teams

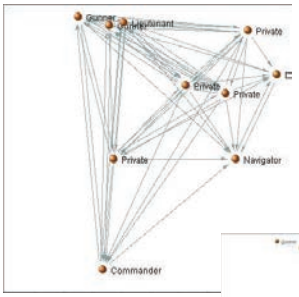
- There is safety in numbers
- Improved thinking and increases in creativity
- More than their individual parts
- Teams in safety critical environments

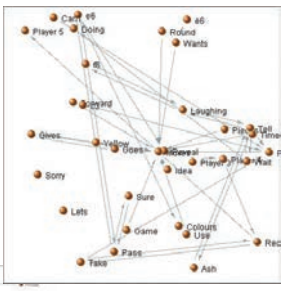
Understanding teams

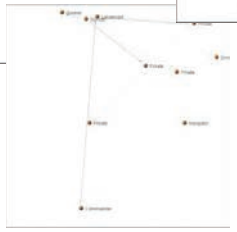
- A systems approach to Situation Awareness (SA)
- SA described as: *"a dynamic and collaborative process binding agents together on tasks" (Stanton et al., 2006)*
- Emergent property – arises from team members' interaction with each other and artefacts in the world
- Communication plays a critical role in developing SA in teams



Teams differ

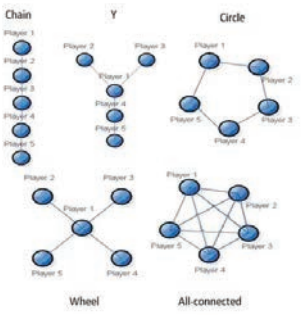






A case study

- Experiment to test the assumption that Distributed SA (DSA) and performance is correlated
- That the relationship is mediated by organisational structure



SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

Analysis

Performance

- The number of red players and non-red players which were taken in games
- Used signal-detection theory to calculate 'hit rates'

Distributed SA

- Knowledge networks has been suggested as a way of representing systems understanding
- Categorised concepts as relevant or irrelevant

Correlations

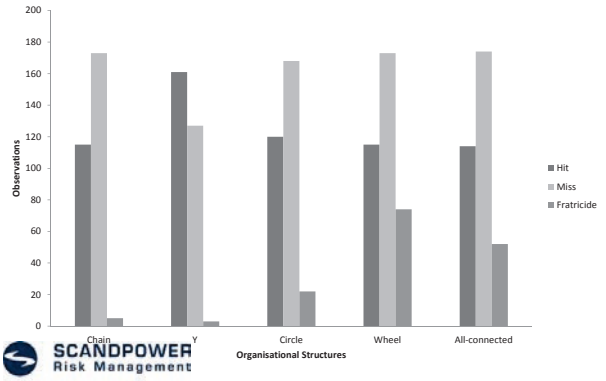
- Target rate by Distributed Situationally Relevant concepts
- Fratricide rate by Distributed Situationally Relevant concepts

		Player classification: Red	Player classification: Non Red
Action: Taken		Hit	Fratricide
Action: Not Taken		Miss	Fratricide Opportunities

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

Performance – hit, miss, fratricide



SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

Performance – rates calculated

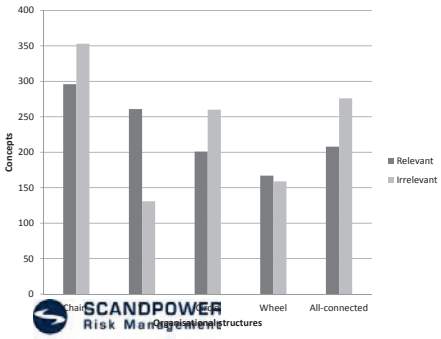
	Target Rate	Fratricide Rate
Chain	0.39	0.02
Y	0.56	0.01
Circle	0.41	0.07
Wheel	0.40	0.20
All-connected	0.39	0.15

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

Distributed SA

Relevant and irrelevant concepts

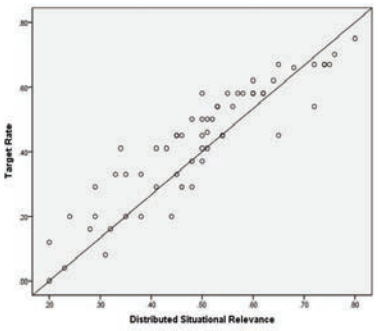


Distributed Situationally Relevant (DSR) ratio

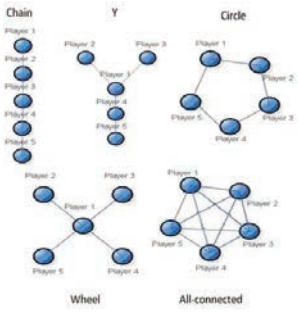
	DSR
Chain	0.45
Y	0.66
Circle	0.43
Wheel	0.51
All-connected	0.42

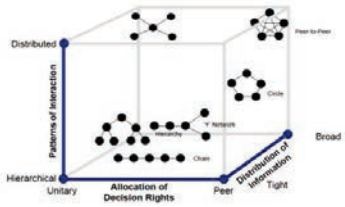
Correlations

- A strong positive correlation found between target rate and distributed situational relevance (r=0.923, P<0.001).



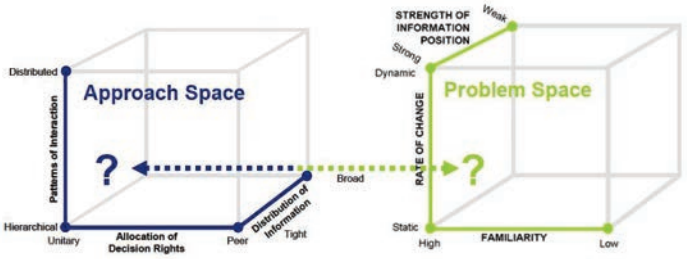
Teams as barriers





- Sorensen, Stanton and Walker (2010), Studies and Models of Command and Control, HFI DTC, BAE Systems, Aldershot.
- Stanton, Walker and Sorensen (2012) It's a small world after all: contrasting hierarchical and edge networks in a simulated intelligence analysis task. Ergonomics, 55, 3, p. 265-281.
- Walker, Stanton, Salmon, Jenkins, Rafferty and Bessell (2009). Beyond NEC. HFI DTC, BAE Systems, Aldershot.

Is there an optimal fit between structure and task?



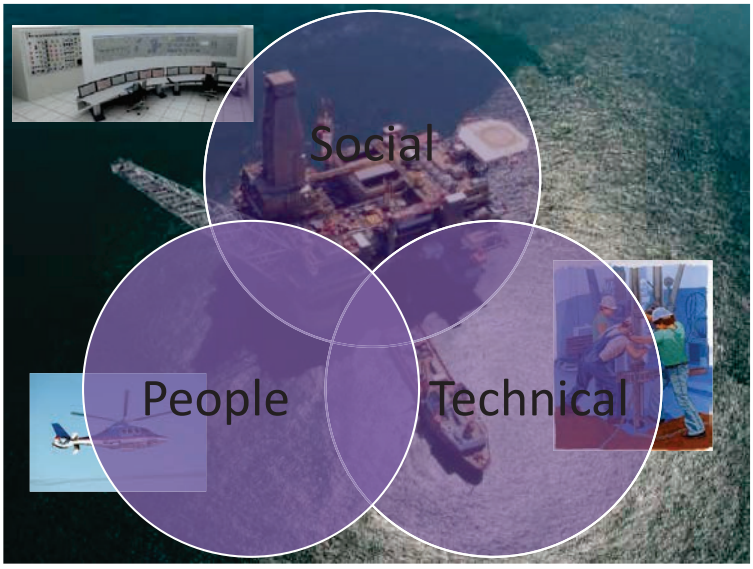
Predictions

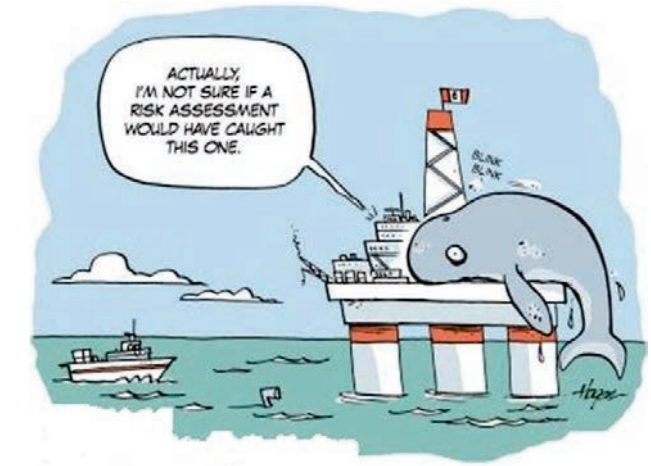
Rate of Change	Strength of Information Position	Familiarity	Moves	Red Taken	Workload	Trust	Cohesion
Dynamic	Weak	Unfamiliar					
		Familiar					
	Strong	Unfamiliar					
		Familiar					
Static	Weak	Unfamiliar					
		Familiar					
	Strong	Unfamiliar					
		Familiar					

Rate of Change	Strength of Information Position	Familiarity	Command Intent	Freq of Comms	Situation Relevance	Predicted
Dynamic	Weak	Unfamiliar				
		Familiar				
	Strong	Unfamiliar				
		Familiar				
Static	Weak	Unfamiliar				
		Familiar				
	Strong	Unfamiliar				
		Familiar				

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS





SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

For more information, please contact:

Linda J. Sørensen
Consultant, Human Factors and Ergonomics

Scandpower AS

T 95 45 01 07
E lso@scandpower.com
W www.scandpower.com
www.lr.org

SCANDPOWER Risk Management
A member of the Lloyd's Register Group

Lloyd's Register LIFE MATTERS

INVITASJON

Human Factors in Control

9.-10. mai
2 0 1 2

Human Factors i et internasjonalt perspektiv

8.mars

Kjære deltaker.
Vi vil med dette invitere til møte i HFC-forum (Human Factors in Control). Tema for møtet vil være "Human Factors i et internasjonalt perspektiv" hvor vi ser på utfordringer og god praksis knyttet til områder som sikkerhet, effektivitet og samarbeid mellom forskjellige land. Vi har lagt opp til en paneldiskusjon med tema "*HF across borders – Challenges to face".* Vi har innlegg fra det tekniske universitet i Delft, Sintef, Ptil, Propel, Health and Safety Executive - UK, Høgskolen i Stord/Haugesund (HSH), ABB og Scandpower.

Møtet holdes onsdag 9. og torsdag 10.mai 2012 i Oslo, på Radisson Blu Plaza Hotel, i 33.etg, møterom Oslofjord. Vi starter kl 11:00 onsdag med lunsj og avslutter etter lunsj på torsdag.

Vi har også reservert rom på Radisson Blu Plaza Hotel. Frist for beskjed om rombestilling er 16.april, for å sikre at dere får rom på hotellet. Dere kan ta kontakt direkte til hotellet via hotellets call senter på tlf 02525 eller via websiden: www.radissonblu.no/plazahotell-oslo., opplys da om at det gjelder HFC forum. Vi kan også bestille rom for dere – kryss da av på siste side.

Programmet i grove trekk
Foredrag holdes bl.a. av: P. Hudson professor "Human factor in safety" ved T.U. Delft; R. Miles "lead on the topic of human and organisational factors" fra "offshore division of the HSE"; G. Lamvik fra SINTEF, J. Tharaldsen fra Ptil, T. Soma fra Propel, T. Sydnes fra HSH, T.G. Graven fra ABB og L. Sørensen fra Scandpower.

Visjon og hovedoppgave for HFC forumet
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 vil også benytte anledningen til å minne om kurset "MTO-Human factors" ved UiS som går høsten 2012, og NTNU kurset "Introduksjon til Human Factors, metoder og teorier med eksempler fra integrerte operasjoner. " -våren 2012, se videre.ntnu.no

Vennlig hilsen
Arne Jarl Ringstad /Statoil, Atoosa P-J Thunem/IFE, Mark Green/HCD, Koen van de Merwe /DNV og Stig Ole Johnsen/SINTEF.

Vær vennlig og returner registreringen innen 30.april 2012 til:
jannicke.neeb@hrp.no, IFE (FAX: 69 21 24 90)

HFC Møte

AGENDA

9. til 10. mai
2 0 1 2

Human Factors i et internasjonalt perspektiv

Oslo, Radisson Blu Plaza Hotel 33.etg Oslofjord

Dag 1	Innlegg og diskusjon	Ansvar
11:00-12:00	Registrering	
11:00-12:00	Lunsj i 34.etg	
12:00-12:30	Velkommen	
12:30-13:15	Identifying the roles of individuals, organizations, company culture and regulators in accident prevention	P. Hudson/TU Delft
13:15-13:45	Diskusjon/Pause	
13:45-14:15	Forholdet mellom kulturforskjeller, arbeidspraksis og sikkerhet. Eksempler fra offshore- og sjøfartsindustrien.	G. Lamvik/Sintef
14:15-14:45	Perspectives on safety: The impact of group membership, work factors and trust on safety performance in UK and Norway	J. Tharaldsen /Ptil
14:45-15:30	Diskusjon/Pause	
15:30-16:00	Human and organisational factors - what can be learned from international shipping	T. Soma/Propel
16:00-16:15	Diskusjon/Pause	
16:15-17:00	HF across borders – Challenges to face - panel discussion (Chaired by M. Green)	Panel: P. Hudson, R. Miles, J. Tharaldsen og N. Suparamaniam-Kallerdahl.
18:30	Buss til middagen	
19:00	Middag på Ekebergrestauranten	

Dag 2	Innlegg og diskusjon	Ansvar
08:30-09:00	Kaffe og noe å bite i	
09:00-09:45	Managing risk – international lessons from the loss of the Deepwater Horizon platform	R. Miles/HSE-UK
09:45-10:00	Diskusjon/Pause	
10:00-10:30	Cross-cultural communication at an offshore service vessel	T. Sydnes/HSH
10:30-10:45	Diskusjon/Pause	
10:45-11:15	Quick and dirty ethnography as basis for user-centered design in industry	T.G. Graven/ABB
11:15-11:30	Diskusjon/Pause	
11:30-12:00	England vs. Norway: HF across the North Sea	L. Sørensen/Scandpower
12:00-12:30	Avsluttning, oppsummering og evaluering	
12:30-13:30	Lunsj i 2.etg, Gaio/Lakata	

REGISTRERING

Human Factors in Control

9. til 10. mai
2 0 1 2

Oslo - Radisson Blu Plaza Hotel

Human Factors i et internasjonalt perspektiv

Ja, jeg vil gjerne delta:

Navn: __ _____

Tittel / stilling: ____ _____

Organisasjon: ___ _____

Adresse: __ _____

Kryss av for:

__ Lunsj 9/5, __ Middag 9/5, __ HFC bestiller hotellrom for meg 9/5 __ Lunsj 10/5

Tlf. : _____ evt. Fax: _____

E-post: _____

Hvem faktureres (PO-Nr/Bestillingsnr/Referansenr:)_____

For å være med må man betale inn medlemsavgift eller møteavgift, som dekker lunsj, middag og kopi av presentasjonene som holdes samt annet relevant materiale.
Medlemsavgiften er pr år:
- 25.000 for bedrifter med mer enn 15 ansatte (dekker 3 deltakere)
- 12.500 for bedrifter med mindre enn 15 ansatte (dekker 2 deltakere)

Møteavgiften er pr møte:
- 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 30.april 2012 til:
jannicke.neeb@hrp.no, IFE (FAX: 69 21 24 90)