| HFC - forum for human factors in control | HFC Forum 19-20.April 2006 |
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| Postadresse: 7465 Trondheim<br>Besøksadresse: S P Andersens veg 5<br>7031 Trondheim<br>Telefon: 73 59 03 00<br>Telefaks: 73 59 03 30 | SAK, FORMÅL<br>**Presentasjoner og deltakerliste fra HFC Forum møte 19-20.April 2006**<br>ORIENTERING<br>Går til<br>Møtedeltakerne i HFC forum — X |

| PROSJEKTNR. | DATO | SAKSBEARBEIDER/FORFATTER | ANTALL SIDER |
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| | 2006-05-10 | Stig O. Johnsen | 143 |

Vi vil med dette sende ut agenda, presentasjonene og deltakerliste fra HFC forum møtet den 19-20. April i Halden og minne om neste møte den 25-26. Oktober.

Oppdatert aksjonsplaner og innspill fra deltakerne vil diskuteres i referansegruppemøtet i mai/juni og deretter sendes ut til deltakerne i møtet. (Løpende kommentarer kan sendes til HFC@Sintef.no eller CRIOP@sintef.no. Materialet vil legges ut på http://www.hfc.sintef.no).

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# Leading Indicators of Safety In Virtual Organizations

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# Leading Indicators of Safety In Virtual Organizations

## 1. Introduction

A primary purpose in measuring safety is to develop intervention strategies to avoid future accidents. Recognizing signals before an accident occurs offers the potential for improving safety, and many organizations have sought to develop programs to identify and benefit from alerts, signals and prior indicators. A recent study by the U.S. National Academy of Sciences focused on these signals, the conditions, events and sequences that precede and lead up to accidents, or the "building blocks" of accidents (Phimister, Bier, & Kunreuther, 2003, p.6):

> *In the aftermath of catastrophes, it is common to find prior indicators, missed signals, and dismissed alerts, that, had they been recognized and appropriately managed before the event, might have averted the undesired event. Indeed, the accident literature is replete with examples, including the space shuttle Columbia (Columbia Accident Investigation Board, 2003), the space shuttle Challenger (Vaughan, 1996),Three Mile Island (Chiles, 2002), the Concorde crash (BEA, 2004), the London Paddington train crash (Cullen, 2000) and American Airlines flight 587 to Santo Domingo (USA Today, May 25, 2003), among many others (Kletz, 1994; Marcus & Nichols, 1999; Turner & Pidgeon, 1997).*

In this paper, we address the challenge of identifying and evaluating leading indicators of safety in virtual organizations--organizations comprised of multiple, distributed members, temporarily linked together for competitive advantage, that share common value chains and business processes supported by distributed information technology (Davidow and Malone, 1992; Mowshowitz, 1997; Kock, 2000). Examples of virtual organizations in which risk mitigation processes are critical include health maintenance systems of doctors in widely dispersed managed care environments, medical societies, and electronically-linked members of Physicians On-Line (Physicians On-Line/Medscape, 2006); fire and emergency medical services units providing support in large-scale disasters (Weick, 1993; 1996); oil spill response teams responding to oil spills of national significance (Harrald, Cohn, & Wallace, 1992; Grabowski, Harrald & Roberts, 1997); aerospace conglomerates jointly developing mission- and safety-critical applications (Augustine, 1997; Spotts & Castellano, 1997); international oil exploration consortia merging in the North Sea (Herring, 2002) and developing oil fields in the Caspian Sea (*Oil and Gas Investor*, 2003), global telecommunications alliances providing 99% of the world's inter-bank financial transactions (SWIFT, 2006), offshore oil and gas exploration and drilling in Norway (Gulbrandsoy, Hepso & Skavhaug, 2002), and Danish offshore wind farm management consortia (Andersen & Drejer, 2005).

Risk in systems can exist because one or more components in the system are risky, or it can result from components that are themselves relatively safe, but interact in ways that increase risk. Perrow (1984) discusses such risk propensities at length, but generally for smaller systems than those that can be imagined as virtual organizations. Here we use the commonly used engineering definition of a risky event as one that is low probability but high consequence (e.g. Wenk, 1982).

Virtual organizations and systems of organizations are of increasing interest to systems and organizational researchers. The literature on inter-organizational alliances offers one paradigm for studying organizational systems (Barrett & Konsynski, 1982; Cash & Konsynski, 1985; Johnston & Vitale, 1988; Hagedoorn, 1993; Benasou &

Venkatraman, 1995), as does the literature on network organizations (Powell, 1990; Miles & Snow, 1992; Nohria & Eccles, 1992). More recently, researchers have begun to examine systems of organizations (e.g. Uzzi, 1997; Eisenhardt & Schoonhaven, 1996), and risk propensities in large-scale systems have received empirical attention (Perrow, 1984; Pauchant & Mitroff, 1992; Sagan, 1993; Vaughan, 1996; Grabowski & Roberts, 1996; 1997; 1999). The efficiency, effectiveness and trustworthiness of virtual organizations has also been the subject of recent research (Staples, Hulland and Higgins, 1999; Kasper-Fuehrer & Ashkanasy, 2001; Morris, Marshall & Rainer, 2002).

In this paper, we draw on research on high reliability organization (HRO's) (LaPorte, 1982; Roberts, 1990); risk, safety and leading indicator research (Shrivastava, 1986; Wildavsky, 1988; Sagan, 1993; Vaughan, 1996, Mearns, Whitaker & Flin, 2001, 2003; Phimister, Bier & Kunreuther, 2003); research on network organizations (Powell, 1990; Nohria & Eccles, 1992; Jarillo, 1988; Thorelli, 1986) and inter-organizational systems (Barrett & Konsynski, 1982; Johnston & Vitale, 1988; Konsynski & McFarlan, 1990); and virtual organization research (Davidow and Malone, 1992; Goldman, Nagel & Preiss, 1995; Preiss, Goldman and Nagel, 1996; Staples, Hulland & Higgins, 1999; Kock, 2000; Morris, Marshall & Rainer, 2003) in our exploration of leading indicators of safety in virtual organizations. We begin by discussing risk propensity in virtual organizations, and examine in detail characteristics of virtual organizations important to enhancing safety. We then discuss research to identify leading indicators of safety in virtual organizations, and conclude with a discussion of next steps and suggestions for how thoughtful management of leading indicators can enhance safety.

# 2. Risk Propensity in Virtual Organizations

The major distinction between virtual and other organizations is that the former are networked (usually electronically) organizations that transcend conventional organizational boundaries (e.g. Barner, 1996; Berger, 1996; Mowshowitz, 1997). The bonds among members of virtual organizations are temporary, and virtual organizations are noted for forming and dissolving relationships with other members of the virtual organization (e.g. Palmer, Friedland & Singh, 1986; Bleeker, 1994; Nohria & Berkley, 1994; Coyle & Schnarr, 1995). The traditional advantages attributed to virtual organizations include adaptability, flexibility, and the ability to respond quickly to market changes.

Although members of virtual organizations may occasionally meet face-to-face as well as electronically, members are not co-located, and virtual organization success hinges on shared, interdependent business processes that are designed to achieve shared business objectives. Virtuality thus has two features: the creation of a common value chain among the distinct entities of the virtual organization (Benjamin & Wigand, 1995; Rayport & Sviokla, 1995), and business processes supported by distributed information technology (Palmer & Speier, 1997; Kumar, 2001). Virtual organizations are distinguished from traditional network organizations by the temporary linkages that tie together the distinct organizations, and by the members' shared business processes and common value chains supported by distributed information technology. Network organizations, in contrast, generally establish more permanent linkages between members, and generally do not create shared value chains and interdependent business processes between members, as virtual organizations do.

Research shows that risk propensity in traditional organizations has its roots in a number of factors (Wenk, 1982; Perrow, 1984, National Research Council, 1996; Grabowski & Roberts, 1996; Tenner, 1996; Vaughan, 1996). One cause of risk is that the activities performed in the system are inherently risky (e.g. mining, medicine, manufacturing, airline transportation); another is that the technology is inherently risky, or exacerbates risks in the system (e.g. drilling equipment, high speed engines, nuclear propulsion systems). Yet a third cause is that the individuals and organizations executing tasks, using technology, or coordinating both can propagate human and organizational errors. In addition, organizational structures may encourage risky practices or encourage workers to pursue risky courses of action (e.g. lack of formal safety reporting systems or departments in organizations, or organizational standards that are impossible to meet without some amount of risk taking). Finally, organizational cultures may support risk taking, or fail to sufficiently encourage risk aversion (e.g. cultures that nurture the development of "cowboys" who succeed by taking risks, or of management practices that encourage new generations of risk takers) (Grabowski & Roberts, 1996).

Virtual organizations are characterized by several of the same factors that determine a traditional organization's risk propensity. Tasks executed by members of the virtual organization, although distributed, may still be inherently risky (e.g. oil exploration, fire fighting, eye surgery), as in traditional organizations. Technology used to execute the virtual organization’s tasks may also be inherently risky (e.g. drilling equipment, interacting chemicals, lasers, or infrared equipment). Human and organizational error can continue to propagate in virtual organizations as long as humans and organizations are a part of them. Organizational structures in virtual organizations may make risk mitigation difficult (e.g. virtual management structures can reduce physical oversight and contact, and organizational relationships presumably based on shared commitments to safety may not be equally shared among members of a virtual organization). Finally, organizational cultures may send confusing or contradictory messages to members about risk tolerance in the virtual organization (e.g. safety bulletins that celebrate the number of accident free days while the virtual organization simultaneously rewards workers for flaunting safety practices and "living on the edge").

However, risk propensity in virtual organizations has some interesting differences. Because virtual organizations are distributed, networked organizations with fluid and shared business processes, risk in the virtual organization can migrate between organizational members, making risk identification and mitigation difficult. Because virtual organizations are comprised of members with their own individual goals, policies, and cultures, and because the members are bound in temporary alliances that reflect changing marketplace opportunities, developing a shared culture of reliability and shared commitments to reliability goals is difficult, as the presence of simultaneous interdependence and autonomy creates an inherent tension in the virtual organization. Finally, because virtual organizations are large scale organizations with complex interactions between their members, precipitating incidents and accidents may have long incubation periods, making identification of a leading error chain difficult (Grabowski & Roberts, 1997; 1999). These risk propensities can provide important clues about effective risk mitigation in virtual organizations, and important motivation for examining leading indicators of safety in virtual organizations.

# 3. Leading Indicators

Safety performance has traditionally been measured by ‘after the loss’ type of measurements such as accident and injury rates, incidents and dollar costs. However, there is a growing consensus among safety professionals and researchers that lagging indicators, which means that an accident must occur or a person must get injured before a measure can be made, may or may not provide the necessary insights for avoiding future accidents. A low reported accident rate, even over a period of years, is no guarantee that risks are being effectively controlled, nor will it ensure the absence of injuries or accidents in the future (Lindsay, 1992).

*Leading indicators,* one type of accident precursor, are conditions, events or measures that precede an undesirable event and that have some value in predicting the arrival of the event, whether it is an accident, incident, near miss, or undesirable safety state. Leading indicators are associated with proactive activities that identify hazards and assess, eliminate, minimize and control risk (Construction Owners Association of Alberta, 2004). Lagging indicators, in contrast, are measures of a system that are taken after events, which measure outcomes and occurrences.

Examples of leading indicators include near hit reporting in anesthesia management (Pate-Cornell, 2003), accident precursor assessment programs in nuclear safety (Sattison, 2003), and hazard identification and analyses for offshore oil and gas in the United Kingdom (Step Change in Safety, 2004). Examples of lagging indicators include recordable injury frequencies, lost time frequencies, total injury frequencies, lost time severity, vehicle accident frequencies, workers' compensation losses, property damage costs, and numbers and frequency of accident investigations (Construction Owners Association of Alberta, 2004).

Leading and lagging indicators differ by granularity and focus, as seen in Figure 1 (Bergh, 2003). Leading indicators are primarily focused at the individual and perhaps departmental level. In contrast, lagging indicators are broader in scope and generally focus on organizational measures. Lagging indicators are seldom focused on individual performance; similarly, leading indicators are most often focused on small units of analysis (i.e., at the individual, group or departmental level). These differences have important implications for data collection, analysis and measurement of leading indicators.

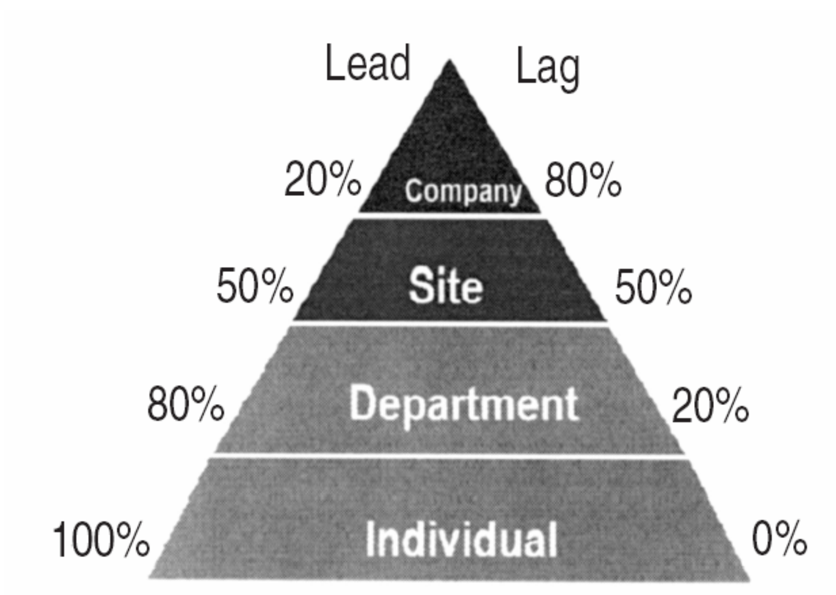


**Figure 1**
**Units of Analysis for Leading and Lagging Indicators (Bergh, 2003)**

Figure 1 also suggests the notion of shared leading and lagging indicators within the same organization or domain, ideas echoed by Bergh (2003), Petersen (1998), and Step Change in Safety (2004). Thus, both leading and lagging indicators coexist within the same domain, although they can be expected to focus on different units of analysis within that domain.

## Indicator Characteristics

The links or associations between signals or indicators in a system and the onset of adverse events may take a variety of forms. Some indicators may precisely herald the onset of an adverse event in a predictive way; other indicators may be direct causes of adverse events. In either of these cases, the links or associations between indicators and events are direct, visible and demonstrable. An individual's presence could be an indicator, for instance; one such example of a causal link between an indicator and an adverse event is the recent case where a nursing home attendant was convicted of administering lethal doses of medications to patients in the home. The signal and cause were the presence of the attendant; the adverse event was clearly the death of the nursing home residents.

Historical accident analyses, however, reveal that accident causes are more often the result of interactions between interdependent elements in complex, high hazard systems (Perrow, 1984). Investigations into the dynamics of system interdependence and complexity are still the focus of much on-going research (Sagan, 2004). Thus, several indicators or signals can be correlated with the onset of an adverse event. These correlations might be links between single indicators and adverse events, or between groups or clusters of indicators and adverse events. Examples of correlations between leading indicators and adverse events include links between electrical system defects and main propulsion system failures. Examples of correlations between groups of leading indicators can be seen in links between large numbers of port state detentions, structural failures and substance abuse problems within a shipping company and an operational failure (Soma, 2005). Some indicators may serve as *proxies* or surrogates for other indicators. Proxy or surrogate indicators are substitutes or approximations for leading indicators; they are more easily measured, captured or analyzed than are the true leading indicators, and they have predictive associations with adverse events. Clusters and groups of indicators have also been used to develop *risk indices* to categorize and rank leading indicators of risk in a system. Each of these different types of relationships between indicators and adverse events can be considered in analyses of leading indicators for virtual organizations.

## Previous Work with Leading Indicators

Leading indicators have been studied in many types of systems, with widely varying results (Leveson, 1995; Hollnagel, 1998). Many economic systems, including the U.S. economy, use composite indexes and economic series with leading, coincident, and lagging indicators of economic performance (Conference Board, 1997; 2004). In economic systems, leading indicators are those indicators that tend to shift direction in advance of a business cycle. Coincident economic indicators, such as employment and production, are broad series that measure aggregate economic activity, and thus define the business cycle. Lagging indicators tend to change direction after the coincident series.

In economic systems, lagging indicators are used to confirm turning points and to warn of structural imbalances in the economy.

Over the past thirty years, the medical community has developed increasingly sophisticated leading indicators of health in the United States. Initially, these efforts focused on identifying predictors of individual mortality; recently, the focus has shifted to include identifying leading indicators for improving the nation's health (Chrvala & Bulger, 1999), echoing the notion from the previous section that leading indicators can be individually and broadly focused within the same domain. The electric power industry has also evaluated the predictive validity of leading indicators of individual and group safety and performance in nuclear power plants (Gross, Ayres, Wreathall, Merritt, & Moloi, 2001; Ayres & Gross, 2002).

Some industries, such as aviation, have a relatively long history of seeking to identify leading indicators; others, such as blood banks and hospitals, are relative newcomers to the field. Nevertheless, each field uses similar information-gathering processes and weighs common design choices (Tamuz, 2003). Some of these industries discovered accident precursors based on their common experiences, such as having to draw on small samples of accidents (March, Sproull & Tamuz, 1991), while other industries developed signal detection programs as a result of learning by imitation (Levitt & March, 1988), such as medicine's Patient Safety Reporting System, which drew on aviation's experience with its Aviation Safety Reporting System (Tamuz, 2003). It is worthwhile noting that, although very little predictive validity has been provided with the use of leading indicators, attempts still continue to identify and validate such measures in a variety of safety- and mission-critical industries. One such example is given in the following section, where a pilot study to identify a framework for leading indicators in marine transportation is described.

# 4. Pilot Study: Leading Indicators for Marine Transportation

A pilot study was undertaken in 2004 to identify, evaluate and analyze a set of leading indicators of safety for marine transportation. Initially, the focus of the project was on domestic U.S. tanker operations. It was thought that such a pilot study could serve as the foundation for a broader study of leading indicators in virtual organizations, such as international shipping organizations, as well as remote offshore oil and gas operations.

Previous work in leading indicators suggests that the process of identifying leading indicators involves two steps: first, identifying significant safety factors, and second, identifying suitable metrics or leading indicators that correlate with the safety factors (Khatib-Rahbar, Sewell, & Erikson, 2000; Sorensen, 2002). In this pilot study, an expert elicitation technique, referred to as Value Focused Thinking, was utilized in order to identify significant safety factors in marine transportation. The initial safety factor structure elicited is shown in Figure 2 (Merrick, Grabowski, Ayyalasomayajula & Harrald, 2005).

Figure 2 illustrates each of the safety factors thought important by key decision makers in the pilot study's industry partner organization. The senior management team identified that hiring quality personnel, providing safety orientation, promoting safety through top management commitment, and developing a formal learning system were critical to improving an organization's safety culture. The vessel management team identified that responsibility, communication, problem identification, problem prioritization and a feedback system aboard the vessel were critical to improving a vessel's safety culture. Similarly, the safety, health and environmental team identified that individual empowerment, responsibility, and systems for anonymous reporting and feedback were essential to improving an individual's safety attitude. The items elicited in the expert elicitation sessions thus represent the initial safety factor structure.

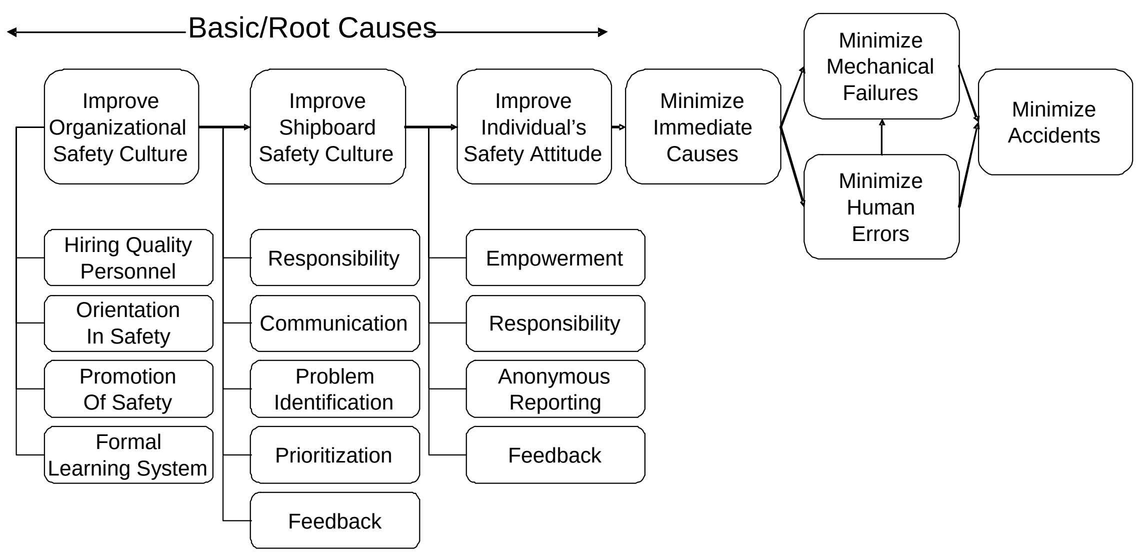


**Figure 2. Initial safety factor structure**

Figure 3 shows the research model constructed from the Figure 2 safety factors (Merrick, et al., 2005). The independent variables in the boxes to the left were derived from the expert elicitation sessions; the dependent variables listed under "Safety Performance" in the boxes on the right hand side of Figure 3 represent measures of safety performance commonly used in marine transportation (Mearns, et al., 2001; 2003; Soma, 2005). Each arrow in Figure 3 represents a causal relationship. For example, an improvement in organizational safety is hypothesized to lead to an improvement in vessel safety culture and an improvement in individual safety attitudes.

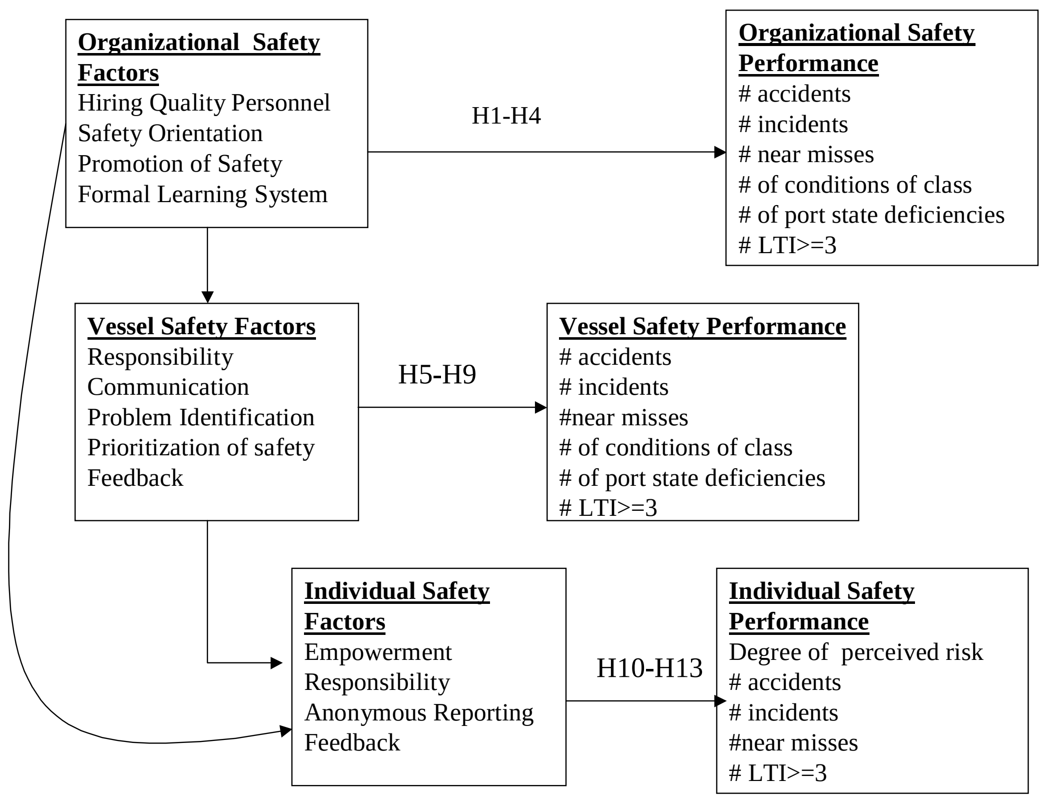


**Figure 3. Research Model for Safety Factors for Marine Transportation**

**H1 through H13 refer to hypotheses in the research model (Table 1)*

The research model hypothesized that improvements in safety performance can be linked causally to the organizational, vessel and individual safety factors. The organizational safety factors--Hiring Quality Personnel, Safety Orientation, Promotion of Safety and Formal Learning System—were proposed to influence the safety performance of organizations. Similarly, the vessel safety factors and individual safety attitudes were hypothesized to influence the safety performance of vessels and individuals, respectively. The hypotheses associated with the research model are listed in Table 1.

| | |
|---|---|
| **Organizational Hypotheses** | |
| H1 | **Hiring Quality People** at the organizational level will lead to an improvement in safety performance |
| H2 | **Safety Orientation** at the organizational level will lead to an improvement in safety performance |
| H3 | **An effective formal learning system** at the organizational level will lead to an improvement in safety performance |
| H4 | **Promotion of safety** at organizational level will result in better safety performance |
| **Shipboard Hypotheses** | |
| H5 | **Prioritization of Safety** at the shipboard level will result in better safety performance |
| H6 | **Effective Communication** at shipboard level will result in better safety performance |
| H7 | **Effective problem identification** at the shipboard level will result in better safety performance |
| H8 | **Effective feedback** at the shipboard level will result in better safety performance |
| H9 | **Responsibility** at shipboard level will result in better safety performance |
| **Individual Hypotheses** | |
| H10 | **Employee empowerment** will result in better safety performance |
| H11 | **Anonymous Reporting** by individuals will result in better safety performance. |
| H12 | **Effective feedback** at individual level will result in better safety performance |
| H13 | **Responsibility** at the individual level will result in better safety performance. |

**Table 1: List of Organizational, Shipboard and Individual Hypotheses**

Both objective measures of safety and subjective safety climate measures were used to establish the statistical significance of the safety factors and identify the leading indicators. The correlations between the significant safety factors and safety performance were used to validate the leading indicators. In the past, guidance notes have been developed by research organizations that suggest the use of objective measures as leading indicators (Chrvala & Bulger, 1999; Step Change in Safety, 2004). However, the validity of these indicators has not been empirically established. Thus, one of the contributions of this pilot study was to empirically assess objective safety and subjective safety climate data to identify leading indicators of safety that are quantitatively validated and supported by the available data.

# 5. Leading Indicators in Virtual Organizations

The initial pilot study provided a research model and framework from which to consider the development of leading indicators of safety in virtual organizations. High reliability organization (HRO) research also suggests issues that merit attention in developing leading indicators for virtual organizations. In high reliability organizations, as in safety-critical virtual organizations, small errors can propagate into grave consequences, and risk mitigation processes are critical to the organization's survival (Roberts, 1990; LaPorte and Consolini, 1991; Sagan, 1993; Weick, 1987; 1993). Typical examples of high reliability organizations include flight operations aboard aircraft carriers, command and control organizations in battle management operations, the U.S. air traffic control system, and operations of some U.S. commercial nuclear power plants (Rochlin, LaPorte, & Roberts, 1987; LaPorte, 1988; Roberts, 1990; La Porte & Consolini, 1991).

Initially, four findings from high reliability research seem appropriate to consider in our examination of leading indicators of safety in virtual organizations (Grabowski & Roberts, 1999). First, high reliability organizations are characterized by *prioritization of* *safety and reliability as goals,* as such practices enhance a milieu of safe operations. High reliability organizations clearly define what they mean by safety goals and establish safety standards against which they assess themselves. For instance, at the Navy Aviation School in Monterey, California, aviation accidents are detailed on a large board adjacent to a chart showing the Navy's aviation safety record since the early 1950's. In safety-critical virtual organizations, prioritizing safety and reliability across the entire virtual organization is also important. Thus, *prioritizing safety* across the virtual organization is one example of a safety factor for improving safety in a virtual organization.

Operationalizing safety and reliability goals in high reliability organizations often takes the form of *redundancy in personnel and technology.* Pilots and co-pilots on commercial airliners can both fly the airplane, and both pilots and co-pilots are required aboard before commercial airliners will fly. In safety-critical virtual organizations, redundancy creates opportunities for system members to communicate, to cross check information, and to ensure that individual and business goals and plans are consistent with the goals and plans of the virtual organization, particularly in a dynamic environment. The geographical distribution of virtual organizations and the necessity for reliability enhancing organizations to prioritize safety goals and engage in redundancy suggest the necessity of paying attention to *organizational structuring and design* in the interests of safety in virtual organizations.

High reliability organizations are also noted for developing a high reliability culture that is decentralized and constantly reinforced, often by continuing practice and through training. For instance, nuclear power plants that run well build in high reliability cultures for regular employees, and try to build them in for additional employees who are brought in for scheduled outages. The building process involves continuing practice, continual training, and reinforcement through incentives and reward systems. Because interfaces are a key aspect of virtuosity and because trust and culture in the virtual organization are important for obtaining reliability, communication processes must be a point of focus. This suggests that leading indicators of safety in virtual organizations should therefore consider communication at the interfaces of the virtual organization. Because creating a common, reliable value chain is of primary interest to virtual organizations seeking to enhance safety, a leading indicator of safety in virtual organizations might be the degree to which such organizations develop a *shared organizational culture of reliability across all members of the virtual organization, utilizing effective communication at the organization's interfaces.*

A final non-variant process inherent in reliable operations is trust. The development of *trust* among members of virtual organizations is also critical to enhancing safety, and is a key safety factor. High reliability organizations continually attend the development of interpersonal trust. Incident command systems (ICS) in fire authorities, for instance, routinely publicize information about local, state and federal fire authority personnel who can be trusted. Trust is then further developed in the ICS fire authorities by training and encouraging firefighters to get to know each other. International shipping conglomerates have also been known to develop lists of ship's pilots who can and cannot be trusted with an organization's assets. Thus, trust is a critical safety factor in virtual organizations, and the degree to which it exists in virtual organizations may be a significant leading indicator of safety. These safety factors suggest a revised structure for virtual organizations, as illustrated in Figure 4. Figure 4 expands the initial safety factor structure to include safety factors to improve safety across a virtual organization: prioritizing safety, attention to organizational structuring and design, effective communication at the interfaces of the virtual organization, and developing a shared culture of reliability and trust in the virtual organization.

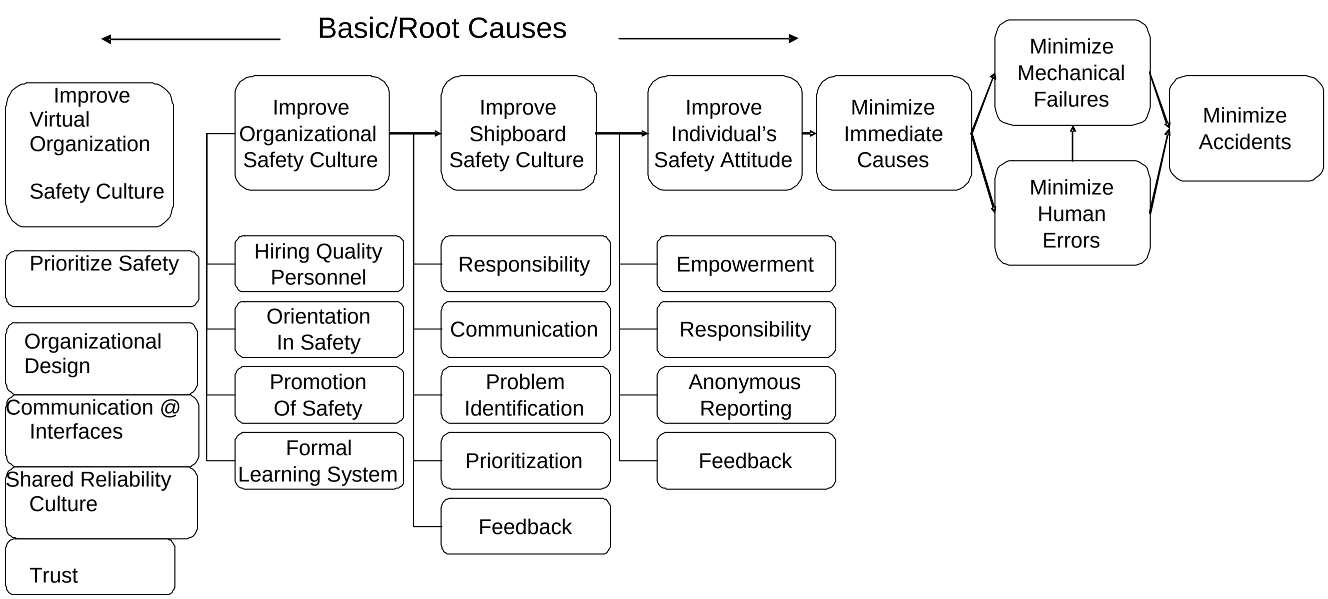


**Figure 4. Safety Factors in Virtual Organizations**

Taken together, these safety factors suggest a revised research model as well, as seen in Figure 5. The revised research model suggests that prioritizing safety, attention to organizational structuring and design, effective communication at the interfaces of the virtual organization, and developing a shared culture of reliability and trust across the virtual organization will influence the safety performance of the virtual organization, and of the systems and organizations that comprise it. The original safety factor model, incorporating individual, unit (vessel) and organizational elements, remains intact. The revised research model now includes safety factors thought important in virtual organizations.

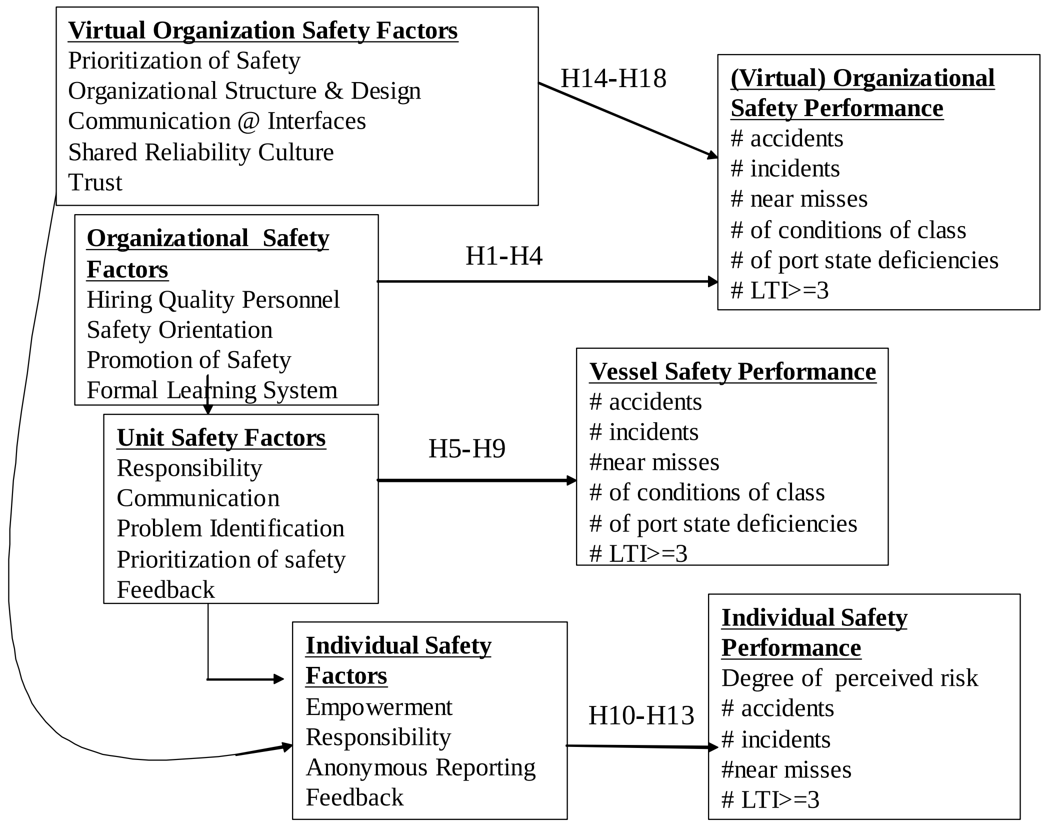


**Figure 5. Research Model for Leading Indicators in Virtual Organizations**

Identifying leading indicators of safety is critical in safety-critical virtual organizations. The revised safety factor structure and research model provide a starting point for this investigation. However, validating and measuring these predictors in the virtual world are difficult. For instance, insuring everyone in a distributed virtual organization has the same safety and reliability goals is difficult at best. While sheer numbers of persons and job functions in virtual organizations assures some redundancy, without careful attention to design, it is not clear the redundancies are of the form required to assure reliability. Geographical dispersion of virtual organizations constrains their ability to develop a shared, reinforced culture of reliability, and the lack of a shared culture inhibits the development of interpersonal trust in virtual organizations. These challenges underscore the need for both objective and subjective leading indicators as metrics of the safety factors, particularly in a dynamic virtual organization.

Enhancing safety in virtual organizations thus requires attention to and knowledge of the role of leading indicators, of risk and safety research and processes in conventional and high reliability organizations, as well as an understanding the nature and behavior of virtual organizations. With attention to these requirements, we propose investigation of the candidate leading indicators of safety in virtual organizations, focusing on the five characteristics just identified: prioritization of safety, attention to organizational structuring and design, communication at the interfaces, and developing a shared culture of reliability and trust across the virtual organization.  Developing empirically validated metrics for the proposed safety factors, and establishing the links and correlations between and among the safety factors, leading indicators, and performance, is an appropriate next step.

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# Leading Indicators of Safety in Virtual Organizations

http://www.eagle.org/default.html

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**SeaRiver Maritime, Inc.**

**Overseas Shipholding Group**



## *Leading Indicators of Safety*

*"In the aftermath of catastrophes, it is common to find prior indicators, missed signals, and dismissed alerts, that, had they been recognized and appropriately managed before the event, might have averted the undesired event.*

*Indeed, the accident literature is replete with examples, including the space shuttles Columbia (Columbia Accident Investigation Board, 2003) and Challenger (Vaughan, 1996), Three Mile Island (Chiles, 2002), The Concorde crash (BEA, 2004), the London Paddington train crash (Cullen, 2000), and American Airlines flight 587 to Santo Domingo (USA Today, May 25, 2003), among many others (Kletz, 1994; Marcus & Nichols, 1999; Turner & Pidgeon, 1997).*

Phimister, J.R., Bier, V.M., & Kunreuther, H. (editors). *Accident Precursor Anlaysis and Management: Reducing Technological Risk through Diligence.* Washington, D.C.: National Academy Press, 2003.

# Virtual Organizations

http://www.eagle.org/default.html

- Organizations comprised of multiple, distributed members
- Temporarily linked together for competitive advantage
- Share a common value chain and business processes via distributed information technology



# Virtual Organizations

Health maintenance systems of distributed physicians, medical societies, managed care systems

Fire and emergency medical service units

Global telecommunications alliances providing 99% of the world's secure interbank transactions

Danish wind farm consortia

International offshore oil and gas consortia

Oil spill response teams

## Characteristics of Virtual Organizations

http://www.eagle.org/default.html

- Members are not co-located
- May occasionally meet face-to-face as well as electronically
- Success depends on shared, interdependent business processes to achieve shared objectives

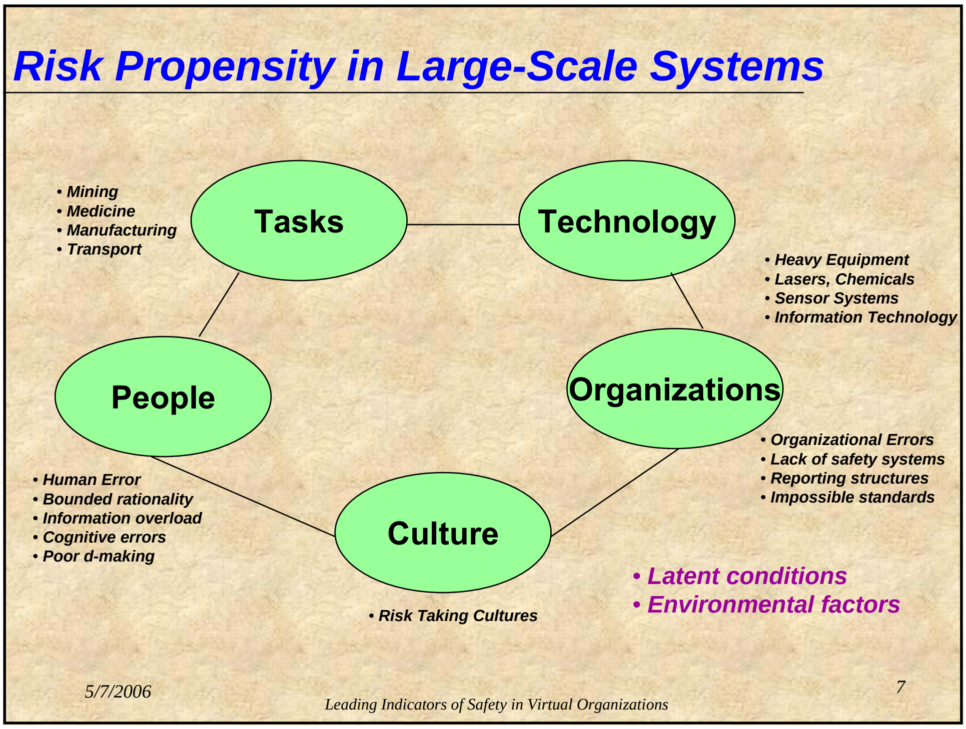


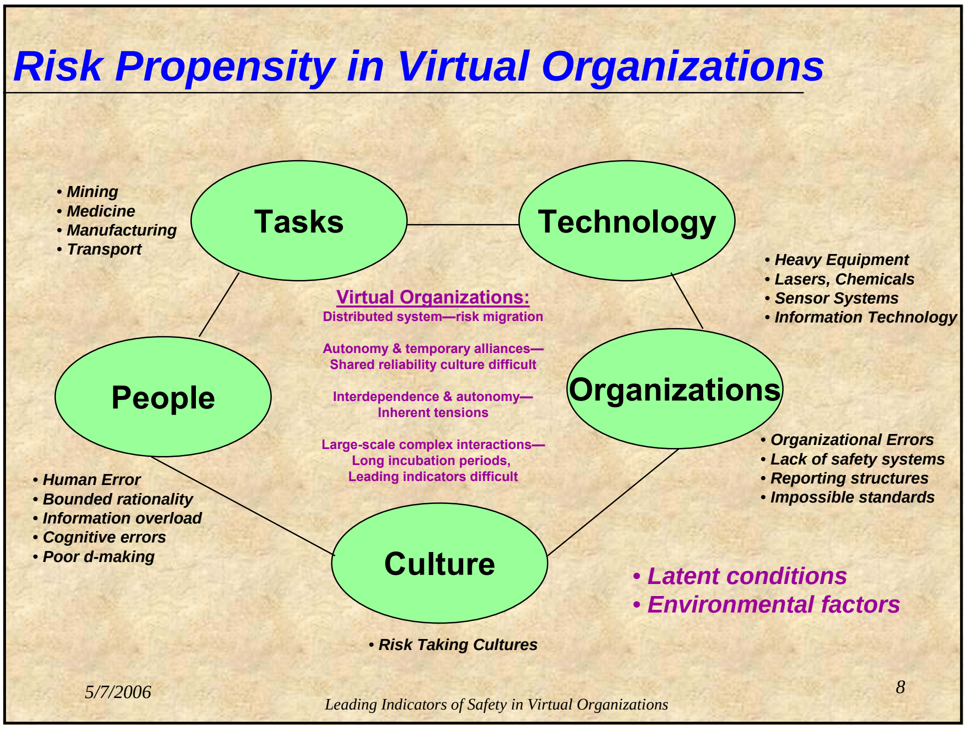
## Characteristics of Virtual Organizations

http://www.eagle.org/default.html

Several common features….

- Creation of a common value chain among the members
- Temporary linkages between members
- Business processes supported by distributed information technology


Risk Propensity in Large-Scale Systems
• Mining
• Medicine
• Manufacturing
• Transport
Tasks
Technology
• Heavy Equipment
• Lasers, Chemicals
• Sensor Systems
• Information Technology
People
Organizations
• Organizational Errors
• Lack of safety systems
• Reporting structures
• Impossible standards
• Human Error
• Bounded rationality
• Information overload
• Cognitive errors
• Poor d-making
Culture
• Latent conditions
• Environmental factors
• Risk Taking Cultures
5/7/2006
Leading Indicators of Safety in Virtual Organizations
7


Risk Propensity in Virtual Organizations
• Mining
• Medicine
• Manufacturing
• Transport
Tasks
Technology
• Heavy Equipment
• Lasers, Chemicals
• Sensor Systems
• Information Technology
Virtual Organizations:
Distributed system—risk migration
Autonomy & temporary alliances—
Shared reliability culture difficult
Interdependence & autonomy—
Inherent tensions
Large-scale complex interactions—
Long incubation periods,
Leading indicators difficult
People
Organizations
• Organizational Errors
• Lack of safety systems
• Reporting structures
• Impossible standards
• Human Error
• Bounded rationality
• Information overload
• Cognitive errors
• Poor d-making
Culture
• Latent conditions
• Environmental factors
• Risk Taking Cultures
5/7/2006
Leading Indicators of Safety in Virtual Organizations
8

# Leading Indicators

http://www.eagle.org/default.html

- **Conditions, events or measures that precede an undesirable event *and have some value in predicting the arrival of the event***

- **Associated with proactive activities that identify hazards and assess, eliminate, minimize or control risk**



# Leading Indicators of Safety

*"In high reliability industries, where significant hazards are present and rarely realized, organizations and their regulators pay considerable attention to safety assessment and risk mitigation.*

*In recent years, there has been a movement away from safety measures based purely on retrospective data or 'lagging indicators' such as fatalities, lost time accident rates and incidents, towards so called 'leading indicators' such as safety audits or measurements of safety climate…*

*It has been argued that these are predictive measures enabling safety condition monitoring (Flin, 1998) which may reduce the need to wait for the system to fail in order to identify weaknesses and to take remedial action. This can also be conceived as a switch from 'feedback' to 'feedforward' control (Falbruch & Wilpert, 1999; Flin, Mearns, O'Connor & Bryden, 2000, p. 177)."*

Falbruch, B. & Wilpert, B. System Safety—an Emerging Field for I/O Psychology. In Cooper, C. & Roberston, I. (editors). *International Review of Industrial and Organizational Psychology*. Chichester, UK: Wiley Publishing, 1999; Flin, R. Mearns, K., O'Connor, P. & Bryden, R. Measuring the Safety Climate: Identifying the Common Features. *Safety Science*, 34: 2000, 177-192.

# Leading Indicators--Examples

http://www.eagle.org/default.html

- Economic leading, lagging and coincident indicators
- Health systems
- Electric power industry
- Near hit reporting in anesthesia management
- Nuclear safety precursor management
- Offshore oil & gas hazard analyses



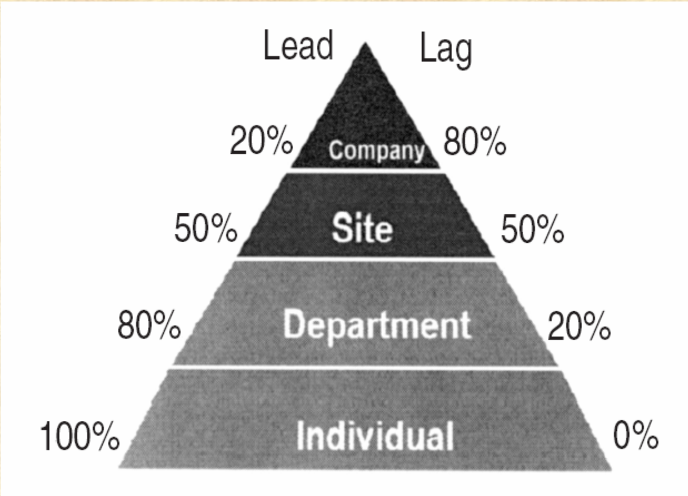
# Lagging Indicators--Examples

http://www.eagle.org/default.html

- Measures of a system taken after an event
- Measure outcomes and occurrences

- Recordable injury frequencies
- Lost time frequencies
- Lost time severity
- Vehicle accident frequencies
- Workers' compensation losses
- Property damage costs
- Numbers & frequency of accident investigations

# Leading and Lagging Indicators




[Bergh, V. Leading and Trailing Indicators: Occupational Safety. Presented at the ISSA/Chamber of Mines Conference 2003. Mines and Quarries—Prevention of Occupational Injury and Disease. Sandton, South Africa, 2003]



# Types of Indicators

http://www.eagle.org/default.html

- Indicators with <u>direct links</u> between signals and adverse events

  *--causal link (presence of an individual)*

- Indicators with <u>correlations</u> between signals (or clusters) and adverse events

- <u>Proxy</u> or surrogate indicators

# Criteria for Selecting Indicators

http://www.eagle.org/default.html

*[Chrvala & Bulger, 1999]*

Chrvala, C.A. & Bulger, R.J. (editors). *Leading Health Indicators for Healthy People 2010: Final Report.* Washington, D.C.: National Academy Press, 1999. http://books.nap.edu/html/healthy3/.

- **Indicators should be worth measuring,**
- **Indicators can be measured for diverse populations,**
- **Indicators can be understood by people who need to act,**
- **Information will galvanize action,**
- **Actions that can lead to improvement are known and feasible, and**
- **Measurement over time will reflect the results of action.**

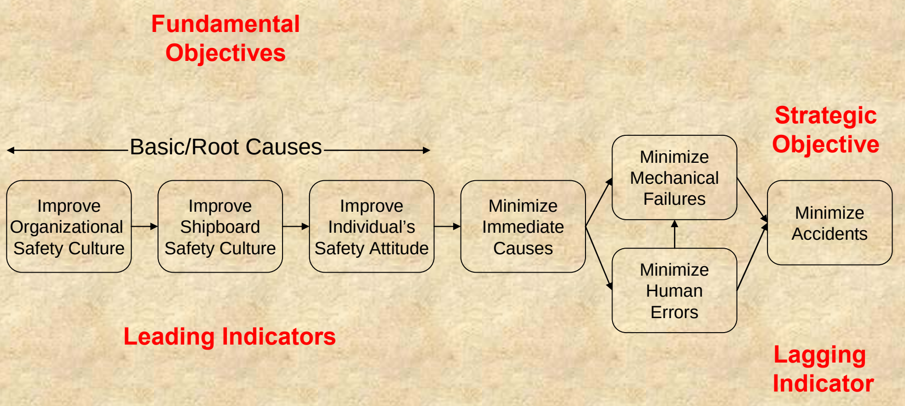


# Pilot Study

http://www.eagle.org/default.html

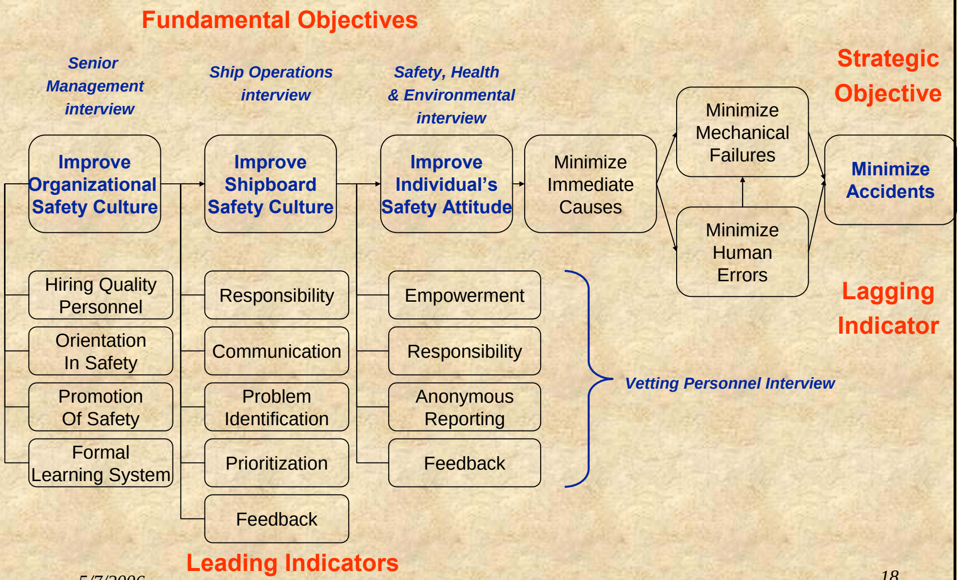
- **Identify, analyze & evaluate a set of leading safety indicators in marine transportation**
- **Initially, domestic tankers (2004-2006)**
- **Data analysis & structuring**
- **Partnerships with industry**

# Value-Focused Thinking

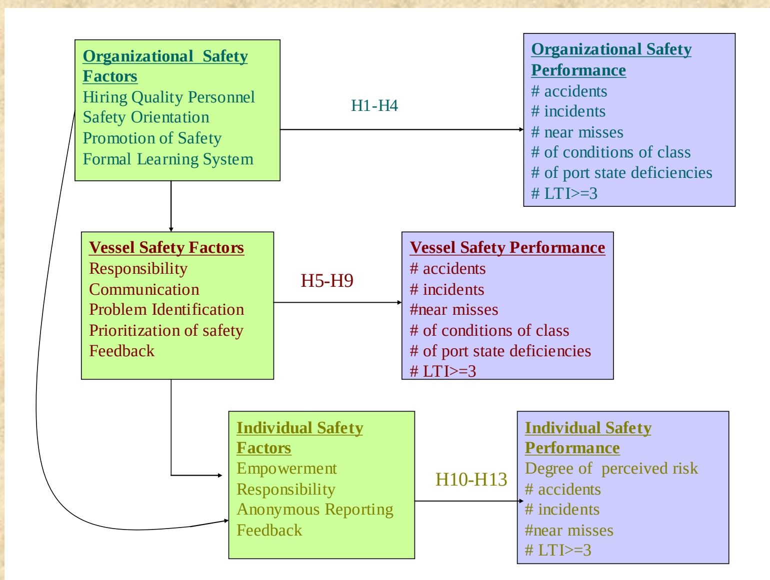





# Initial Safety Factor Structure



# Research Model

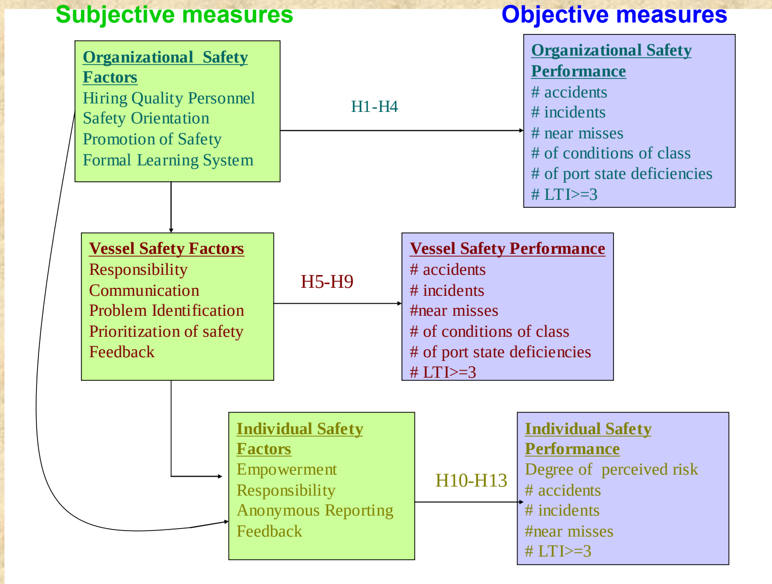





# Hypotheses

| | |
|---|---|
| Organizational Hypotheses | |
| H1 | **Hiring Quality People will lead to an improvement in organizational safety performance.** |
| H2 | **Safety Orientation will lead to an improvement in organizational safety performance.** |
| H3 | **An Effective Formal Learning System will lead to an improvement in organizational safety performance.** |
| H4 | **Promotion of Safety at the organizational level will lead to an improvement in organizational safety performance.** |
| Shipboard Hypotheses | |
| H5 | **Prioritization of Safety at the shipboard level will improve shipboard safety performance.** |
| H6 | **Effective Communication at the shipboard level will improve shipboard safety performance.** |
| H7 | **Effective Problem Identification at the shipboard level will improve shipboard safety performance.** |
| H8 | **Effective Feedback at the shipboard level will lead to improved shipboard safety performance.** |
| H9 | **Responsibility at the shipboard level will lead to improved shipboard safety performance.** |
| Individual Hypotheses | |
| H10 | **Employee empowerment will improve individual safety performance.** |
| H11 | **Anonymous Reporting will improve individual safety performance.** |
| H12 | **Effective Individual Feedback will improve individual safety performance.** |
| H13 | **Individual Responsibility will improve individual safety performance.** |

# Method






# Method

http://www.eagle.org/default.html

- Subjective measures
- Objective measures

- Subjective measures—safety factor surveys
  *(Flin, Mearns & O'Connor 2000, 2001)*
  *--5 point Likert scale*
  *--Strongly agree to Strongly disagree*
  *--Employee perceptions of the importance of safety factors in safety performance*
- Objective measures—safety performance data

# Individual Survey

http://surveymonkey.com/s.asp?u=863991467514

**Individual Safety Factor Questionnaire**

*Department of Decision Sciences and Engineering Systems*
*Rensselaer Polytechnic Institute*
*Troy, New York, 12180*

Your organization is participating in a research project, sponsored by American Bureau Shipping and being conducted by Rensselaer Polytechnic Institute, that is examining employee perceptions of factors responsible for safety performance in the U.S. marine transportation system. This survey is being administered as part of this research project. The researchers will not collect any identifying information from the survey (e.g., IP addresses ).



# Individual Survey

http://surveymonkey.com/s.asp?u=863991467514

**Hiring Quality People**

| | Strongly disagree | Slightly disagree | Neutral | Slightly agree | Strongly agree |
|---|---|---|---|---|---|
| a) My colleagues consider safety issues seriously while performing job duties. | | | | | |
| b) The hiring process in my organization is effective in identifying the right people for jobs. | | | | | |

## Vessel Survey

http://surveymonkey.com/s.asp?u=675411524477

**Vessel Safety Performance Questionnaire**

**TO BE FILLED OUT BY THE CHIEF SAFETY OFFICER OF EACH VESSEL**

*Department of Decision Sciences and Engineering Systems*
*Rensselaer Polytechnic Institute*
*Troy, New York, 12180*

Your organization is participating in a research project identifying the factors responsible for safety performance in the U.S. marine transportation system. The attached questionnaire is being administered as part of this research project. It is recommended that the chief safety officer of the vessel or someone who has access to the safety performance data of the vessel answer this questionnaire.



## Organizational Survey

http://surveymonkey.com/s.asp?u=597531527497

**Organizational Safety Performance Questionnaire**

**TO BE FILLED OUT BY THE CHIEF SAFETY OFFICER OF THE ORGANIZATION**

***Department of Decision Sciences and Engineering Systems***
*Rensselaer Polytechnic Institute*
*Troy, New York, 12180*

Your organization is participating in a research project identifying the factors responsible for safety performance in the U.S. marine transportation system. The attached questionnaire is being administered as part of this research project. It is recommended that the safety officer of the organization or someone who has access to the safety performance data of the organization complete this questionnaire.

# Safety Performance Data

| Organizational Safety Performance | Vessel Safety Performance | Individual Safety Performance |
|---|---|---|
| #accidents per vessel | #accidents per employee | #accidents |
| #incidents per vessel | #incidents per employee | #incidents |
| #near-misses per vessel | #near-misses per employee | #near-misses |
| # conditions of class per vessel | # conditions of class per employee | # LTI>=3 |
| # port state deficiencies per vessel | # port state deficiencies per employee | Perceived risk |
| # LTI>=3 per vessel | # LTI>=3 per employee | |



# Participants

| No. | Organization | Operation | Trade | Fleet |
|---|---|---|---|---|
| **1** | **Sea River Maritime Inc.** | **Oil tanker** | **Domestic US** | **7, 2 tugs** |
| 2 | Alaska Tanker Company | Oil tanker | Domestic US, Intern. | 8 |
| 3 | Bouchard Transportation Inc. | Tug-barge | Domestic US, Great Lakes, Intern. | 26 B, 19T |
| 4 | Keystone Shipping Company | Oil tanker | Domestic US, TAPS | 6 |
| 5 | Crowley Maritime Corp | Tug-barge, Oil tanker | Inland | 6+ |
| 6 | SeaBulk International | Petro. & Chem. tankers | Inland, Intern | 10, 26T |
| 7 | Chevron Shipping Company | Oil and LNG | Domestic US, Intern | 30 |
| 8 | Cononco Philips Polar Tankers | Oil tankers | Domestic US, TAPS | 6 |
| **9** | **Overseas Shipholding group** | **Oil tankers** | **International** | **86+** |
| 10 | Shell Shipping | Oil tanker, LNG | Domestic US, Intern | 10 |
| 11 | AHL Shipping Company | Oil tanker | Domestic US, Gulf Tr. | 7 |
| 12 | EL Paso Marine | LNG | International | 6 |
| 13 | American Steamship Comp. | Dry Bulk | Great Lakes | 11 |
| 14 | Odjfell USA Inc. | Chemical tankers | International | 32 |

# Statistical Analysis

http://www.eagle.org/default.html

- **Correlation analysis** between
  - --indicators and safety factors
  - --indicators and safety performance
  - --Pearson product moment correlation
  - --t-test to test significance of correlation



# Statistical Analysis

http://www.eagle.org/default.html

- **Regression analysis** to determine predictive power of leading indicators
  - --Safety factors with safety performance
  - --Leading indicators with safety performance

  - --Distribution of mean errors to validate predictive power of leading indicators
  - --Kolmogrov-Smirnoff statistic

# Statistical Analysis

http://www.eagle.org/default.html

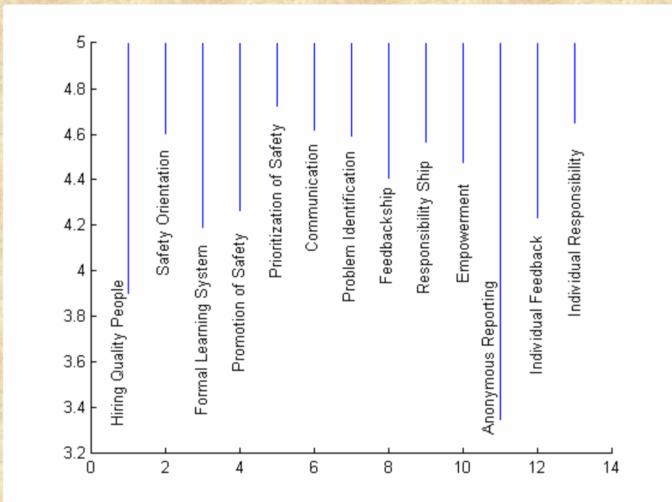
**Factor analysis of safety climate data**
**--orthogonal and oblique rotations**
**--is there a common factor structure in all operator organizations?**

- **Questionnaire reliability**

- **Logical analysis of data**



# Safety Factor Results

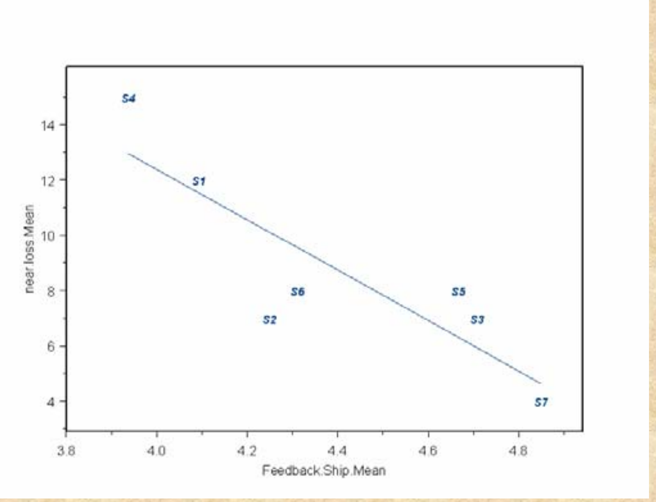



**Principal Component Factor Analysis** followed by orthogonal varimax rotation. The factors are chosen on the basis of minimum eigen value criterion.

**Factor Analysis:**

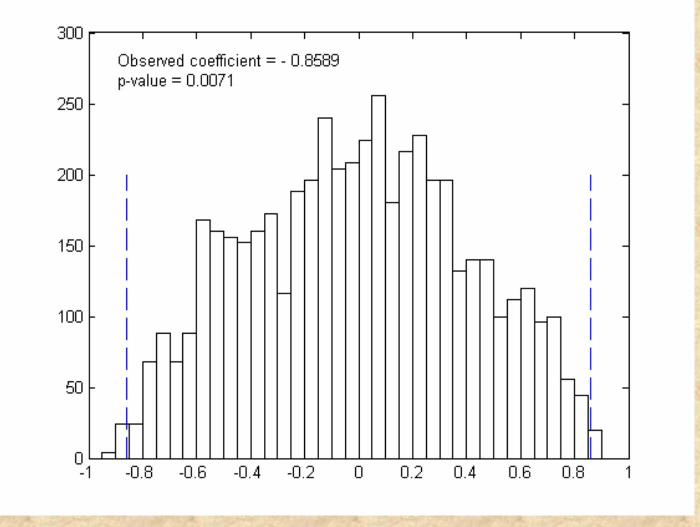
- **Anonymous Reporting**
- **Hiring Quality People**
- **Feedback (Individual, Ship)**
- **Formal Learning System**
- **Empowerment**
- **Communication**

# Feedback vs. Near Losses






# Permutation test--Feedback_Ship



# Safety Index

$$Safety\ Index = w_i * SafetyFactor_i$$

**Weights provided by solution to the following optimization problem**

$$\min_{w} Corr(Safety\ index, Near\ Loss)$$

$$\sum w_i = 1$$

$$w_i \geq 0$$



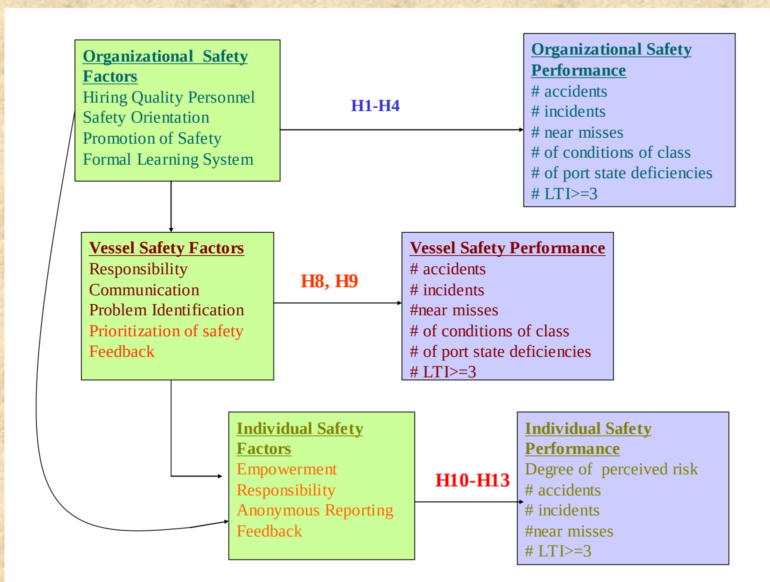
# Ship Safety Index

$$Safety\ Index = w_i * SafetyFactor_i$$

$$\begin{aligned} SafetyIndex = {} & 0.326 * prioritization\ of\ safety + \\ & 0.0 * communication + \\ & 0.036 * problem\ identification + \\ & 0.637 * feedback\ ship + \\ & 0.0 * responsibility \end{aligned}$$

$$Mean\ NearLoss = 59.40 - 11.23 * SafetyIndex$$

# *Pilot Study Significant Results --*



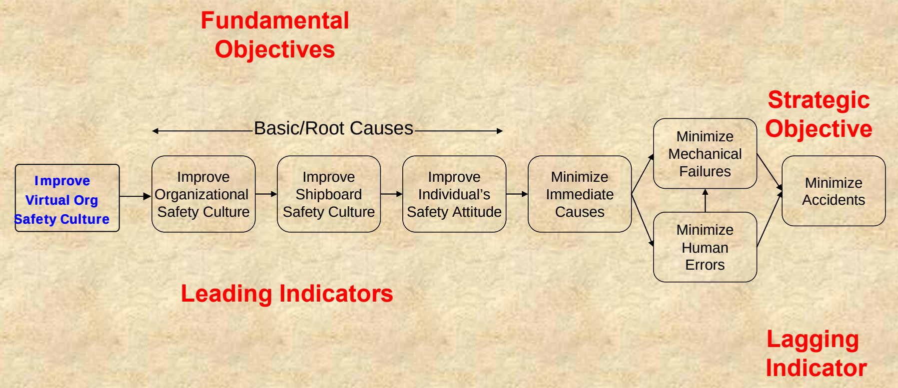



# *Leading Indicators in Virtual Organizations*

- **High reliability organization research**
- **Network, virtual organizations**

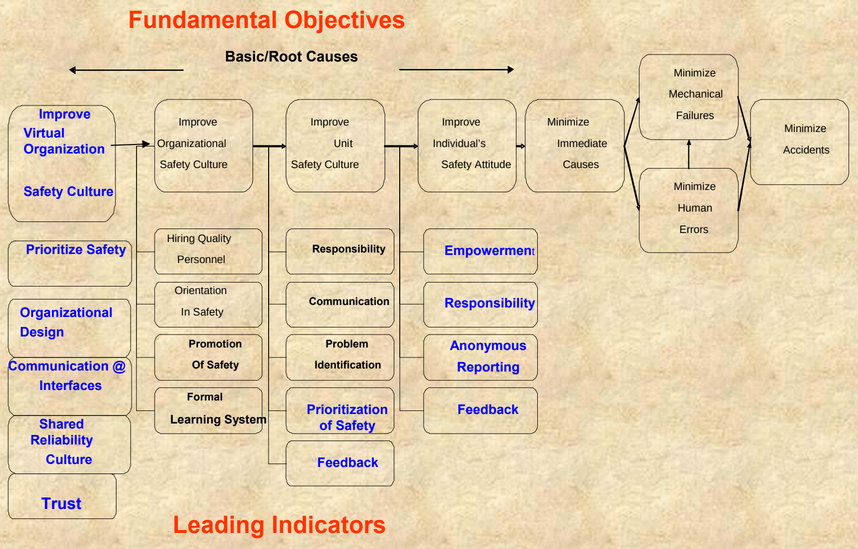
- **Prioritization of safety and reliability as goals**
- **Organizational structuring and design**
- **Shared organizational culture of reliability**
- **Communication at the organization’s interfaces**
- **Trust**

# Virtual Organization Safety Factors

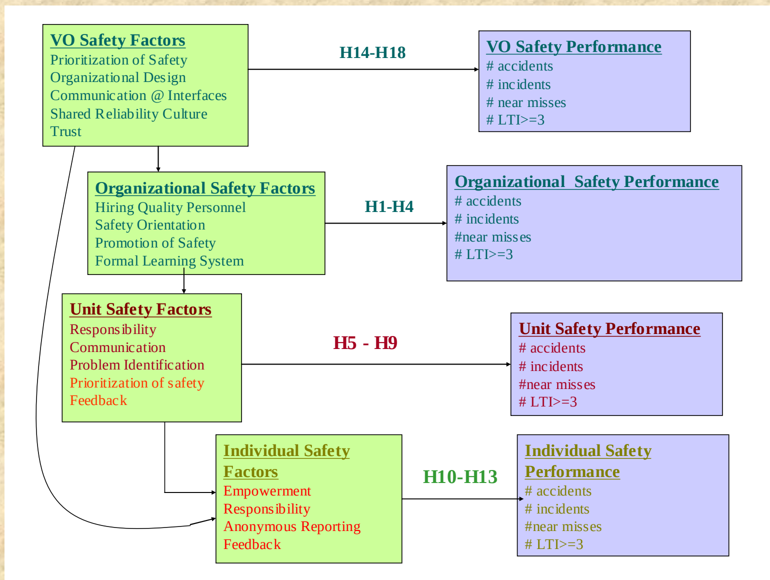





# Virtual Organization Safety Factor Structure



# Revised Virtual Organization Model






# Candidate Leading Indicators

## Soma Neural Nets, 2004

- #ILO conventions adopted by vessel flag
- Propulsion system availability
- Primary fleet flag
- Co-ownership?
- Country of registry
- Non-IACS class?
- Mean fleet age
- Ship type
- Vessel flag

$R^2$ = .43 - .61

**Safety Performance**

- ADAC score
- # deficiencies per PSC inspection
- # Accidents
- # Immaculate PSC inspections

(Soma, Chapter 4, Figure 5, p 72)

## Soma PCA, 2004

- Safety rehearse
- Commitment
- Communication
- Job satisfaction
- Acknowledgement of personal limitations
- Work integrity
- Social integration
- Power & dignity

Principal Components
(Soma, Ch. 7, p. 126)

## UK HSE, 2000

- Productivity vs. safety
- Learning organization
- Safety resources
- Participation
- Shared perceptions about safety
- Trust
- Training

- Management commitment & visibility
- Communication
- Job satisfaction and industrial relations

## Mearns, et al., 2003

- Involvement
- Perceived supervisor competence
- General safety behavior
- Safety behavior under incentive
- Rules & implementation of safety measures
- Propensity to report incidents/ accidents

- Perceived management commitment
- Communication
- Satisfaction with safety
- Job satisfaction

# Candidate Leading Indicators

## ABS, 2004
- Safety management
- Maintenance systems
- Incident investigations
- Safety system evaluat'n & improvement
- Work integrity
- Safety training/orientat'n
- Mgmt commitment
- Communication
- Job satisfaction
- Emeg preparedness
- Management of change

## Soma Neural Nets, 2004
- #ILO conventions adopted by vessel flag
- Propulsion system availability
- Primary fleet flag
- Co-ownership?
- Country of registry
- Non-IACS class?
- Mean fleet age
- Ship type
- Vessel flag

(Soma, Chapter 4, Figure 5, p 72)

## OCIMF TMSA, 2004
- Mgmt, Leadership, Accountability
- Recruitment/mgmt of personnel
- Reliability & maintenance
- Navigational safety
- Cargo, ballast & mooring ops
- Management of change
- Incident investigation & analysis
- Safety management
- Environmental management
- Emergency preparedness
- Measurement, analysis & improvmt

## Soma PCA, 2004
- Safety rehearse
- Commitment
- Communication
- Job satisfaction
- Acknowledgement of personal limitations
- Work integrity
- Social integration
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Principal Components
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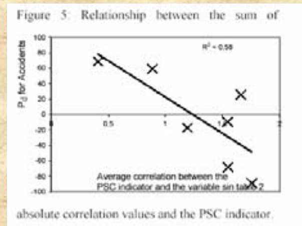
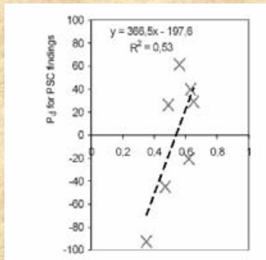
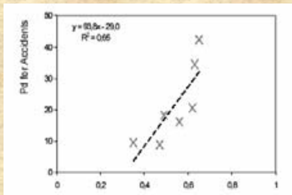
- Communication
- Satisfaction with safety
- Job satisfaction



# Statistical Significance



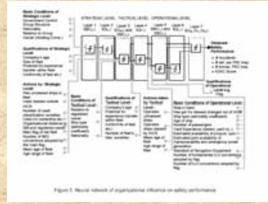

Correlation between ship characteristics and PSC indicator
$R^2 = .58$

Correlation between safety culture correlation measure and PSC indicator
$R^2 = .53$

Correlation between safety culture correlation measure and accidents
$R^2 = .65$

(Soma, Chapter 6, p 104)

## Statistical Significance



### Neural Net, Ch. 4

**Correlation between NN results and ADAC score**
**$R^2$ = .43**

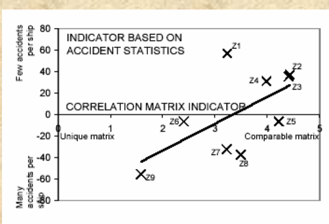
**Correlation between NN results and accidents**
**$R^2$ = .61**

| | # Accidents (M = 100) | # PSC DEF (M = 51) | # IMMAC PSC (M = 51) |
|---|---|---|---|
| ADAC Score | P = 0.15 | P = 0.10 | P= 0.15 |
| # Accidents | | P = 0.36 | P = -0.08 |
| # PSC Deficiencies | | | P = -0.63 |

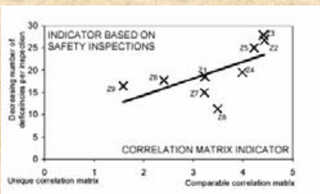
*(Soma, Chapter 4, p 104)*



## Statistical Significance




**Correlation between correlation matrix indicator and accident indicator $R^2$ = .61**




**Correlation between correlation matrix indicator and PSC indicator $R^2$ = .65**

*(Soma, Chapter 7, Figure 7)*

- **'It is now assumed that having the cultural pattern that is most similar to the others have the most mature pattern.'**
- **The correlation coefficient between the correlation matrix indicator and the accident indicator was 0.61, and the same figure for the safety inspection indicator was 0.65.**
- **Even though the values isolated are not statistically significant, it is unlikely that 2 independent analyses [would] produce spurious correlations of this high value."**

*(Soma, Chapter 7, p 122)*

# Validating Leading Indicators

http://www.eagle.org/default.html

*Once candidate leading indicators have been identified….*

- Scatter plot analysis
- Multiple regression analysis
- Validation against additional data sets
- Principal components analysis
- Neural nets
- Artificial (hybrid) neural nets
- Logical analysis of data (LAD) [data mining]

… to determine predictiveness of indicators



# Cautions

http://www.eagle.org/default.html

*Several cautions associated with leading indicators…*

- Safety plateaus—mishap rates stabilize

*--suggests a mix of system- and individual-level leading indicators*

- Heedfulness important to identify indicators
- Shared understanding of normal and abnormal

# Cautions

http://www.eagle.org/default.html

*Several cautions associated with leading indicators…*

- **Learning from accident precursors and leading indicators is difficult for organizations**
  ***--root cause analyses, incident investigations***

- **Different subsystems within a large system may have their own cultures**
  ***--different vessels may have different leading indicators***



# Event Chain for Maritime Accidents

## Causal Chain

**Stage 1 Basic/ Root Causes** → **Stage 2 Immediate Causes** → **Stage 3 Incidents** → **Stage 4 Accidents** → **Stage 5 Consequence** → **Stage 6 Impact**

**Stage 1 Basic/ Root Causes**
- Inadequate skills, knowledge, equipment, maintenance, management
- Human and organizational errors

**Stage 2 Immediate Causes**
- Operational errors
- Equipment failure
- Hazardous situation

**Stage 3 Incidents**
- Propulsion failures
- Steering failures
- Human failures

**Stage 4 Accidents**
- Collisions
- Groundings
- Allisions
- Ice collisions
- Fire & explosion

**Stage 5 Consequence**
- Oil outflow
- Persons in peril

**Stage 6 Impact**
- Environmental damage
- Loss of life
- Loss of proper

I. Decrease Frequency of Root/Basic Causes → II. Decrease Frequency of Immediate Causes or III. Exposure to Hazardous Conditions → IV. Intervene to Prevent Accident if Incident Occurs → V. Reduce Consequences if Accident Occurs → VI. Reduce Impact if Consequence Occurs

## Risk Reduction Interventions

*Safety Management Programs* | *Channel Closure Restrictions* | *Escort Vessels, Redundancy* | *Double Hulls* | *Booming and Containment*

# Integrated Operations
# Meeting with PSA - 090306

**Agenda**

- VRD introduction
- Description of Integrated Operation
- The design process  (MTO)
- Functional analysis/ Work processes
- Technical development
- Risk elements
- Plan forward
- Next meeting

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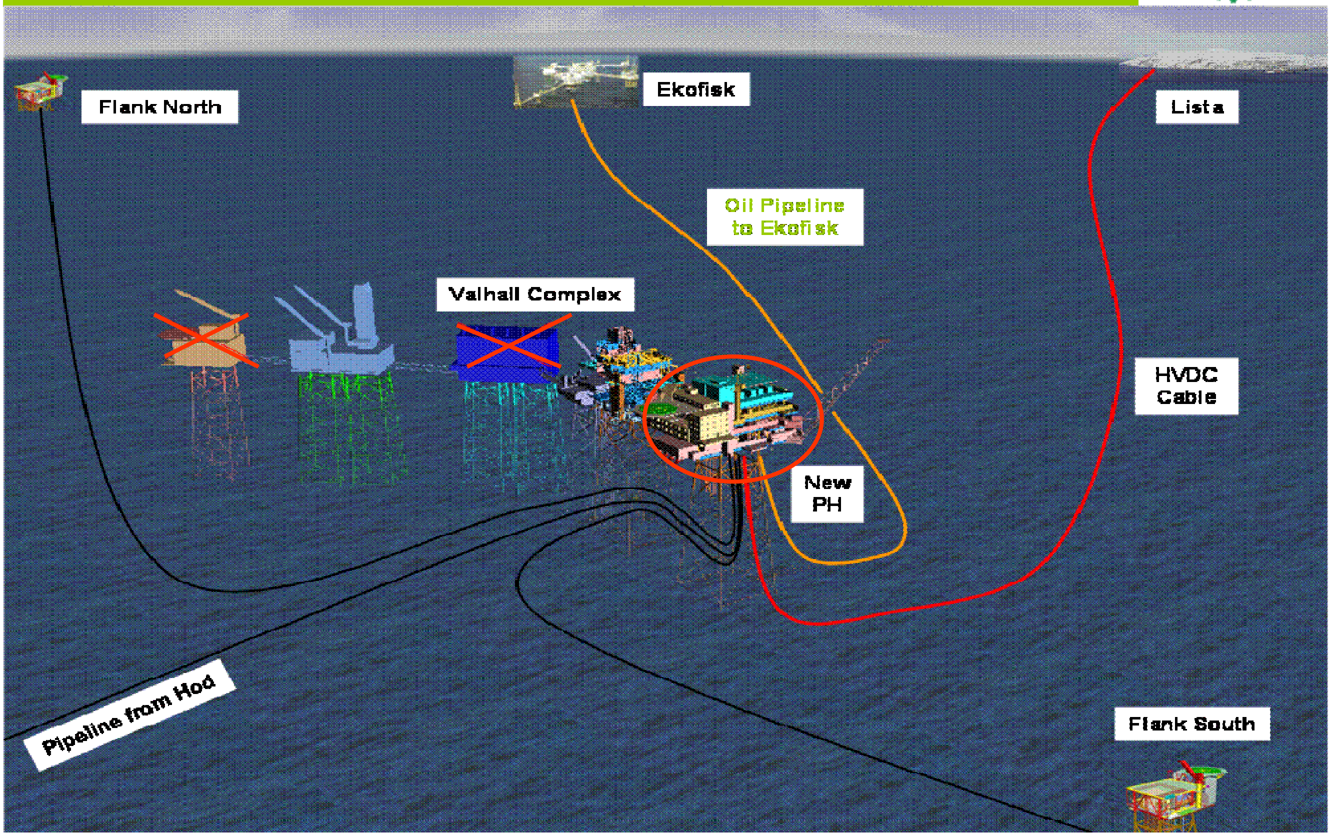
# Valhall Field

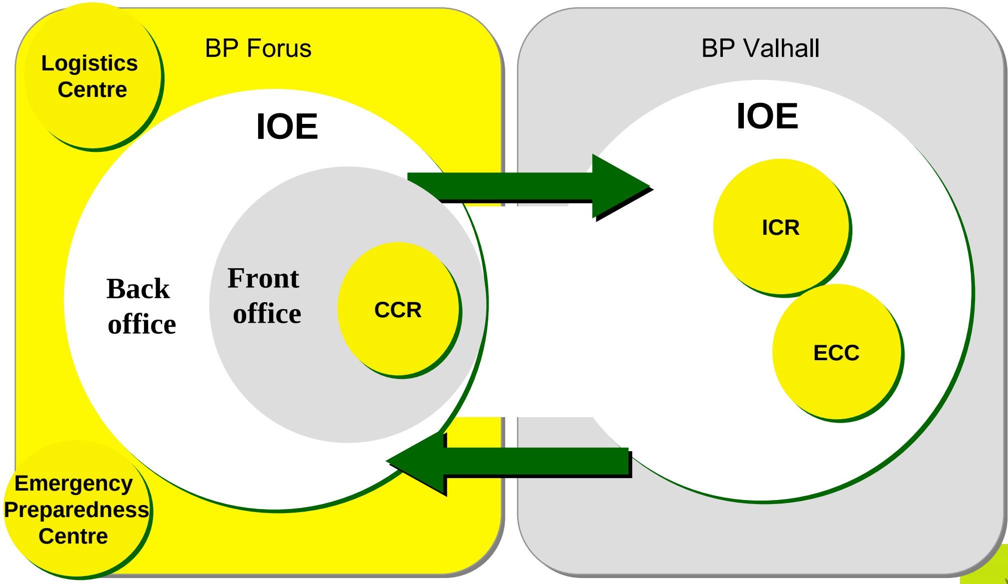
# Valhall Re-Development




# Onshore Fibre Connections

# Description of Integrated Operations

**Objective: Create <u>one</u> integrated operation team independent of location**




IOE = Integrated Operation Environment ICR = Intervention Control Room
CCR = Central Control Room ECC = Emergency Control Centre

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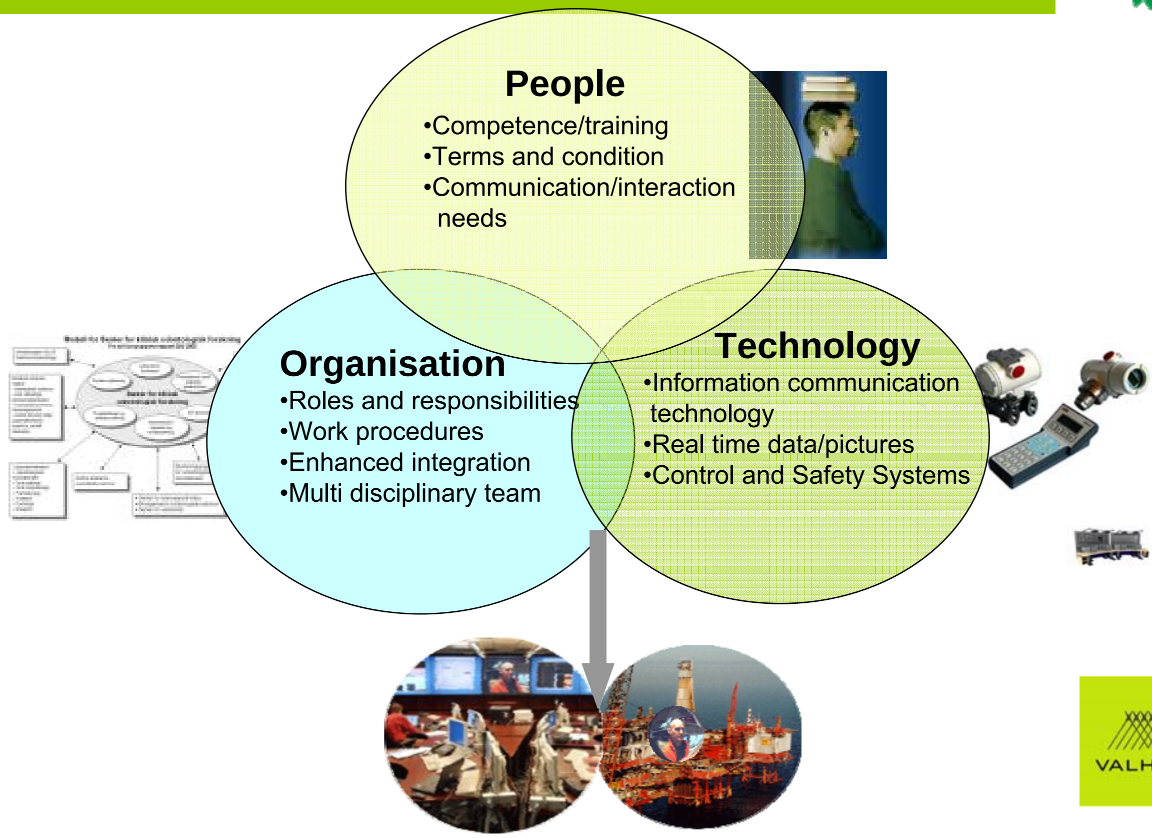
# Integrated Operations
# People – Organisation - Technology

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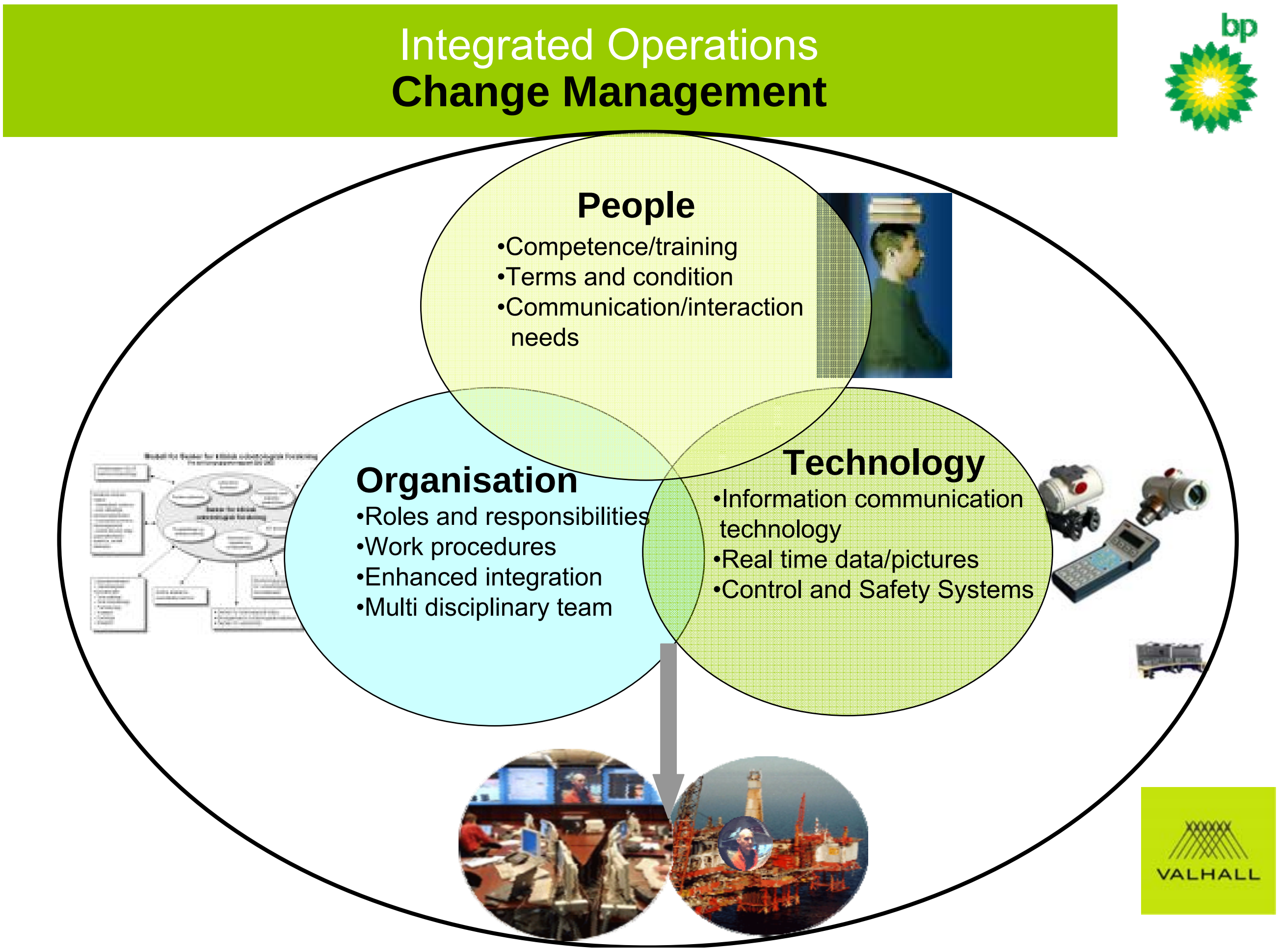
Integrated Operations
Change Management
People
•Competence/training
•Terms and condition
•Communication/interaction needs
Organisation
•Roles and responsibilities
•Work procedures
•Enhanced integration
•Multi disciplinary team
Technology
•Information communication technology
•Real time data/pictures
•Control and Safety Systems
bp
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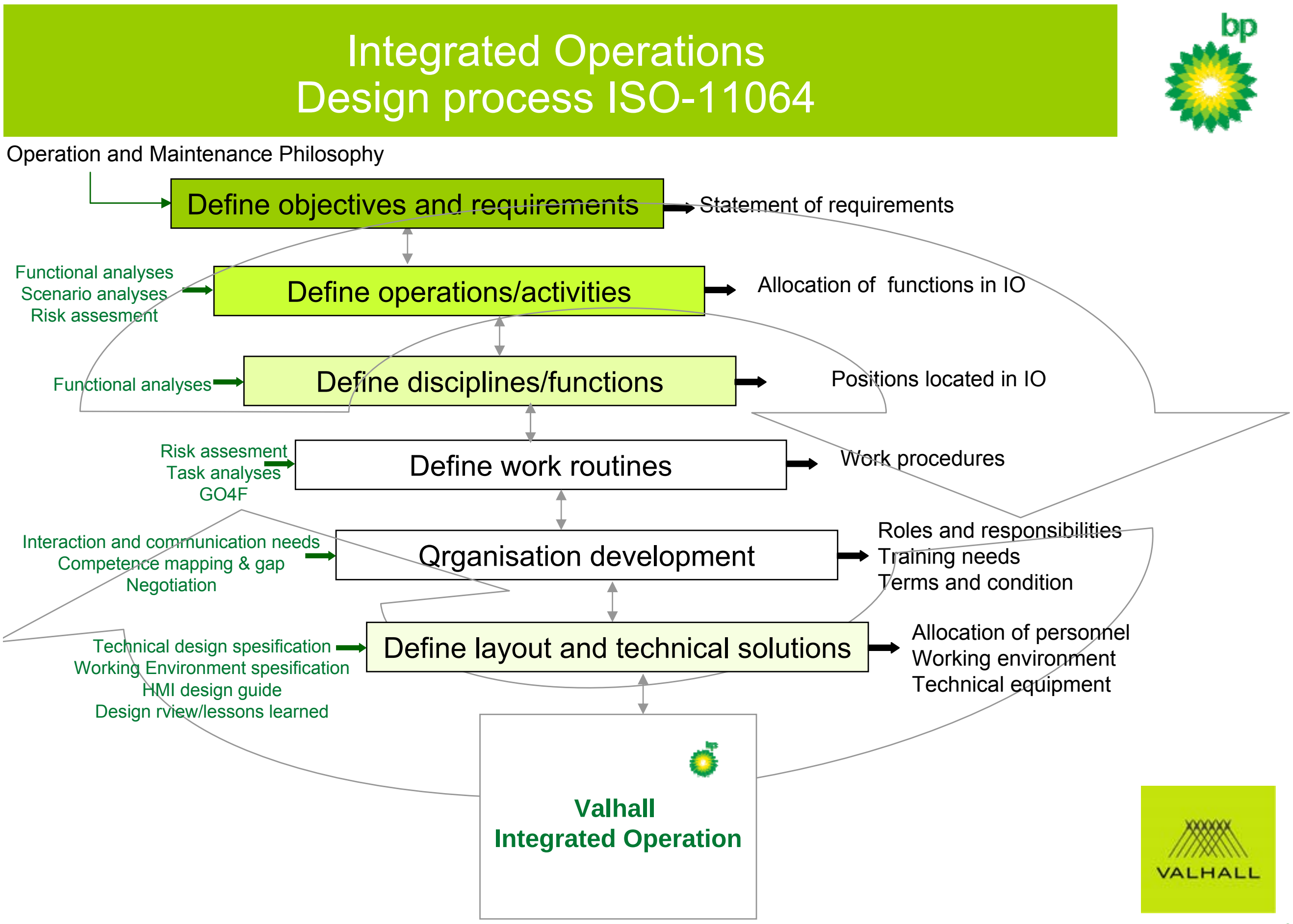
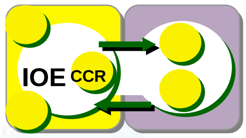

Integrated Operations
Design process ISO-11064
Operation and Maintenance Philosophy
Define objectives and requirements
Statement of requirements
Functional analyses
Scenario analyses
Risk assesment
Define operations/activities
Allocation of functions in IO
Functional analyses
Define disciplines/functions
Positions located in IO
Risk assesment
Task analyses
GO4F
Define work routines
Work procedures
Interaction and communication needs
Competence mapping & gap
Negotiation
Organisation development
Roles and responsibilities
Training needs
Terms and condition
Technical design spesification
Working Environment spesification
HMI design guide
Design rview/lessons learned
Define layout and technical solutions
Allocation of personnel
Working environment
Technical equipment
Valhall
Integrated Operation
bp
VALHALL

# Integrated Operation Environment (IOE) Onshore

**Valhall field activities will be managed and monitored daily from onshore IOE. This includes the CCR.**

- Preliminary list of functions* is:
  - Operation and production efficiency/optimization
  - Maintenance planning and optimization
  - Integrated field planning and logistics
  - Well monitoring and optimization
  - Preparation of work permits and safety-job-analyses
  - General support to offshore operation and maintenance activities
  - Problem solving in collaboration with:
    - offshore personnel
    - worldwide BP resources
    - vendors
  - Assist CCR operators to avoid and manage process upsets and emergency situations
  - Integrate suppliers in IOE and/or remotely linked




*List of functions to be determined in design process

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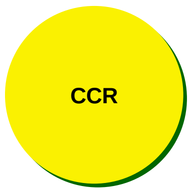
# Central Control Room (CCR)

**CCR is the core of the Onshore IOE**




- Preliminary list of functions* is:
  - Monitor, control and supervise the plant
  - Coordinate work permit and daily activities
  - Change process variables and setpoints
  - Implement safety systems overrides
  - Implement changes recommended by IOE to optimise production
  - Initiate PSD/ESD shutdowns
  - Initiate automatic fire fighting systems remotely
- The control room operator will have continuous access to the offshore staff through visual and audio communication links

*List of functions to be determined in design process

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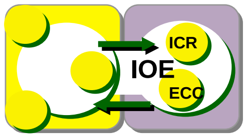
# Integrated Operation Environment (IOE) offshore




**Offshore IOE will be manned by managers, team leaders, operations and maintenance technicians. IOE includes ICR and ECC.**

- In co-operation with the onshore team, the preliminary list of functions* is:
  - carry out duties in connection with the normal operation of the field
  - first line maintenance and plant services
  - handle and control work permit and SJA
  - problem solving in collaboration with other disciplines, IOE onshore and vendors
  - optimise the production and operation
  - participate in decision making processes

*List of functions to be determined in design process

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# IOE onshore – preliminary activities

workshop 04.01.06 + individual meetings

- Participation in (and possible preparation of preliminary input) Safe Job Analysis
- Performing planning activities, including:
  - Integrated field planning
  - Coordination with logistics department
  - Coordinating and improve maintenance packages (KAO / FV)
  - Coordinating and facilitating work permits / planning and scheduling work
  - Review , QA and preparation for execution of "Construction Work Packages"
  - Controlling POB and allocating beds
- Production optimization
- Short term production forecasting
- Online monitoring of process and wells
- Interfacing with well operations and SIMOPS
- Maintenance and operation of satellite facilities
- Detail planning of maintenance work
- Planning and follow up of well interventions and surveillance
- Planning and follow up of water injection
- Maintenance optimization
- Work permit coordination
- Well integrity monitoring (SCSSV and x-mas tree valves testing)
- Interfacing with the modifications team and projects personnel
- Facilitating handover of Wells, Modifications and major projects
- Optimize resource utilization / sharing of materials and personnel
- Online assessment of vendor based maintenance scope and execution
- Follow-up and investigation of near misses / accidents / events
- Interfacing with supply chain management in;
  - Provide input to QPRs
  - Provide interface to purchasing, rental and performance
  - Waste injection follow up
- Remote surveillance of maintenance and equipment
- Interaction with external support groups (BP Sunbury, Houston, Aberdeen, vendors, R&D) institutes, government)

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# IOE offshore – preliminary activities

workshop 04.01.06 + individual meetings

- Participation in Safe Job Analysis
- Supporting planning activities, including:
  - Integrated field planning
  - Coordination with logistics department
  - Coordinating and improve maintenance packages (KAO / FV)
  - Coordinating and facilitating work permits / planning and scheduling work
  - Review , QA and preparation for execution of "Construction Work Packages"
  - Controlling POB and allocating beds
- Preparation for execution of production optimization
- Ad-hoc (??) online monitoring of process and wells
- Interfacing with well operations and SIMOPS (task dependant)
- Interaction with well interventions and surveillance personnel
- Monitor water injection
- Maintenance and operation of satellite facilities (task dependant)
- Work permit control
- Conduct well integrity testing and monitoring (SCSSV and x-mas tree valves)
- Detail planning of maintenance work
- Interfacing with the modifications team and projects personnel
- Facilitating handover of Wells, Modifications and major projects
- Optimize resource utilization / sharing of materials and personnel
- Online assessment of vendor based maintenance scope and execution
- Follow-up and investigation of near misses / accidents / events
- Managment of emergency preparedness
- Interfacing with supply chain management in;
  - Provide input to QPRs
  - Provide interface to purchasing, rental and performance
  - Perform waste injection and ensure inter-platform communication (Halliburton versus BP)
- Interaction with external support groups (BP Sunbury (?), Houston (?), Aberdeen (?), vendors, government) Ad-hoc basis

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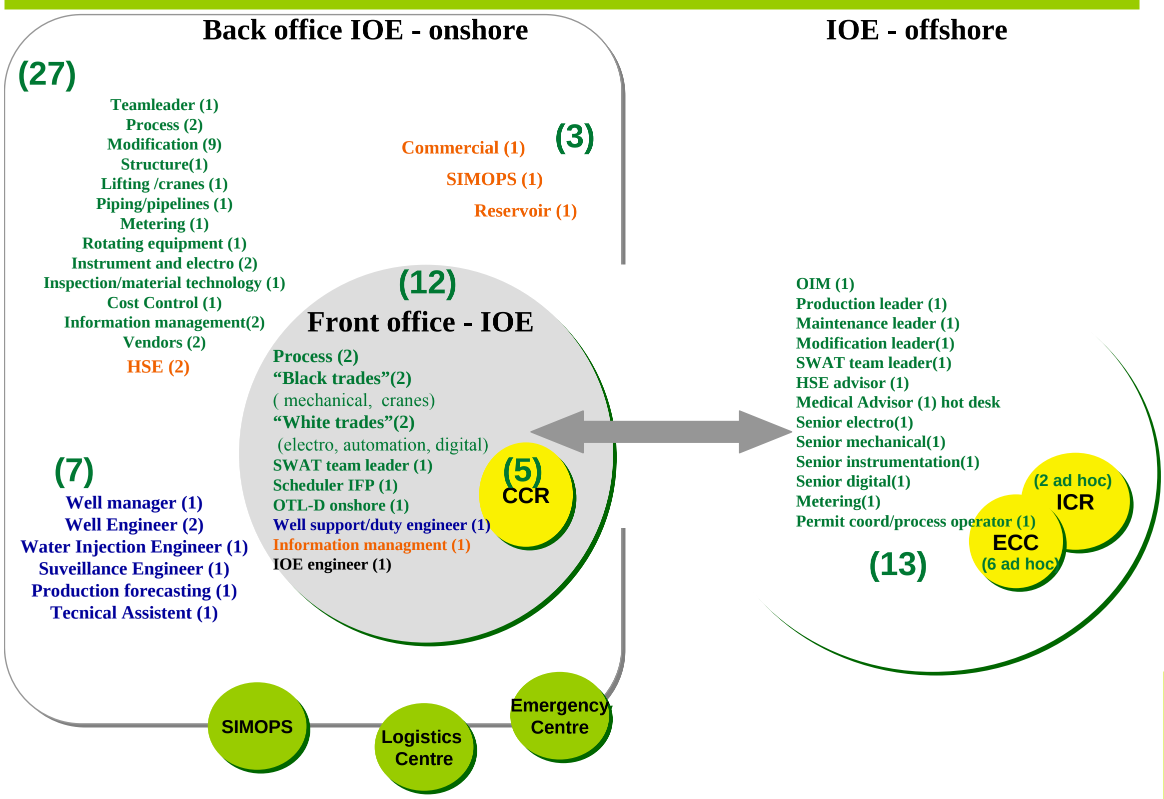
# IOE – preliminary functions

defined in workshop 04.01.06 + individual meetings

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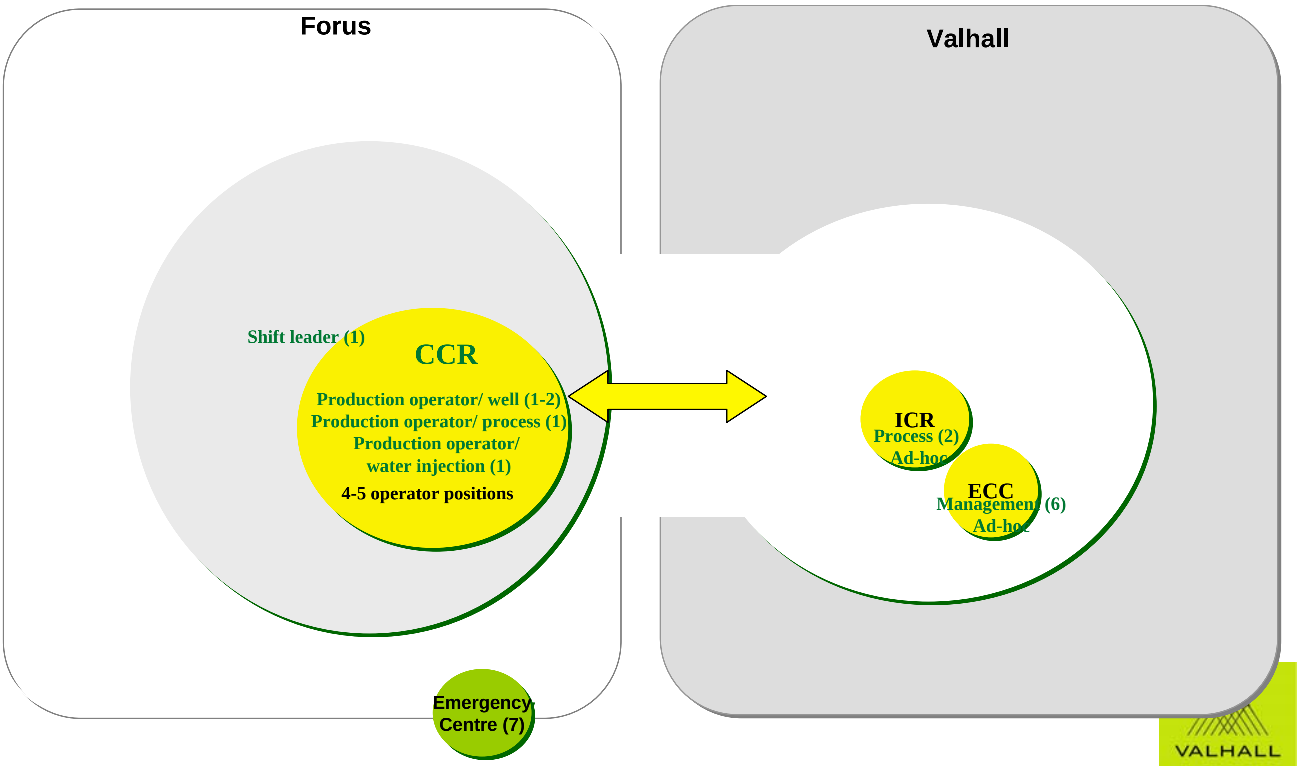
# CCR onshore – preliminary functions




IOE = Integrated Operation Environment
CCR = Central Control Room

ICR = Intervention Control Room
ECC = Emergency Control Centre

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# Function Analysis and allocation CCR/ICR

Document No: VRD-BP-O-000010

| Function | Description | Operational modes | Allocation | | | | Preconditions | Suggestions |
|---|---|---|---|---|---|---|---|---|
| Function | Description of function | | Onshore | Man | Machine | Offshore | Preconditions for allocation of function to onshore | Suggestions |
| **1. Manage CCR/ICR** | | | | | | | * ICR intended to be only used as a control room during emergency or abnormal situations (ref. Statement of Requirements document) | |
| 1.1 Lead CCR/ICR functions | Set performance targets and measure against goals (OTLD or Senior?) | | | | | | Determine organisation incl. roles and responsibilities for CCR - Leader, Senior, Junior, process, etc. Define when control relocated from onshore- offshore. Ref. SoR. | |
| | | Disturbance | | x | x | x | | |
| | | Shut Down | x | x | x | | | |
| | | Start Up | x | x | x | | | |
| | | Isolation for maintenance | x | x | | x | For isolation of safety systems, group states that this control should be offshore | |
| | | Steady state operation | x | x | | | | |
| | | | | | | | | |
| 1.2 Direct CCR/ICR work processes | Direct cross functional CCR work processes, internal/external (deliveries) | | | | | | Video - conferencing facilities. Define what he is / not is in charge of. Must know what others are responsible for / expected of them. | |
| | | Disturbance | | x | | x | As per SoR | |
| | | Shut Down | x | | x | | | |
| | | Start Up | x | | x | | | |
| | | Isolation for maintenance | x | x | | x | If safety systems - offshore - responsibility . FFS. | |
| | | Steady state operation | x | x | | | | |
| 1.3 Direct changes in process | Direct changes as required due to upsets, external demands (i.e. Ekofisk, buyers) or BP | | x | x | x | | Will need support 24/ 7 from Advanced Process Control - IOE.. And from other disciplines for other issues. Support = engineers. Example - wells support. | Should IOE onshore / optimiser be available 24/7 ? |
| | | | | | | | | |
| | | Disturbance | NA | | | | | |
| | | Shut Down | NA | | | | | |
| | | Start Up | NA | | | | | |
| | | Isolation for maintenance | NA | | | | | |
| | | Steady state operation | x | x | x | | | |
| | | | | | | | | |
| 1.4 Guide in task performance | Be a mentor to achieve best practice in work performance in CCR/ICR | | | | | | Include in Training matrix. Must have mentor role onshore and offshore - for all modes of operation. | |

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# Function Analysis and allocation CCR/ICR

Document No: VRD-BP-O-000010

### 1.5 Overview of results

The table below provides an overview of the results in this report and its supporting annexes. It also documents that the study goals have been met. In addition, other results have been achieved, such as the identification of Safety issues for remote control (Annex E) and Operational Concerns (Annex F).

| Study Goals | Status | Reference |
|---|---|---|
| Identify all functions in the CCR and ICR | √ | Annex C |
| Identify preconditions for allocation of functions onshore | √ | Annex C<br>Annex G, Ch 7 |
| Identify functions that are proposed to be controlled from offshore and why | √ | Annex C<br>Ch 6.3, 7 |
| Identify functions that should be further studied | √ | Ch 2, 7 |
| Identify human factors related implications | √ | Annex C and G |
| Propose allocation of function: land, offshore, people, technology | √ | Annex C |
| Provide a rationale for the proposed allocation of functions | √ | Ch 2.2.1 |
| Systematically integrate end users in the process | √ | MOM – Annex A and B |
| Document the process | √ | This report and annexes |

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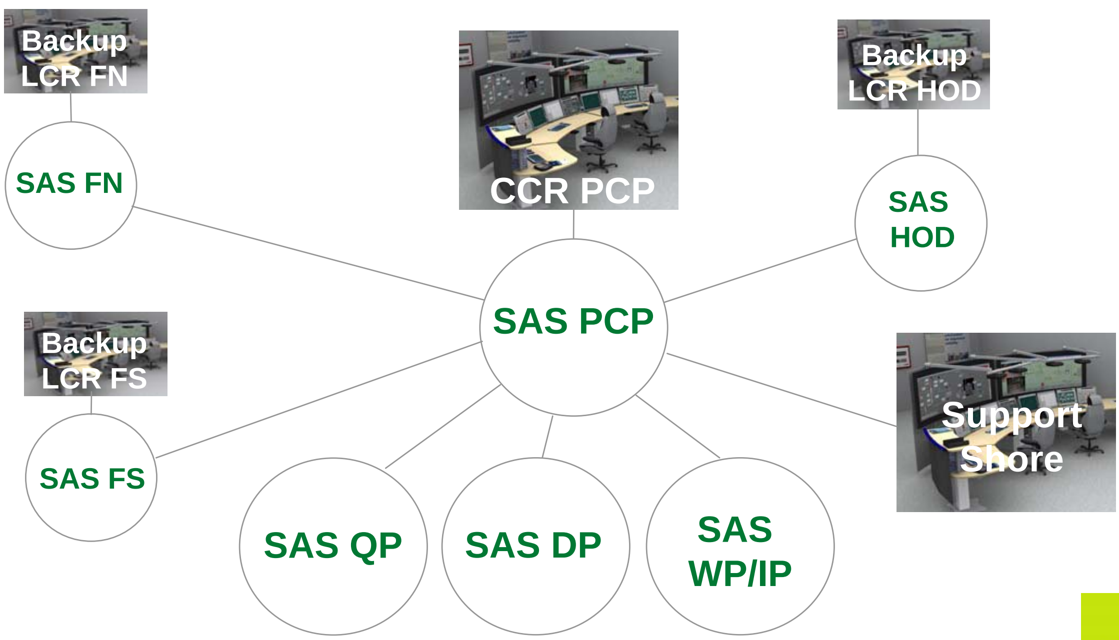
# Point of control today

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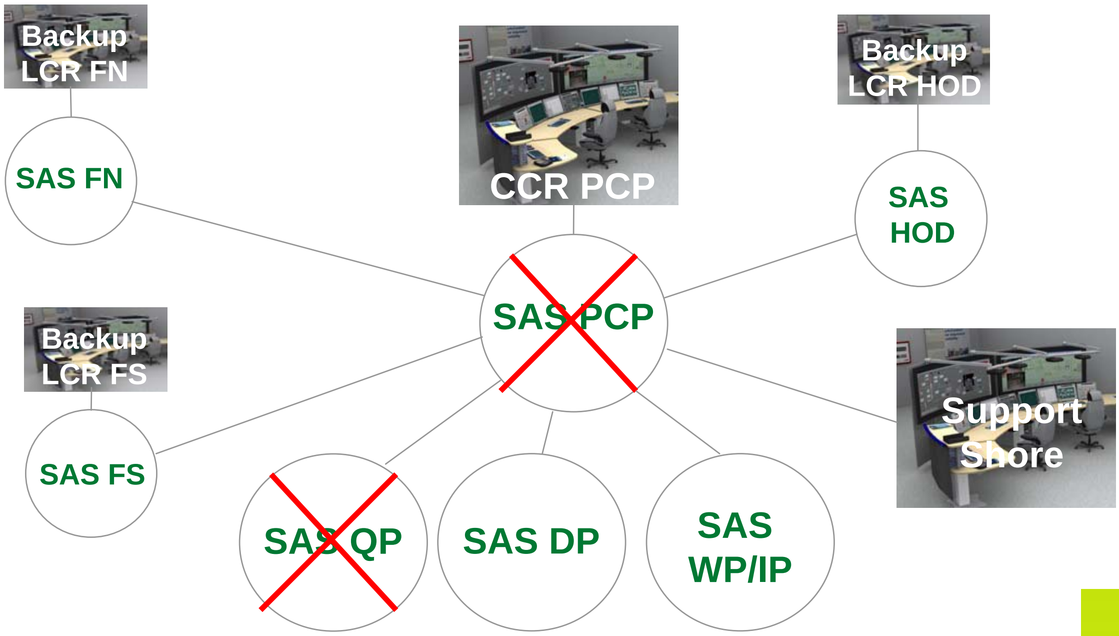
# Point of control next step

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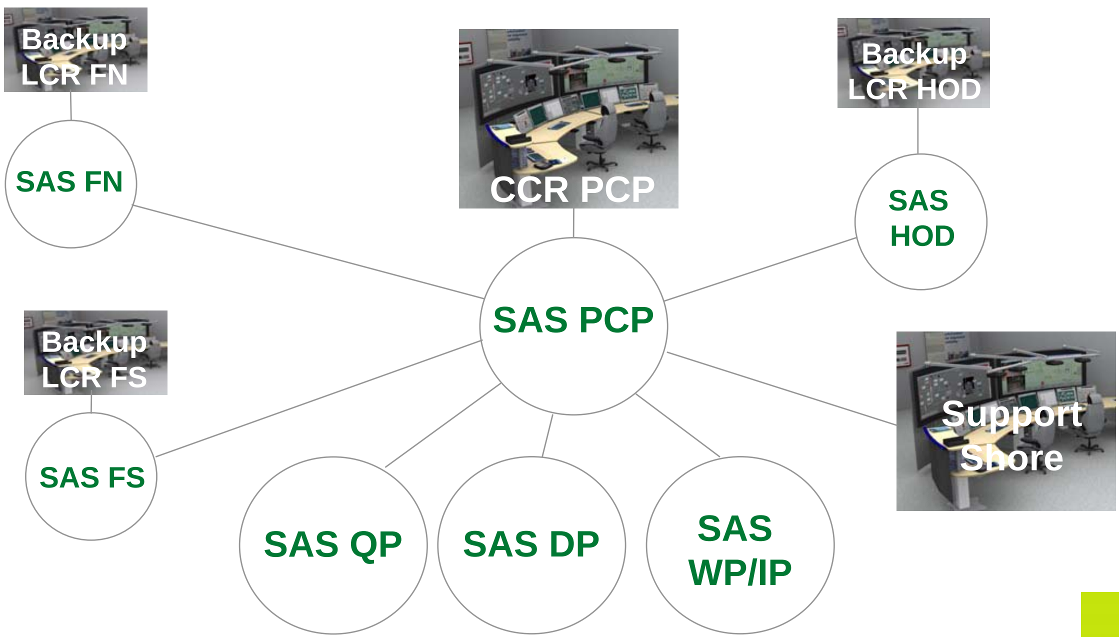
# Point of control next step

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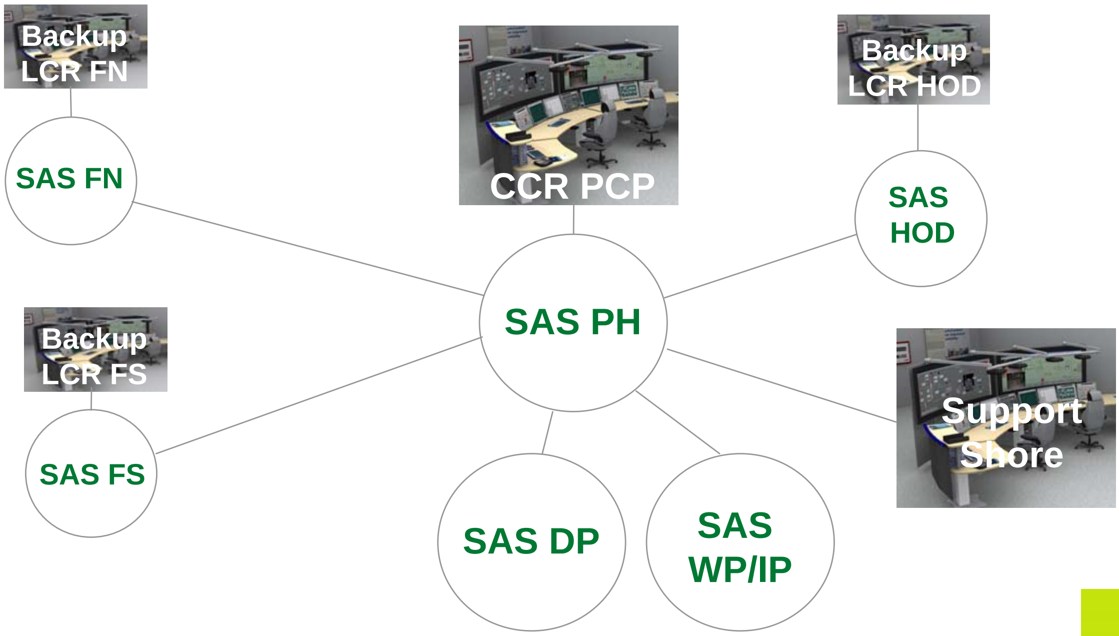
# Point of control after PH

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# Design Review and Testing, Topology

| Activity 2006 | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|---|---|---|
| Develope Topology | | | | | | | | | | |
| Project Design Review | | | | | | | | | | |
| ABB Projext ext. review | | | | | | | | | | |
| Plan Big Config. Test | | | | | | | | | | |
| BCT Testing Vasterås | | | | | | | | | | |
| Normal project Design<br>/IAT/FAT/SAT | | | | | | | | | | |

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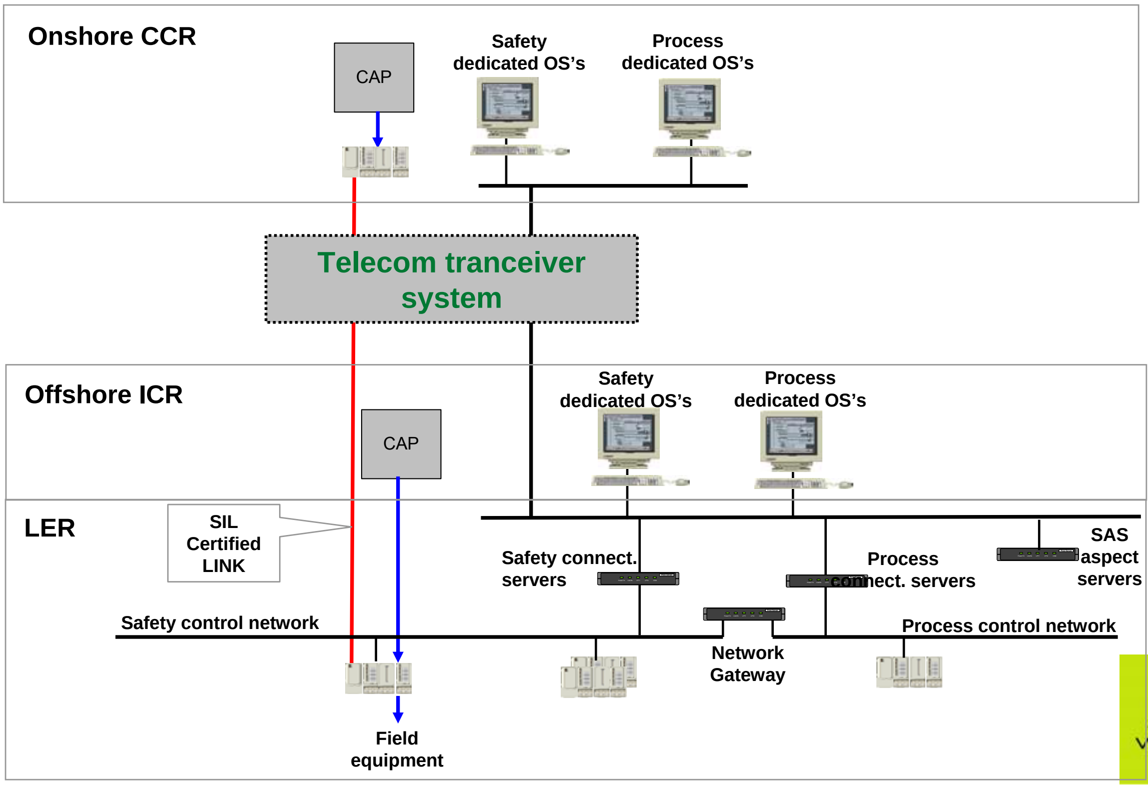
# Simplified Topology

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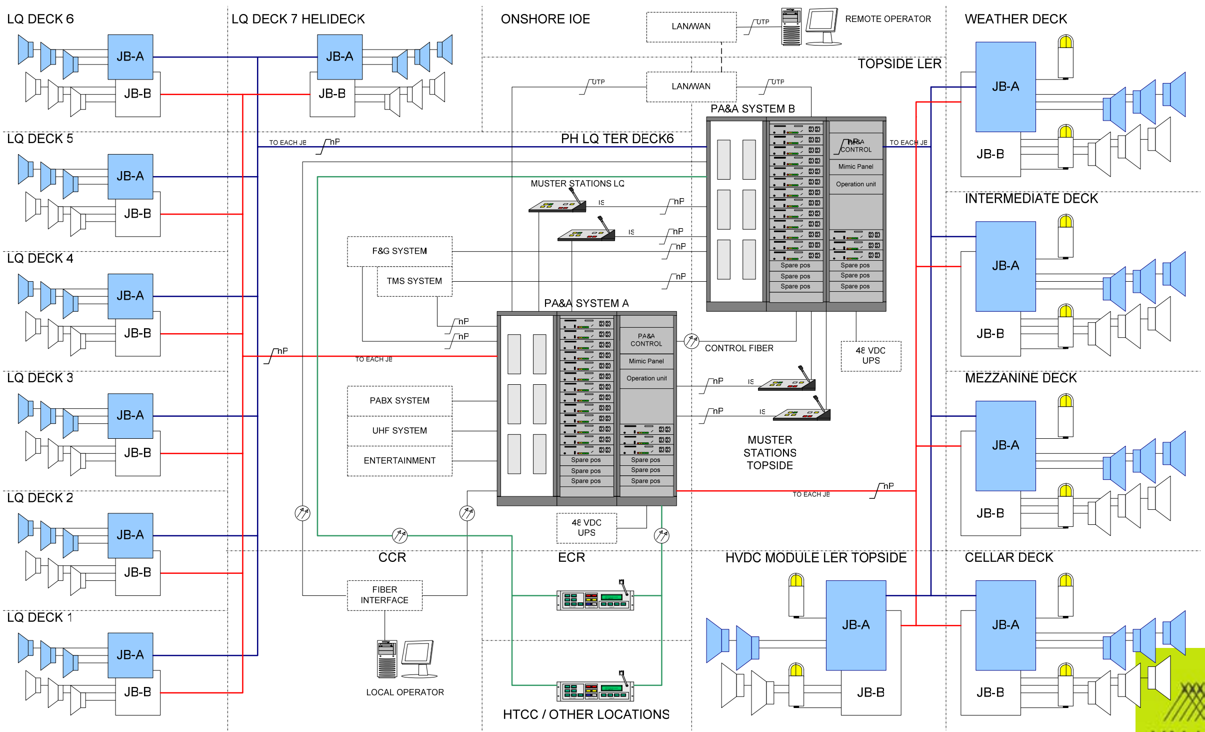
# PA&A

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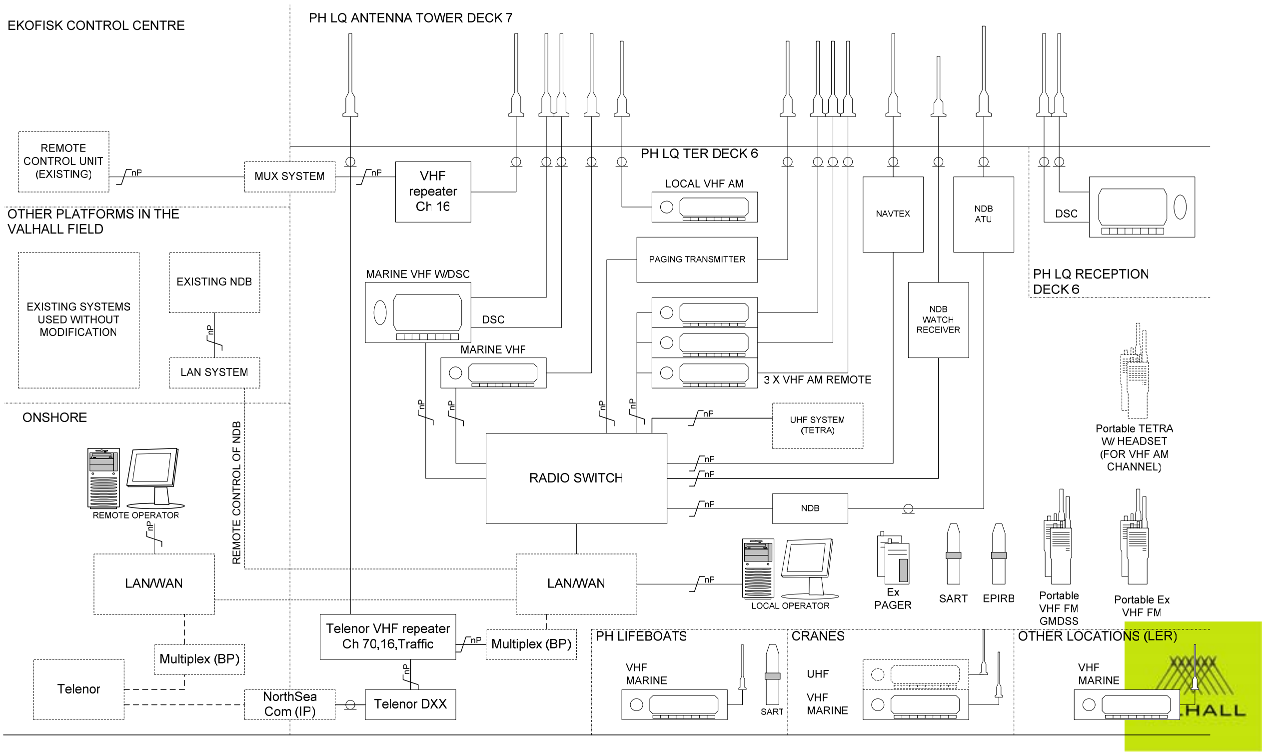
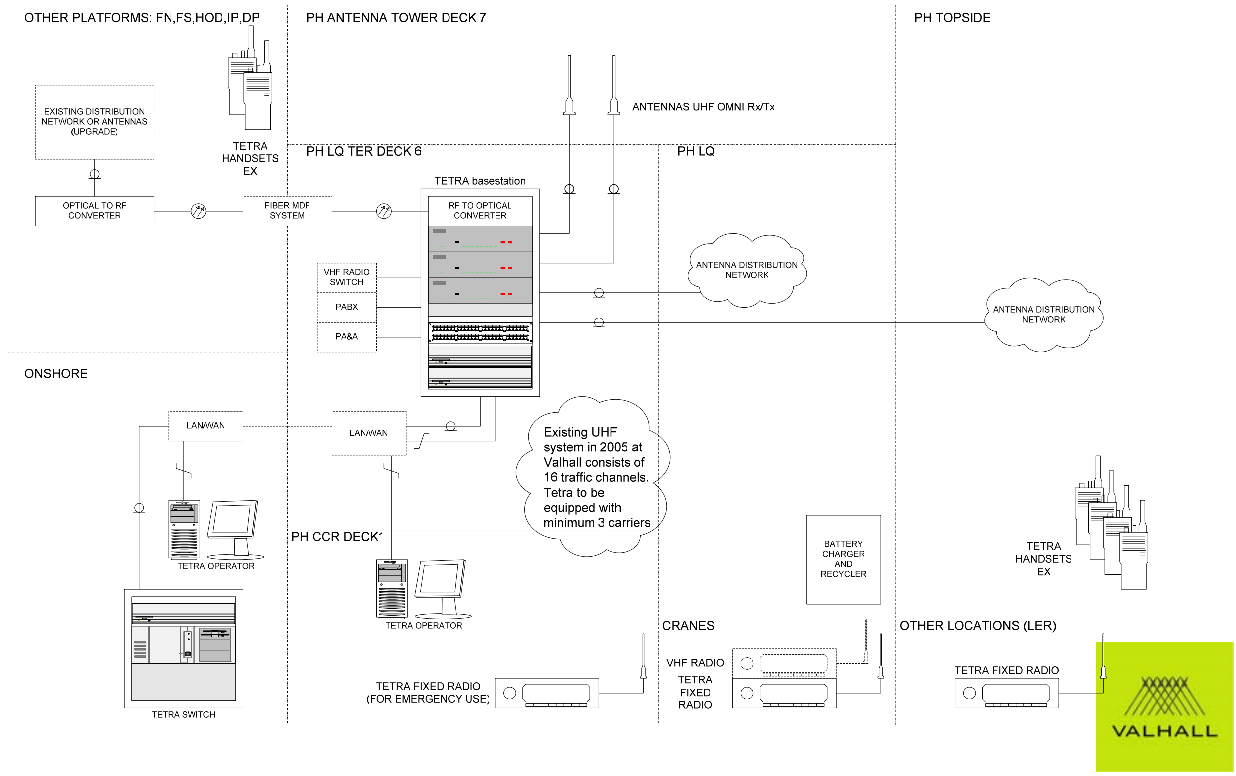
# Radio Systems






# TETRA



# Project schedule

| ID | WBS | Task Name | Duration | Start |
|---|---|---|---|---|
| 1 | 1 | **FEED PHASE** | 141 days | Tue 16.08.05 |
| 2 | 2 | **Statement of requirement and execution plan** | **105 days** | **Tue 16.08.05** |
| 7 | 3 | **Scope of work** | **0 days** | **Wed 01.02.06** |
| 9 | 4 | **Communication and involvement** | **70 days** | **Wed 23.11.05** |
| 12 | 5 | **Experience transfer** | **0 days** | **Tue 28.02.06** |
| 14 | 6 | **Functional and task analyses** | **15 days** | **Tue 20.12.05** |
| 17 | 7 | **HSSE activities** | **15 days** | **Mon 13.03.06** |
| 20 | 8 | **Lay-out development** | **32 days** | **Mon 16.01.06** |
| 23 | 9 | **Basis of Design** | **64 days** | **Thu 01.12.05** |
| 29 | 10 | **Validation and verification** | **0 days** | **Wed 01.03.06** |
| 31 | 11 | **INTERMEDIATE/CONCEPTUAL PHASE** | **329 days** | **Wed 01.03.06** |
| 32 | 12 | **Organizational development** | **871 days** | **Thu 01.09.05** |
| 54 | 13 | **Working environment** | **88 days** | **Wed 01.03.06** |
| 57 | 14 | **HSSE** | **152 days** | **Tue 01.08.06** |
| 61 | 15 | **Verification** | **88 days** | **Wed 01.03.06** |
| 65 | 16 | **Technical design descriptions/requirements** | **22 days** | **Thu 01.06.06** |
| 67 | 17 | **Lessons learned** | **80 days** | **Mon 13.03.06** |
| 70 | 18 | **Communication and involvement** | **1011 days** | **Tue 16.08.05** |
| 77 | 19 | **Construction phase** | **310 days** | **Mon 04.06.07** |
| 94 | 20 | **Commissioning** | **100 days** | **Mon 11.08.08** |

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# Activities in conceptual phase

- Technical design review – integrated Operations
- CRIOP
- Security Analyses
- Emergency Preparedness Analyses
- Review Risk Matrix
- Design review/Lessons Learned
- Peer Review
- Functional and task analyses IOE (front office and offshore)
- CCR/ICR task specification (organization, roles, responsibilities)
- Information flow, criticality and needs
- HMI Design Guide
- Early testing of remote operation (plan and define SOW)
- Culture survey + communication pacakage
- Visualization of Integrated Operation
- IOE (front office and offshore) - organization

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Status: Draft

# ISO 11064, erfaringer og utfordringer

…..en serie avklaringspørsmål

Svein Louis Bersaas

Senior Fagleder Prosess Automatisering

STATOIL



## ISO 11064, erfaringer og utfordringer

Relevante avklaringspørsmål ved anvendelse, hvilke type prosjekt?

- Et forskningsprosjekt om CCR?
  - Graden til dokumentasjonsbehov er mer omfattende enn et engineeringsprosjekt?
- ..eller et utbyggingsprosjekt – et nytt anlegg med CCR?
- ..eller et modifikasjonsprosjekt – eksisterende anlegg men nytt CCR?
- ..eller et modifikasjonsprosjekt – endring av et eksisterende CCR?
- ..eller utskifting / vesentlig endring av prosesskontrollsystem??
- Hvem (disiplin) bør ha eierskapet til "ISO 11064" i et prosjektet?

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## ISO 11064, erfaringer og utfordringer
### Relevante avklaringspørsmål ved anvendelse, hvilken kompetanse?

- Hvilke tidsrammer er det i prosjektet for de enkelte faser?
  - Er ønsket kompetanse tilgjengelig i periodene?
  - Hva er mulig å få utført i periodene?
- Hvor god er disiplin kompetansen og tilgjengeligheten prosjektteamet?
  - Reell driftserfaring sett fra en vinkling som vedlikeholdsoperatør, drifts operatør, skiftleder, driftsingeniør…?...
  - Teoretisk innsikt om system og utstyr inklusiv krav krav til sett fra en ingeniør disiplin som prosess, maskinsystem, elektro, automatisering, teknisk sikkerhet, sub-sea…?…
  - Hvilken kompetanse og innsikt har de som skal foreta "HF" analyser?
    - For stor tro på "HF ekseperter" som orakler?
- Er et engineeringsselskap innvolvert og hvilken kultur / kompetanse representerer det?

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## ISO 11064, erfaringer og utfordringer
### Relevante avklaringspørsmål ved anvendelse, hvilken teknologi?

- Hva er automatiseringskonseptet – "teknologinivå"?
  - Basert på sikkerhet, drift og vedlikehold strategien for anlegget.
  - Inneholder den mer som eksempelvis et fag støtte senter og / eller et fjerntliggende driftsenter?
  - Inneholder den sanntid dynamiske produksjons modeller, modelbasert styring, sanntidsoptimalisering med stasjonære modeller?
  - Inneholder den utstrakt tilstand og ytelsesovervåking av enkeltutstyr og anlegg?
  - Informasjon og aksjoner om hva og til hvem og hvor?
- Standard leverandør prosesskontroll / instrumentert sikkerhetsystem / metering?
  - Kontinuerlige forbedringer gjennom erfaring fra anlegg i drift i et langsiktig samarbeid med leverandørene?
  - Akseptert og godkjent "as is" for bruk til type anlegg (prosjekt)
  - Endringer gir økt arbeidsomfang og risikoeksponering.
  - Standard løsninger ved miksede anlegg som eks. prosess og energi/kraftanlegg?

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## ISO 11064, erfaringer og utfordringer
### Relevante avklaringspørsmål ved anvendelse, hvilke krav?

- Hvilke Tekniske Krav – TR / spesifikasjoner ligger som basis i prosjektet?
  - Hvor krav og erfaringer - "beste praksis" er ivaretatt?
  - Fokus på å ivareta det meste i TR som en selskapstandard før anvendelse i prosjekt….
- Hva er gitte forutsetninger om kunnskap / kompetanse nivået til brukerne?
  - Fokus på opplæring, kunnskap om hvordan anlegg / prosess fungerer og trening på gitte hendelser
- Idelle "HF prinsipper" eller en faktisk løsning som fungerer meget bra i praksis?
- Analysene nyttige for hvem og hva?
  - De som analyserer som får bedre innsikt, et produkt for bedre løsninger, eller en bekreftelse på det vi visste fra før?
  - Vedlikehold av analysene i takt med endringer og erfaringer? Og hvem gjør det?

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## ISO 11064, erfaringer og utfordringer
### Bakgrunnen for avklaringspørsmålene….

- Ukritisk til anvendelse av ISO 11064 kan føre til et prosjekt i seg selv med forbruk av knappe fagressurser hvor resultatet og nytteverdien ikke står i forhold til innsatsen – liten verdiskapning
  - Nødvendige forutsatte ressurser er ikke tilgjengelig – grunnlaget for ønsket kvaliteten er ikke tilstedet!
  - En "CCR Task" blir i ufase med hovedprosjekt og dets faser, det er vanligvis lite tid til iterative prosesser – toget går en vei og fort!
    - Er ikke naturlig del av engineeringsprosessen, men noe som henger utenpå!
    - Eierskapet til prosessen og resultatene er ikke riktig plassert i prosjektorganisasjonen – resultatene blir ikke ivareatt som en naturlig del av engineeringsprosessen.
- Et bevisst forhold til hva oppgaven går ut på og hvilke forutsetninger som gjelder vil føre til en "hvordan i praksis tilpasset anvendelse av ISO 11064" som kan gi verdiskapende resultater på en rasjonell måte.

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# ISO 11064: Introduksjon og erfaringer

Håkon Augensen, Berte Hove, Espen Øren og Adam Balfour

Human Factors in Control, Halden, April 2006

HUMAN FACTORS SOLUTIONS



## Mål og Agenda

### Mål

- Få en felles forståelse for ISO 11064
- Gi tilbakemelding om erfaring ved bruk av ISO 11064

### Agenda

- Gjennomgang ISO 11064
  - kontekst, rammer, intensjonene, deler
- Erfaringer fra bruk - ulike prosjekter/ roller
  - Forutsetninger, mangler, tydeliggjøre, positivt/ negativt

## ISO 11064?

# ISO 11064
# Ergonomic design of control centres

“A generic framework for applying requirements and recommendations relating to ergonomics and human factors in designing and evaluating control centres with the view to eliminating or minimizing the potential for human errors”.

Krav og anbefalinger til ergonomi og human factors ved design og vurdering av kontrollsentra med det formål å fjerne eller minimere muligheten til menneskelige feilhandlinger.



## Hensikten med ISO 11064: Unngå dette

## Om ISO 11064 - Kontekst

ISO 11064 er bare *en* måte å stille HF krav på - blant andre:

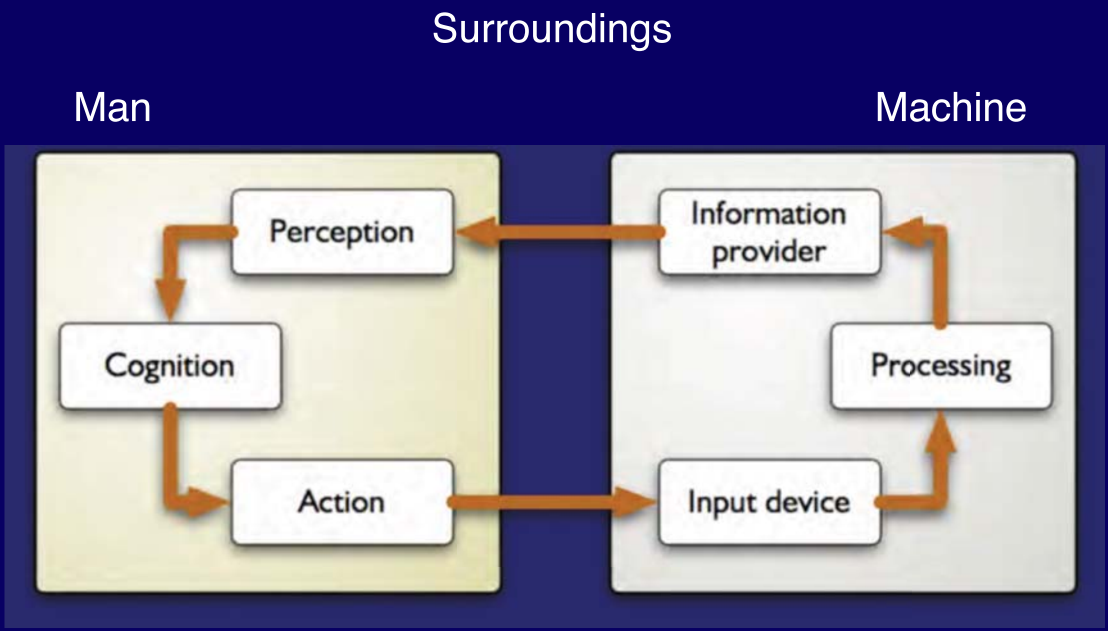
- Detaljerte krav (fontstørrelse skal være... )
- HF Prinsipper... (brukervennlig, motiverende... )
- Retningslinjer (navigering, interaksjon, input...)
- Ytelseskrav (utføre en bestemt oppgave innen xx sekunder)
- Validering & Verifikasjon (sjekklister, scenarier)
- Bruk av HF-verktøy (CRIOP, HFAM etc)
- Designprosess standarder (ISO 11064, ISO 13407 etc)
- Standarder og regelverk



## Human Factors - basis forståelse - ISO 11064


Source: UK HSE and OGP

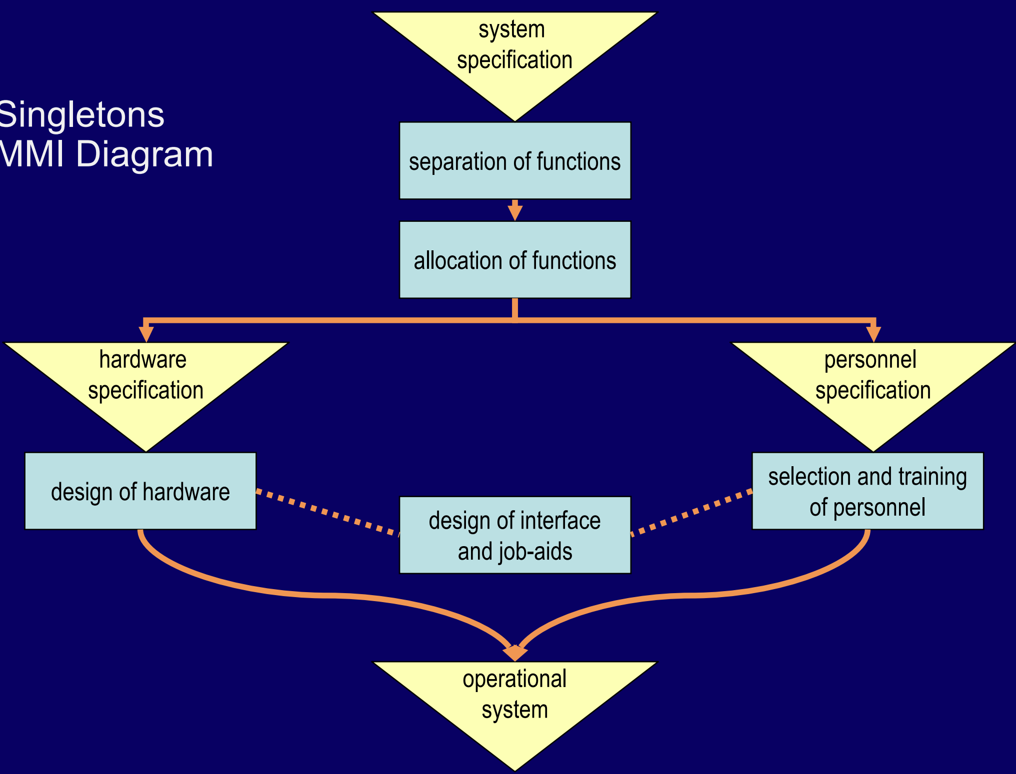
## Basis/ kontekst for ISO 11064






## Om ISO 11064 - Bakgrunn

Singletons
MMI Diagram



## Om ISO 11064 - Bakgrunn

Litt om utviklingen av ISO 11064

- ISO krever at “alle” er enige (lavest felles multiplum)... ikke *nødvendigvis* en standard som sikrer høyt nivå/ gode løsninger (deltagelse, arbeidet er ubetalt/ frivillig)
- 11064 utviklet over lang tid (10 år +), problemstillinger og løsninger ikke nødvendigvis 100% relevante/ up-to-date
- Deltagere: kjernekraft, FoU, teoretikere/ pragmatikere, konsulenter, etc...

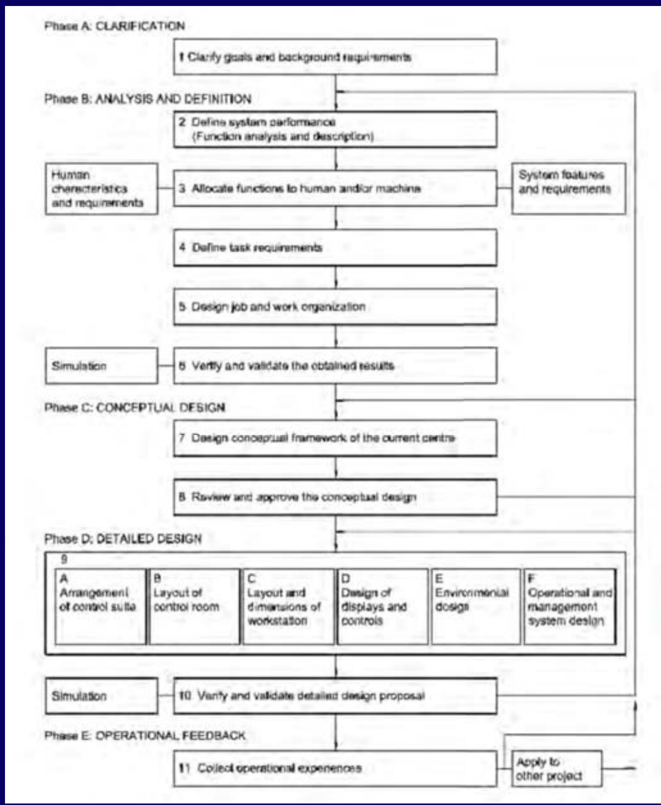


## Om ISO 11064 - Bakgrunn

ISO 11064 er utarbeidet av Technical Committee ISO/ TC 159 *Ergonomics*, Subcommittee SC4 *Ergonomics of human-system interaction*. Den består av 7 deler:

- Del 1: Principles for the design of control centres
- Del 2: Principles for the arrangemenf of control suites
- Del 3: Control room layout
- Del 4: Layout and dimensions of workstations
- Del 5: Displays and controls
- Del 6: Environmental requirements for control rooms
- Del 7: Principles for the evaluation of control centres

# ISO 11064 - designprosessen






# Om ISO 11064 - Generelt

ISO 11064 er:

- Rammeverk (ikke en ferdig oppskrift)/ veiledning/ verktøy - må tilpasses hvert prosjekt
- Definisjoner
- Referanser
- Generelt formulert - filosofi, designprosess
- Detaljert - kontrollromspulter
- For modifikasjoner, nybygg, små og store

## Om ISO 11064 - Prosjektfaser

| | |
|---|---|
| 1: | Planning |
| 2 & 3: | Function Analysis and Allocation |
| 4: | Task Analysis |
| 5: | Job and work organisation |
| 6: | Verification and Validation |
| 7: | Design of conceptual framework |
| 8: | Review and approval |
| 9.1 & 9.2: | Detailed Layout Design Development |
| 9.3: | Workstation Layout and Dimensions |
| 9.4: | Design of Displays and Controls |
| 9.5: | Environmental design |
| 9.6: | Operational and management systems design |
| 10: | V & V |



## Om ISO 11064 - HFS Erfaringer

HFS´ erfaringer basert på:

- Egne erfaringer fra ulike oppdragsgivere - forskjellige roller (myndigheter, operatørselskaper, engineering, SAS-leverandører, via utvikling av andre metoder)
- Undervisning - internasjonale workshops, NTNU og UiO
- Kontrollromsprosjekter - offshore og onshore
- Kabiner (kraner, borekabiner)
- Forskjellige prosjekttyper (nybygg, modifikasjoner) og faser
- Utvikling av HFAM 2002  (Ptil verifikasjonsverktøy)
- Bruk av/ kjennskap til andre designprosesser (generell produktdesign, Universell design, Sustainable design, MMI, etc.)

## Om ISO 11064 - HFS Erfaringer

### Forutsetninger for vellykket bruk: kompetanse og forståelse

- Kjennskap til standarden, dens krav - og bruk av den (internt)
- Kjennskap til andre HF - standarder (referanser) - hvordan henger alt sammen?
- For hva gjelder standarden: kabiner, distribuert kontroll, integrert drift, paneler, etc. ?
- Krav til kompetanse - hos prosjektdeltagere, bestillere, m.fl.
- Krav til prosjekt - oversikt og forståelse: filosofi, systemer, helhet - ikke lese standarden ord for ord men forstå intensjonen!
- Forståelse for enkelte deler (f.eks funksjonsanalyse)
- Hva skal man følge - ISO 11064 eller NORSOK eller ?
- Når er nok nok?
- Erfaringer med bruk av ISO 11064
- Forståelse for Human Factors
- Bruke den!



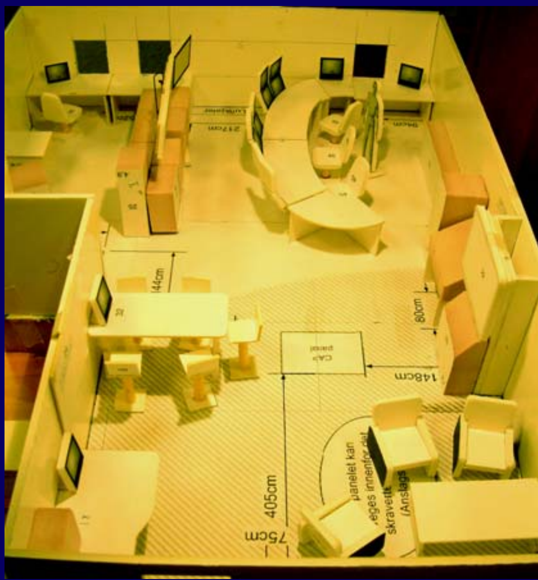
## Om ISO 11064 - HFS' Erfaringer

### Mangler i ISO 11064:

- Aktøranalyse
- Usability
- Fase C: Konseptdesign - alt for dårlig beskrevet....
- Del 5 - MMI - for prosess-spesifikk, ikke andre brukergrensesnitt
- Eget avsnitt/ analyse for samhandling/ kommunikasjon
- Illustrasjoner i forhold til brukergrensesnitt
- Del 5 - MMI - ikke ferdig, overordnede krav
- Redaksjonelle mangler:
  - Gammeldagse tegninger/ illustrasjoner - ikke gjeldende for 2006
- Omfattende (tung)
- 9 designprosess-prinsipper bør fremheves (f.eks. tverrfaglige grupper)

# Concept design: modeller og skissering

En modell er et verktøy for å tydeliggjøre, til å eksperimentere med og et møtepunkt for prosjektdeltagere - designere og sluttbrukere






## Om ISO 11064 - HFS Erfaringer

### Positivt :

- Noe å forholde seg til - et felles utgangspunkt
- Gir synlige resultater
- Generisk - ulike applikasjoner: CCR, kraner, IOE
- Generisk - faser: nybygg, modifikasjoner,
- Generisk - størrelse: stort, lite
- Del 3 har mange bra layout-konsepter som kan anvendes tidlig i designfasen
- Bra rammeverk - godt prosjektplanleggingsverktøy
- Bra mapping med de enkelte selskapers prosjektfaser/ praktisk gjennomføring
- ISO 11064 - 7 Verifikasjon og Validering - hvordan, hva, når? Klar, konsis, håndterlig og godt skrevet

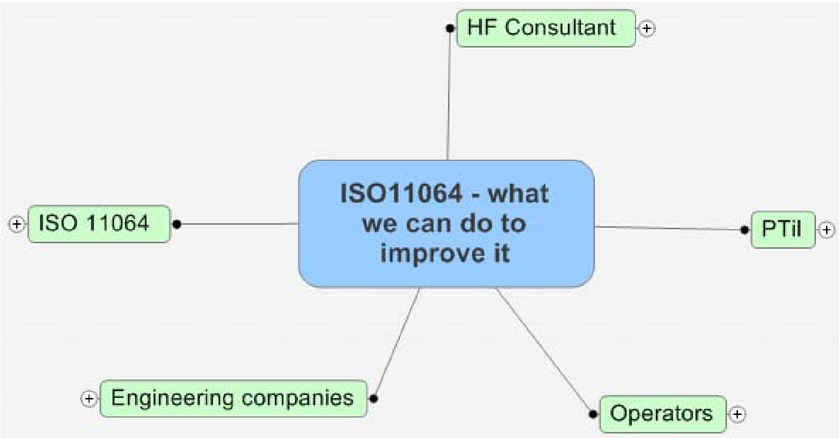


## Om ISO 11064 - HFS Erfaringer

### Oppsummering :

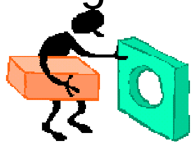
- Bra rammeverk
- Anvendelig/ fleksibel, kan brukes i praksis i ulike typer prosjekter
- Skalérbar
- Krever HF forståelse/ -kompetanse og erfaring
- Omfattende
- Mangler: opplæring, prosedyrer, organisasjon, samhandling

# Experience in using ISO11064 Problems and adapting to them




1

# ISO process ≠ Engineering Design Process



- Need to adapt and streamline methods
  - New FA approach gives better results, is less reource intensive.
- More reuse of existing work
  - Use as a basis not as a finished product
  - Can begin with a template - makes it easier to hang it on.
- Make the level of detail appropriate for the project stage.
  - What questions am I trying to answer at this stage?
  - Differant stages at differant times e.g. layout may be finished while alarms system or displays have not been begun.
- Provide answers and solutions not rigourous methods
  - Quick and dirty can be good enough – it's better than nothing
  - 80/20

2

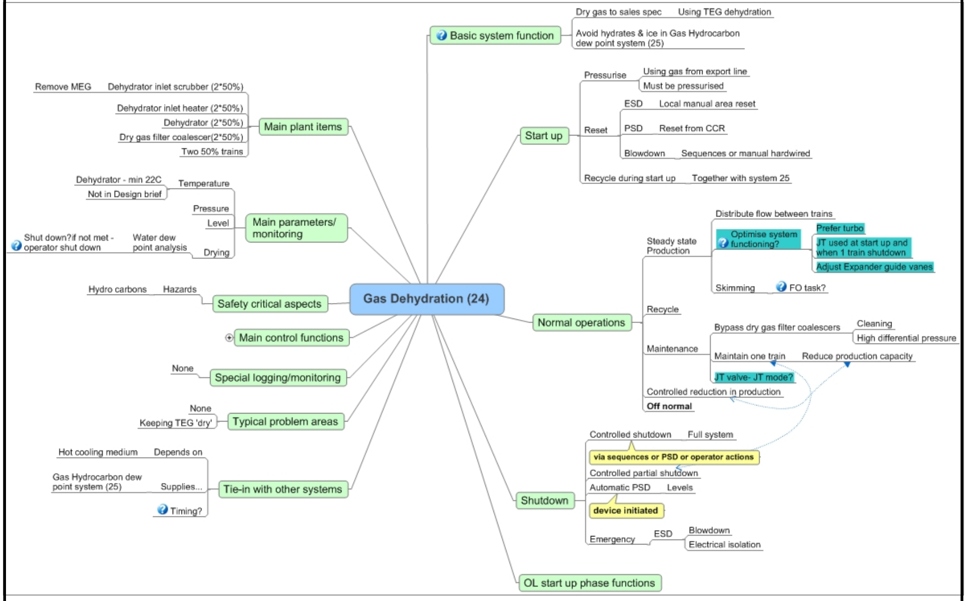
# Reports - too many, too long

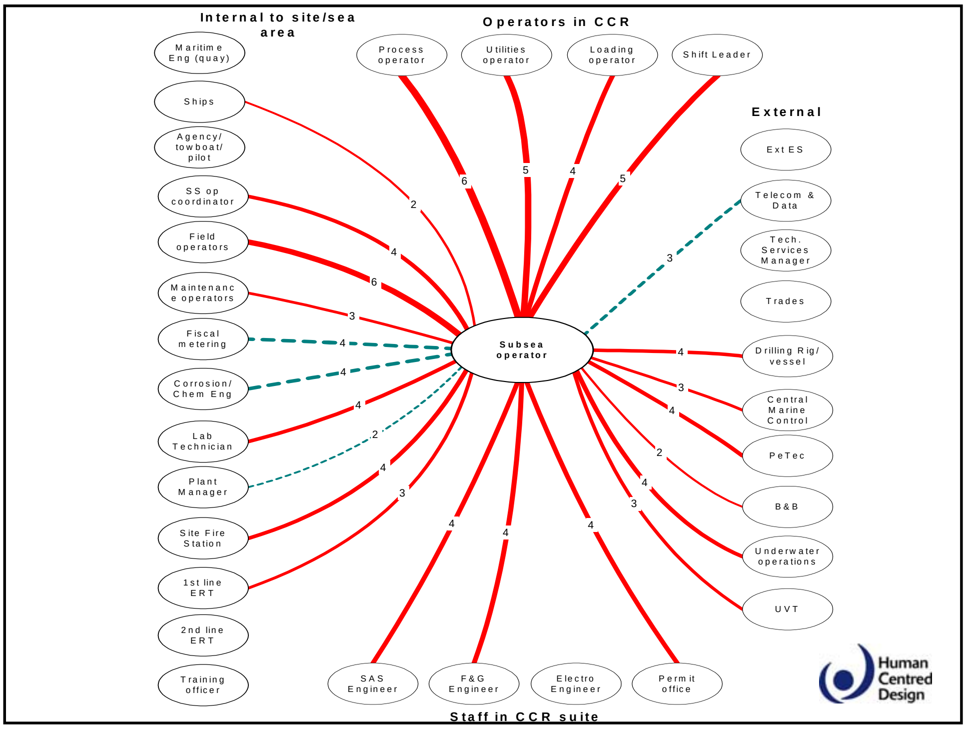
- Package documents and results better
  - Make them user friendly: faster & easier to rea
  - Included user guide
  - Group recommendations for disciplines
- Take the results to the project
  - Meet with discipline leaders to clarify or
  - Get representatives from disciplines to distribute results
- Guidance for where to use/reuse info
  - TA use for training requirements and procedures.
  - FA can be used in work processes

3

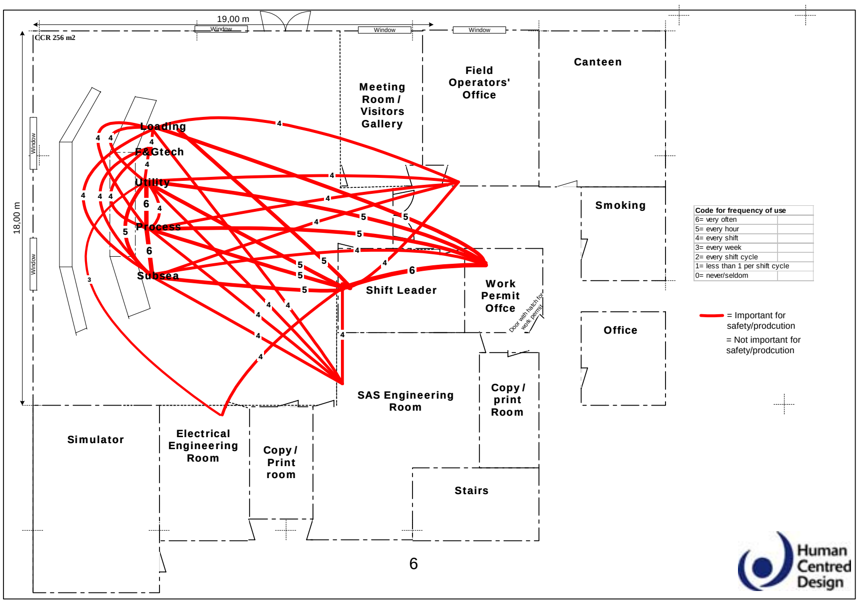
Human Centred Design

# Functional Analysis

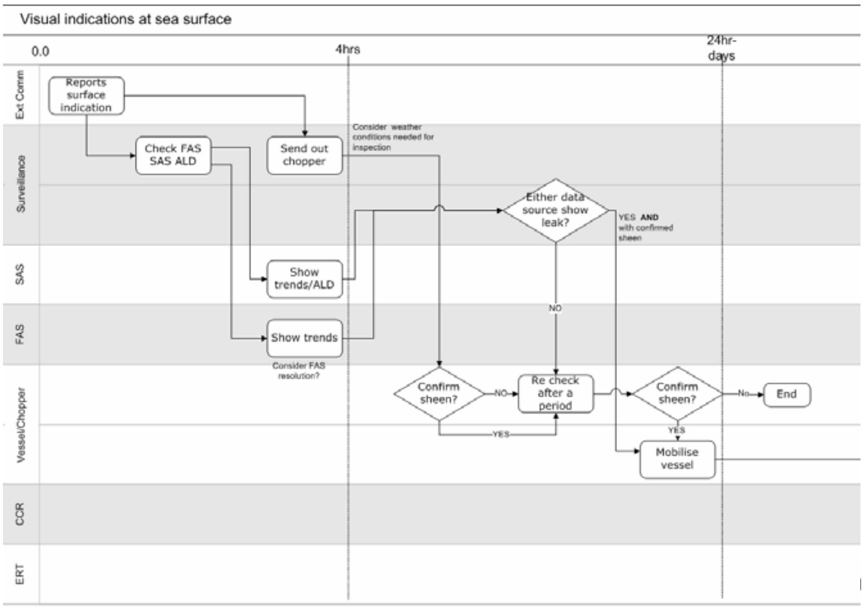





# Communication



# STEP revisited




# Things HF Consultants can do:

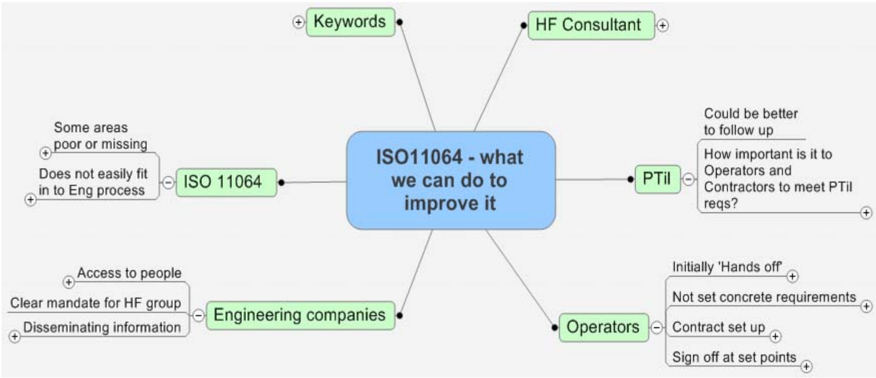
- Simplify and adapt techniques
- Throw out things that don't work and replace with things that do work.
- Develop templates for work
- Learning the engineers language - don't use HF/Psychology jargon
- Become part of the team and work in the project - can't sit in isolation and deliver reports.

8

Human Centred Design

# Workshop

- What issues can other responsible parties fix




9

Human Centred Design

# HFC forum 19.April 2006 - Bilder fra middagen i Kongshallen

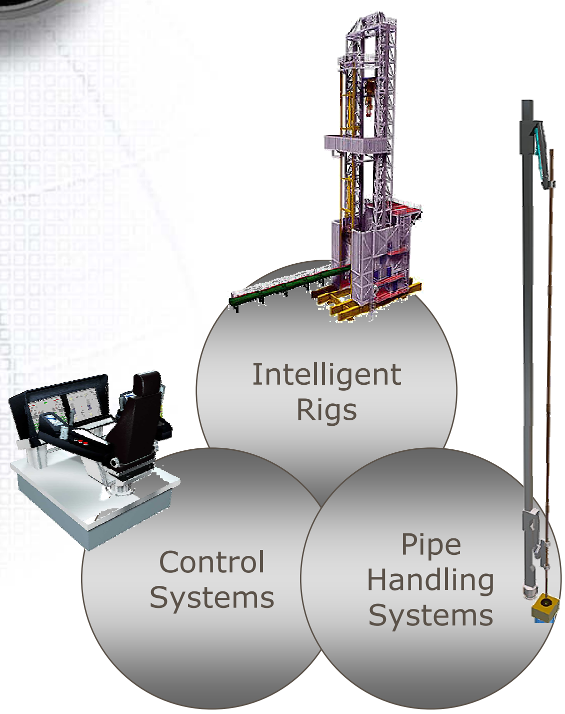
# HF-Problemstillinger innen Boring

Human Factors in Control,
seminar 19-20 april 2006

sense EDM



# Sense EDM




Sense EDM is a supplier of intelligent rigs, innovative tubular handling systems and world class control systems to the international oil & gas industry.

Our core competence is "intelligent movement"

# Sense EDM History - Sense Technology

Sense Technology was established in 2000. Sense Technology has since the start established a position as one of three leading suppliers of advanced drilling control system world wide. Sense Technology drilling systems enables the drilling rigs to achieve higher efficiency and quality in their drilling operations through innovative technology combining advanced control systems and mechanical design.

Intelligent Movement. Delivered.

# Sense EDM History - EDM

EDM Engineering & Drilling Machinery AS was established in 1997, has designed and patented a multifunctional rig based on Rack & Pinion technology. The multifunctional rig includes state of the art technology for efficient work over, well intervention and under balanced drilling. EDM has also established a series of advanced tubular racking systems for both onshore and offshore drilling operations.

Intelligent Movement. Delivered.

# Sense EDM History - Merger

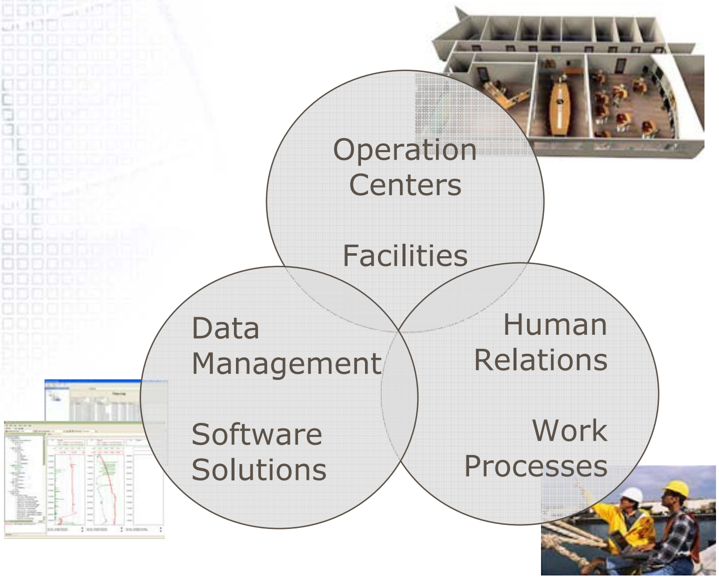
On December 23rd 2005 Sense Technology and EDM merged to form Sense EDM. The new company will continue to develop best in class technology and expand internationally by developing unique, leading edge drilling equipment and solutions within the main focus areas:

| | |
|---|---|
| Drilling Packages | Complete packages for semi submersibles, jack ups and fixed platforms. |
| EDM® R&P Rigs | Patented rig technology enables multi-functional rigs for combined drilling, workover, service work, on and offshore. |
| Drilling Equipment | High capacity heave compensating Drawworks, top drive systems, other equipment for high spec drilling operations. |
| Tubular Handling | Full range of innovative drillfloor and pipe handling systems for faster and more reliable tubular handling. |
| HMI & Controls | World class driller's cabin, operator chair and drilling instrumentation making record-setting wells. |
| Services | Providing customer satisfaction is at the core of our business. A satisfied customer is the key to new sales. |



# Sense Intellifield

Sense Intellifield is an independent supplier of products, systems and solutions for real time remote operations to operators/contractors in the oil and gas industry.




Sense Intellifield consist of personnel with many years of experience in supplying, implementing and servicing advanced products in an oilfield environment.

Intelligent Movement. Delivered.

# HF Tasks/Challenges Drilling

- Layout & Working Enviorment
- Control & Sceen Picture Design
- Alarmsystem
- Design Organization
- Critical Operations



# Layout & Working Enviorment

- Over the last 10-15 years traditional Driller`s Houses with conventional controls, indicators and displayes are integrated into compact graphical interfaces, a modern operator's control and information central.
- The modern Driller`s Control Rooms (DCR) have improved layout and working enviorment.

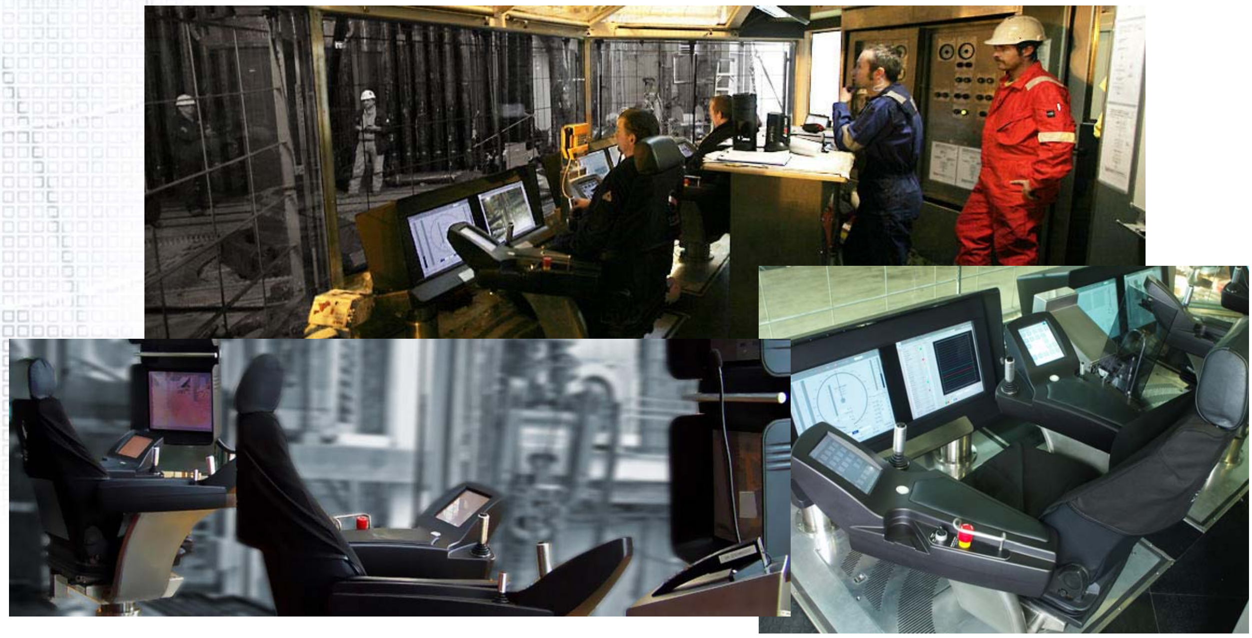
# Layout & Working Enviorment

Typical  conventional Driller`s House. Design inspired by ISO 11064?



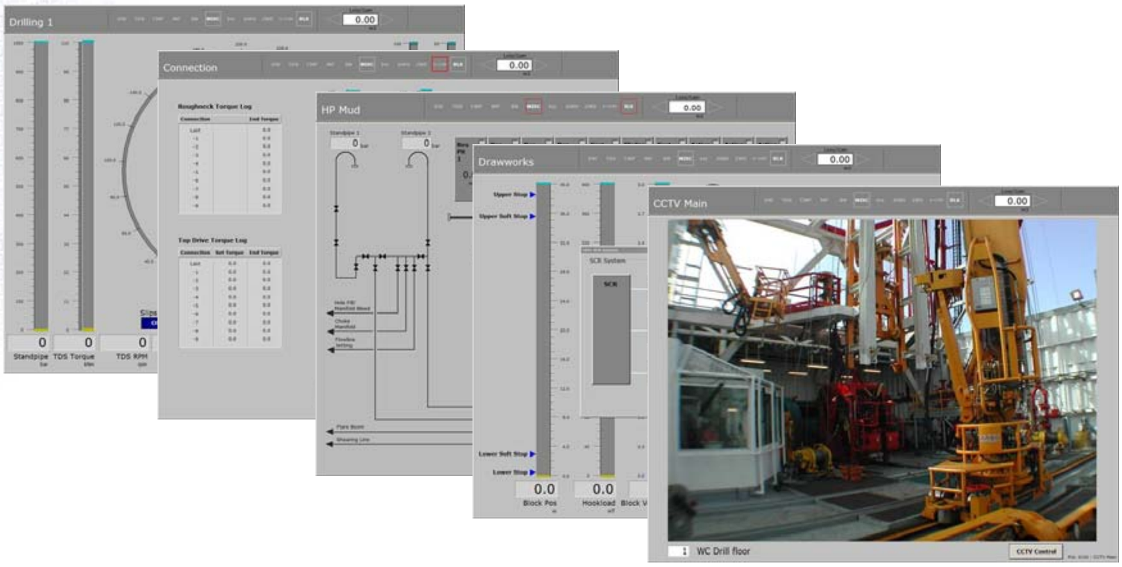

# Layout & Working Enviorment

Modern Driller`s Cabin from Sense EDM.



# Screen Picture Design

How to design intuitive screen pictures? A screen picture application can consist of 15-20.000 control/information signals. What is impotant information and what is less important.

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# Screen Picture Design

Easy and efficient menu structure is a must. A screen picture application can consist of 50-100 screen pictures. How to change from a screen picture to any other picture by one operation?

| Groups | Display strip selected from Touch Pad | | | | | | |
|---|---|---|---|---|---|---|---|
| Operation | Drilling 1 | Drilling 2 | MWD | Tripping | AWD | Trend | Connection |
| Mud | Tank Volume | Trip Tank | Treatment | HP Mud | | | |
| Drilling Equipment | Anti Coll | DWKS | TDS/RT | MP 1-2 | MP 3 | HPU | |
| Pipe Handling | Rough Neck | Hydra Racker | HR Service | HR Set Up | HR Learn | HR Preset | HR FM Status |
| Well Control | Well Config | Choke Control | Kick Calc | Kill Sheet | | | |
| Misc | CCTV Main | CCTV Bar | CCTV Trend | Setup | Power System | | |
| Alarms | Alarm System | AWD Alarms | Event List | | | | |
| System | Tag Browser | C-NET Status | I_NET Status | System | | | |

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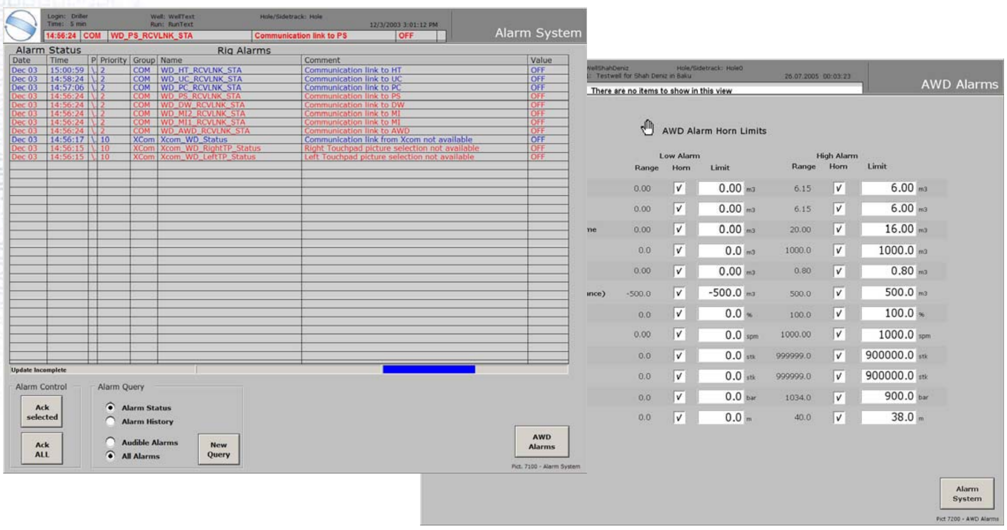
# Control Design

- Flexibility
  - Avoid interruped and deadlock situations
  - Avoid over complexity
- Reliability
  - Designed for 24/7 operation
  - The system must give the operator the comfort he need to control several thousand horsepowers via a computerbased system.



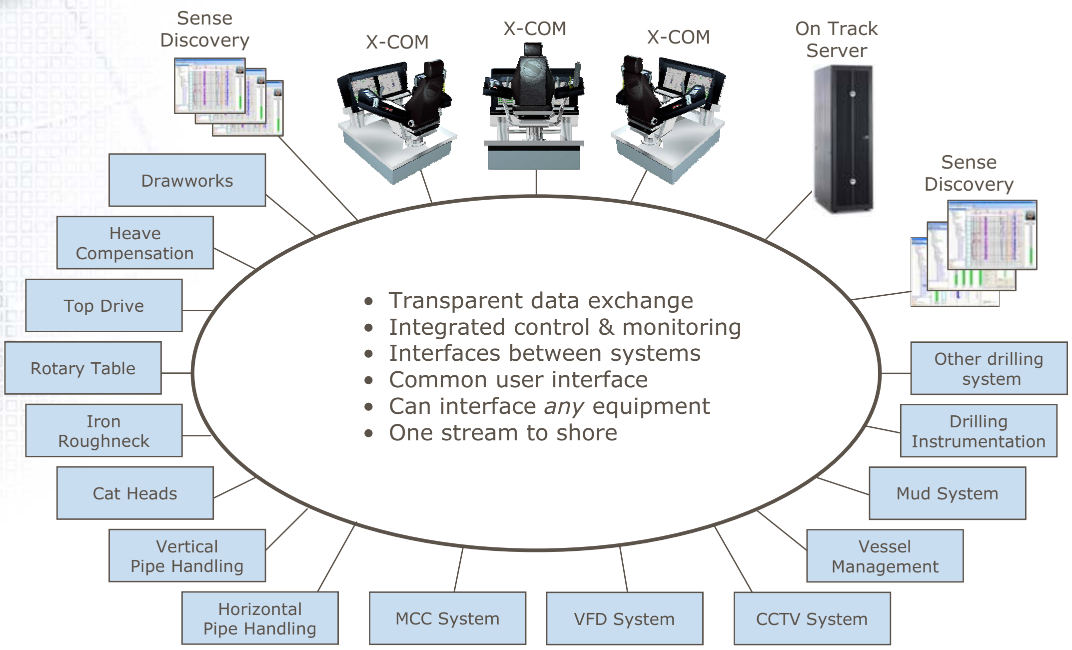
# Alarm System

Alarm system philosophy and design. It is impotant to minimize the amount of alarms.



# Design Organization

Vendor collaboration

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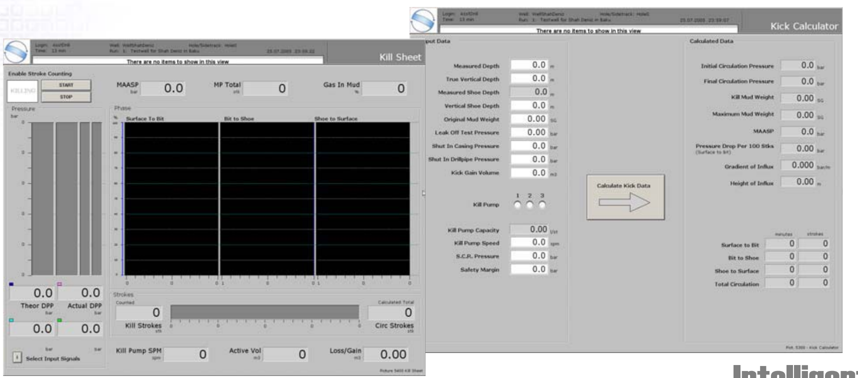
# Critical Operations

- Critical / stress operations
  - Kick situations
  - Locked to bottom
  - Connections
- Simultainious control / Co-pilot principle



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www.sense-edm.com



Intelligent Movement. Delivered.

# Human Faktors-utfordringer knyttet til borers arbeidssituasjon

*Hilde Heber*
*Sjefingeniør*
*Petroleumstilsynet*

PETROLEUMSTILSYNET

## Ptils tilnærming til Human Factors

Human Factors er metoder og kunnskap som kan brukes til å vurdere og forbedre samspillet mellom individ, teknologi og organisasjon.

Målet er å skape en arbeidssituasjon som i størst mulig grad bidrar til å realisere effektiv og sikker drift og som tar hensyn til menneskets muligheter, begrensninger og behov

2

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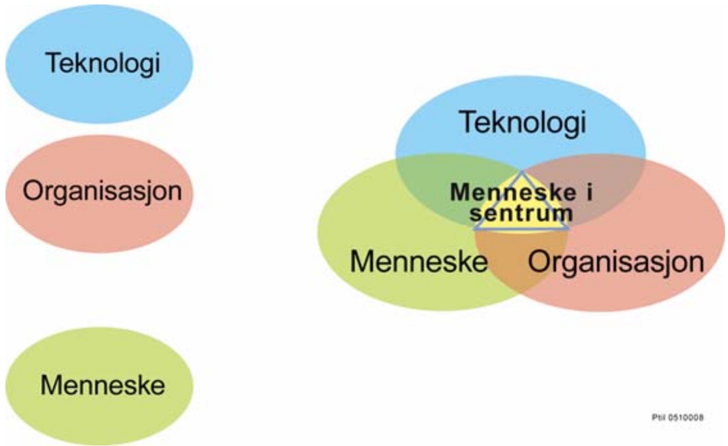
***Tradisjonell tilnærming***

***HF- tilnærming***






# En systematisk og tverrfaglig tilnærming

## Hvorfor forbedre Human Factors-forhold?

En bedring av HF-forhold kan bidra til:

- Bedre arbeidsprosesser – økt kvalitet og effektivitet
- Bedre sikkerhet med færre hendelser
- Bedre arbeidsmiljø



## Årsaker til hendelser innen boring

Direkte og bakenforliggende årsaker på innmeldte alvorlig hendelser i boreområde i perioden 1997 – 2004, totalt 37 hendelser. Årsaker knyttet til:

- Organisasjon og ledelse
- Svikt i utførelse og organisering av arbeidet
- Mangelfull kommunikasjon
- Prosedyrer/ arbeidsinstrukser som ikke er kjent, forstått eller etterlevd
- Ergonomi

## Næringens utfordringer og aktiviteter innenfor bore- og brønnaktiviteter

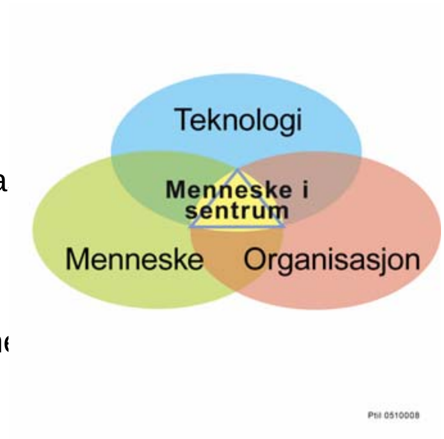
- Likelydende brev:
  - Utfordringer
  - Prosjekter og modifikasjoner
  - Eksempler på kartlegginger og analyser
- Tilbakemelding fra 25 selskaper:
  - 11 operatører
  - 7 redere/boreselskaper
  - 4 serviceselskaper
  - 3 utstyrsleverandører






## Utfordringer

- Ledelse
- Planlegging og samarbeid
- Bemanning og arbeidsbela
- Design og utstyr
- Kompetanse
- Prosedyrer og arbeidsrutin
- Kommunikasjon



## Bores arbeidssituasjon

- fungerer som arbeidsleder på boredekk
- skal ha full kontroll over komplekse operasjoner på boredekk
- skal ha kontroll over og sørge for konstant trykk i brønnen
- systemene har ofte et svært avansert menneske-maskin-grensesnitt –
  borer tidligere fysisk yrke
- kontaktpunkt – boreledelse og serviceselskap - tidligere også varmebu
- avansert kranfører – funksjon som løfteleder flyttet fra kranfører til en av flaggmennene

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## Utfordringer sett fra borerens synspunkt - spørreskjema

- ***Krav i jobben***
- ***Kontroll i jobben***
- ***Opplevelse av nærmeste leder***
- ***Egen rolle som leder***
- ***Støtte fra kolleger***
- ***Prosedyrer***
- ***Tekniske systemer***
- ***Rolleklarhet***
- ***Risikoforståelse***
- ***Møter/ planlegging***
- ***Kommunikasjon***
- ***Opplæring***
- ***Fysiske forhold***

***Generelle spørsmål:***

- **Sykefravær – sammenheng med jobb**
- **Utrygghet som følge av kritiske forhold under boreoperasjoner**
- **Personlige opplysninger**
- **Skiftordning**
- **Type installasjon**

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## Designutfordringer ved innføri av nytt utstyr:

- Trangere forhold både på boredekk og i borekabinen
- Nytt og gammelt utstyr sammen; maskin – maskin – utfordringer
- Fjernstyrer utstyr fra borekabinen, men fortsatt nærstyrt utstyr på dekk som jernroughneck.
- Styring fra ulike kabiner – f eks medium og upper racking arm. En del borepersonell mener dette gir best posisjon - konservative?
- Kabiner og utstyr for styring i uteområder har ofte svært mangelfullt arbeidsmiljø, dårlig sikt og utfordringer knyttet til samarbeid.
- Ofte ikke gjennomført forbedringer pga vurdering av mulig ombygging.

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## Design og utstyr

### Mann – maskin – grensesnitt

- Mann – maskin – grensesnitt – store utfordringer både i borekabinen og på boredekk. Borer hadde tidligere en fysisk arbeidsplass – behov for ny form for kompetanse
- Ønske om større grad av standardisering både knyttet til utstyr på boredekk og i borekabinen.
- Skjedd en større grad av standardisering av kraner faste funksjoner knyttet til ve / hø joystick.

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## Design og utstyr
## HF-analyser

- Mangel på HF-analyser - hvis de utføres – ofte for sent – resultatene blir sjelden brukt
- Ofte mangel på HF-kompetanse og brukermedvirkning
- Analyserer kanskje risiko for *nytt* utstyr som skal innføres. Ser ikke hele operasjonen i sammenheng.





## Menneske - maskin - forhold ved utvikling av avanserte systemer

- Viktig at det er barrierer for å sikre at sikkerhetskritiske operasjoner ikke utføres uten at operatør er helt bevisst hva han gjør
  - Automatisk stopp (interlock) for å forhindre aksjoner hvor det er stor sannsynlighet for å gjøre feil
  - Systemene bør ha krav til bekreftelse ved utførelse av sikkerhetskritiske arbeidsoperasjoner
- Opplæring og utvikling av systemer må ses i sammenheng – under hele utvikling av systemene må opplæringen og fokus på brukergrensesnitt mot operatør være sentralt
- Under innføring er det viktig å legge opp til en god opplæring og trening, også for vedlikeholdspersonell

## Kompetanse

- Selskapene ikke alltid flinke nok til å sikre tilstrekkelig kompetanse.
- Ikke tilstrekkelig med grunnleggende kurs må trene med de en jobber med.
- Ikke tilstrekkelig risikoforståelse.
- Mangelfullt kjennskap til relevante prosedyrer for gjennomføring av arbeidet
- Stor boreaktivitet - vanskelig å få tilstrekkelig kompetent personell - personell flyttes ofte - utfordringer knyttet til samhandling og lokal kjennskap på arbeidsplass.
- Nye borekabiner stiller nye krav til borer.
- Ivaretakelse av nytt personell.

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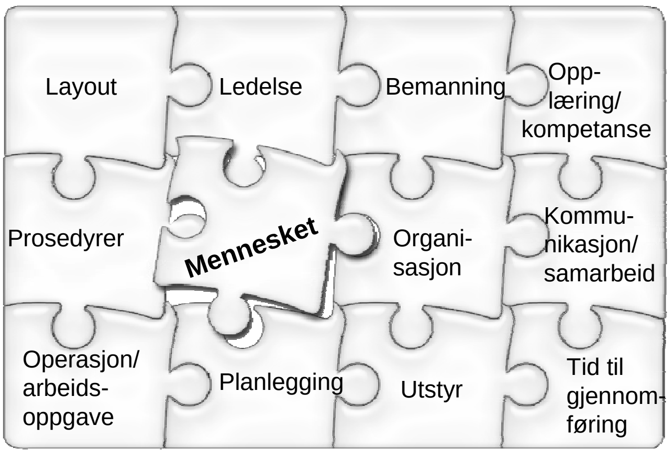
## Viktige faktorer innenfor HF i boreoperasjoner.

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## Veien videre

- Tilsyn med vekt på ulike HF-forhold
- Vurdere borers arbeidsbelastning
- Deltakelse på ulike seminarer
- Samarbeid med andre lands myndigheter

Finn mer om dette på www.ptil.no

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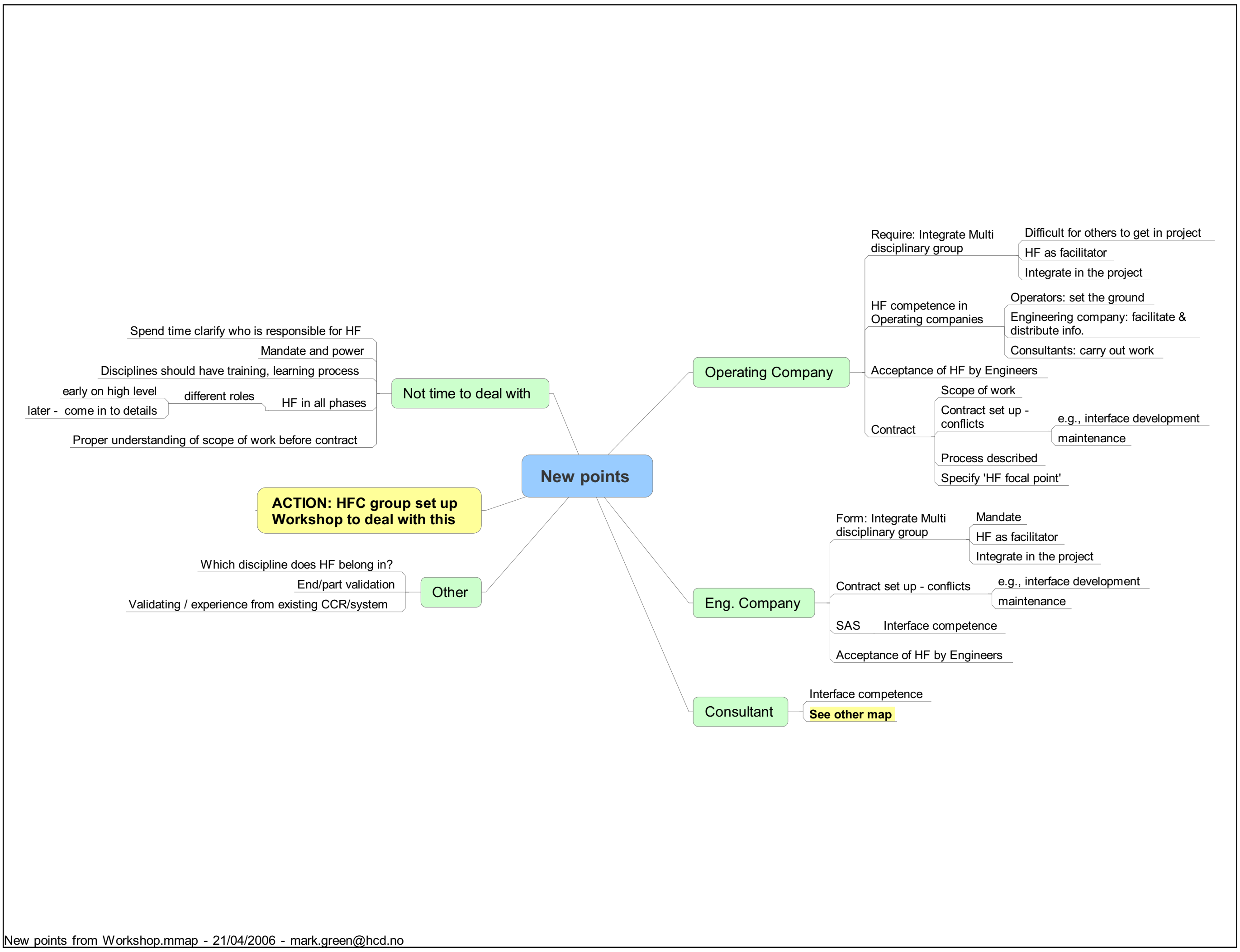
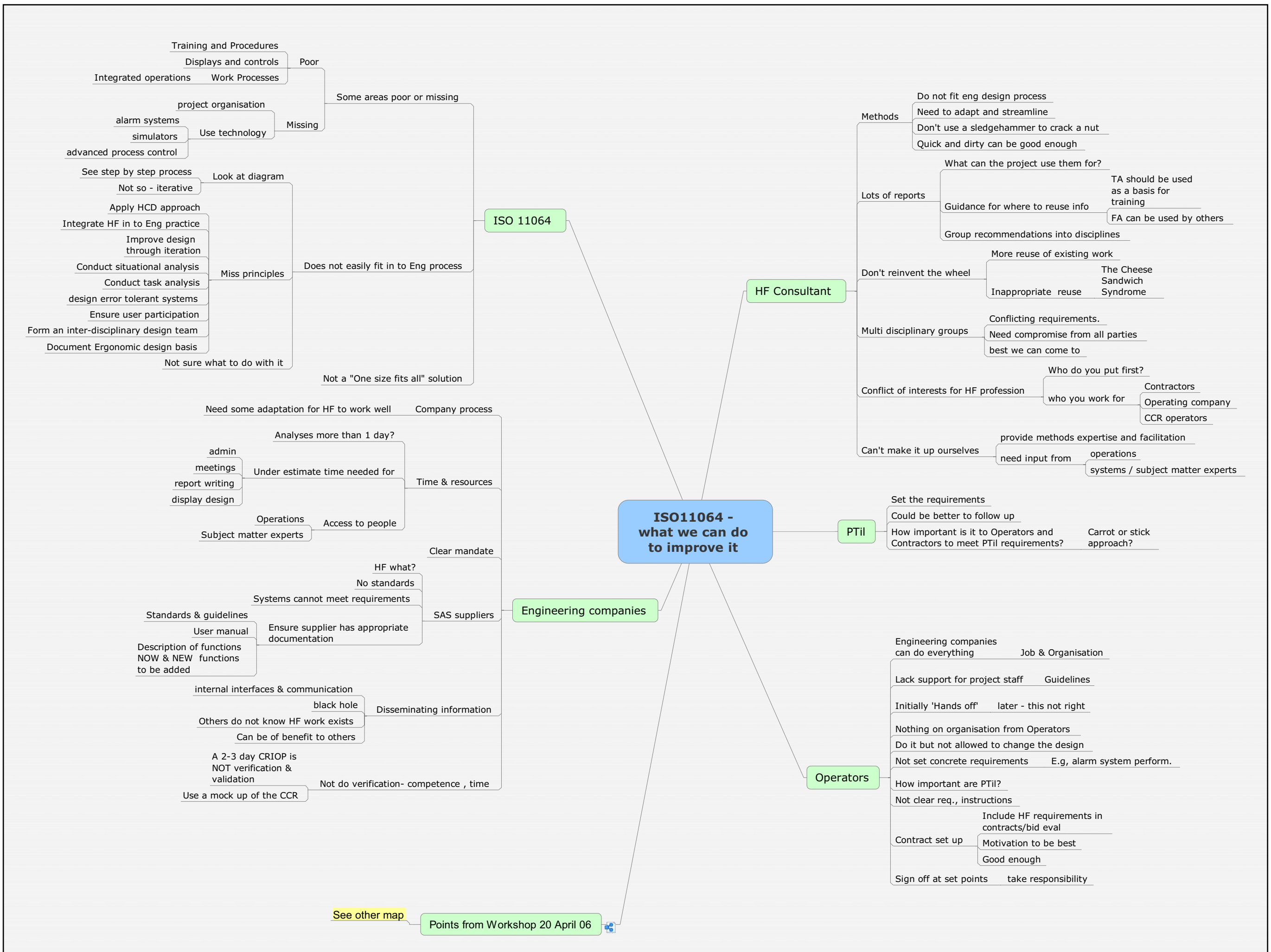



New points from Workshop.mmap - 21/04/2006 - mark.green@hcd.no




HF ISO feedback Group work.mmap - 21/04/2006 - mark.green@hcd.no

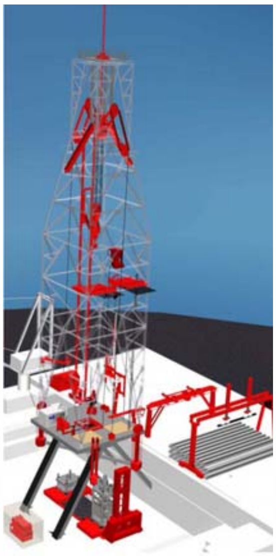
# Funksjonalitet og brukergrensesnitt i design fasen

Harald Langenes, Aker Kværner MH
Drilling System Engineering
HFC – seminar, Halden
20. April 2006

AKER KVÆRNER™
part of the Aker group

## Hvilket utgangspunkt har vi?

- Ved kontraktsinngåelse foreligger:
  - Kontrakt
  - Funksjons / Utstyr spesifikasjon
  - Automatiseringsgrad
  - Antall operatør stasjoner



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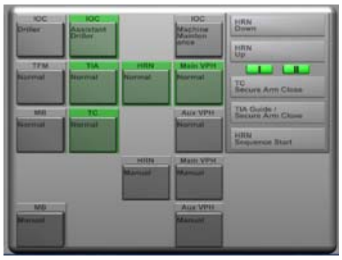
## Hva er målet?

- Levere en komplett ”borefabrikk” som er:
  - Sikker
  - Effektiv
  - Funksjonell for operatør



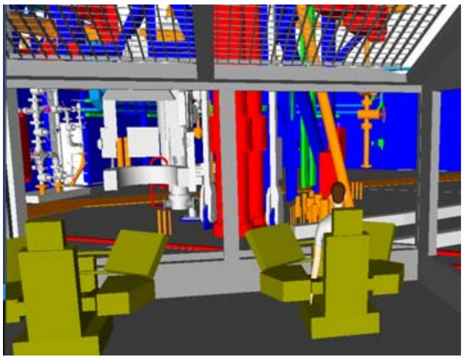

## Hva må gjøres i Engineering

- Vi må skrive en ”disposisjon”
  - Definere håndtering fra båt til boredekk
  - Lage sekvensbeskrivelse av operasjon
  - Etablere Anti Kollisjons matrise
  - Definere operatør stol
  - Definere skjerm bilder



## Hva må gjøres i Engineering?

- Plassere operatør stasjoner riktig i forhold til maskiner
- Definere kamera behov
- Utføre CRIOP
- Utføre HAZOP
- Simulere operasjon
  - 3-D modell
  - Stol applikasjon
  - Skjerm applikasjon



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## Hva oppnår vi?

- God funksjonalitet
- Kvalitetssikret HMI
- Brukervennlig utstyr
- Bedre underlag for HAZOP
- Underlag for opplæring

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part of the Aker group

## Hvorfor gjør AKMH dette?

- Koster ”ingenting” å gjøre ting riktig første gang
- Minimere endringer etter installasjon
- Kortere commissioning
- Vi slipper å ”knekke nøtter” lenge etter levering…….

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Innovation and Creativity

## Control room in Curriculum

- **A new way of safety training**

**Håvard Sjøvoll (sjovoll@ntnu.no)**
**Egil Tjåland (egil.tjaland@ntnu.no)**
Department of Petroleum Engineering and Applied Geophysics
Faculty of Engineering Science and Technology





# Outline

- Control room at IPT, NTNU
  – Timing
  – Design
  – IO Center
- Control room activities
  – Education
  – Training
  – R&D
- Future development

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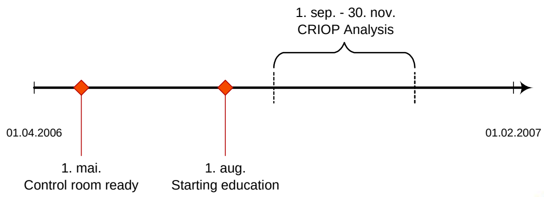
Innovation and Creativity

# Timing

- Control room operational: may ’06
- MSc/PhD courses: autumn ’06
- Evaluation (ISO 11064): spring ’07
  - Improvements
- Training: autumn ‘07

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# Specification

- Projection wall
  - 5.0 * 2.6 metres, back projection
  - Mono: 6 EVO2 projectors
  - Stereo: Two Cineo3 projectors, 16:9
- Tracking
  - 3 * 6 metres area
  - InterSense IS-900 SimTracker
- Sound
  - Spatial sound
  - 16 active speakers

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5

# Specification

- Video conference
  - Multipart (IP/ISDN)
- Interactive whiteboard, smartboard
- Wall-mounted LCD
  - 2 * 40" NEC 4010
- High-end workstations / laptops
- Planned connection: SecureOilLink (SOIL)

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www.ntnu.no [ Status ] Activities Future development

6

# Location

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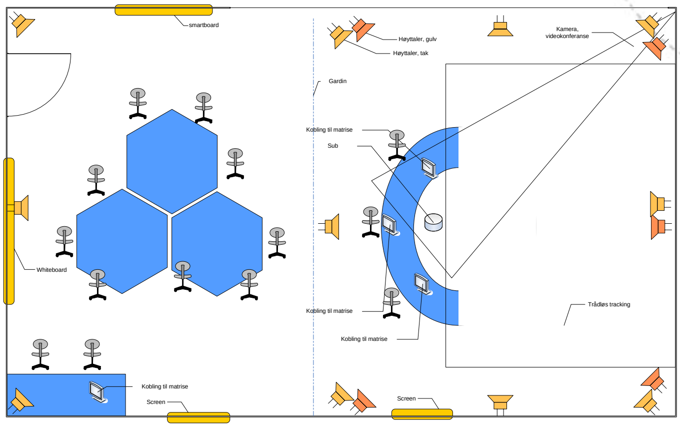
www.ntnu.no [ Status ] Activities Future development

7

# Design

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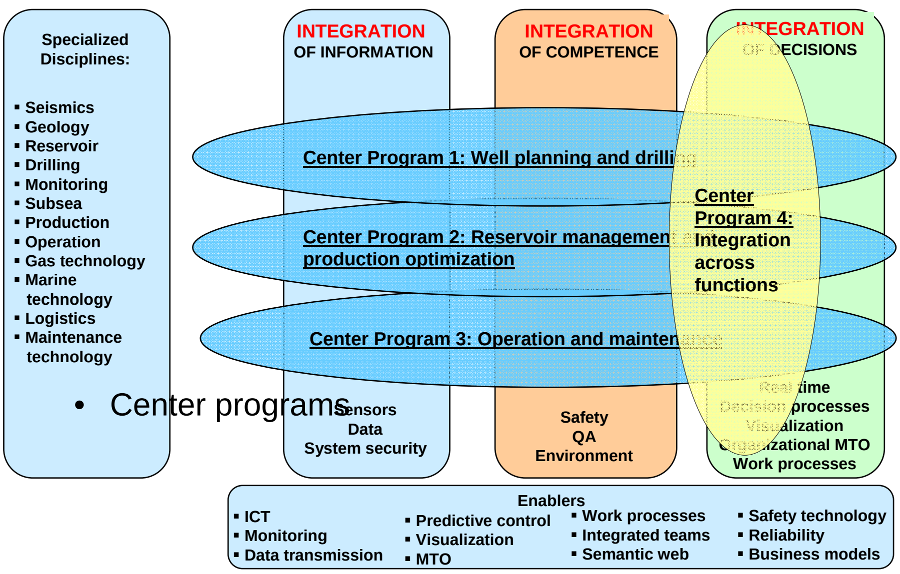


- Center programs

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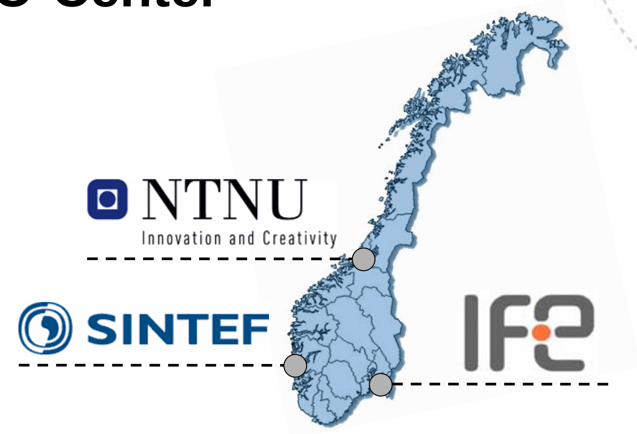
# IO-Center

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# Control room activities

- Education
  - MSc/PhD courses
- Training
  - Continuing education (NTNU Videre)
- R&D
  - IO Center activities
  - Test laboratory

NTNU Innovation and Creativity

# Control room Education

- MSc/PhD courses
  - Engineering Science and ICT (E&ICT)
  - Included in other petroleum related courses
- Purpose
  - Prepare students for industry
    - Work processes
    - Technology

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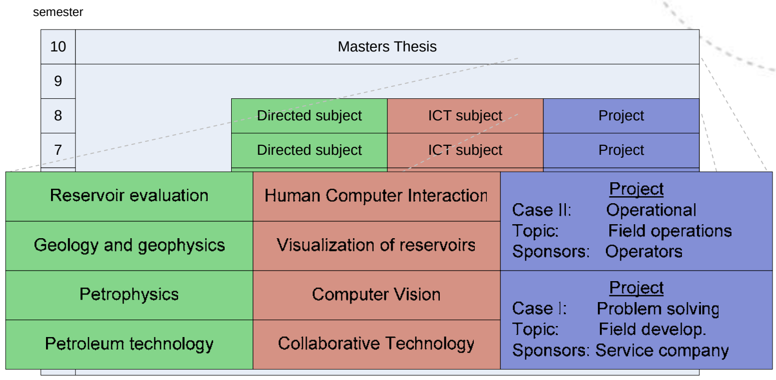
# Control room Education

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# Control room training

- Continuing education (NTNU Videre)
  - Currently 60 courses per year
- Planned activities
  - New courses
  - Part of existing courses

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# Control room training (contd)

- Purpose
  - Training of collaborating teams
  - Safety training
  - Crisis management
  - Operational simulation/training
  - ISO 11064
- Enablers
  - Co-operation with SINTEF / IFE / industry
  - Need for field simulators
  - Access to live/recorded/simulated data

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# Control room R&D

- Test laboratory
  - System development
    - Integrated Information Platform
  - Collaborative teams
- IO Center activities
  - Algorithm development
  - Safety
  - MTO
  - Collaborative research

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www.ntnu.no    Status [ **Activities** ] Future development

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# Future development

- Distributed control rooms
  - Allows wider collaboration
    - Cross-department at NTNU
    - Research institutes
    - Operators
    - Vendors
  - Strengths
    - Realistic collaborative training
      - work process
      - technology

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www.ntnu.no    Status Activities [ **Future development** ]

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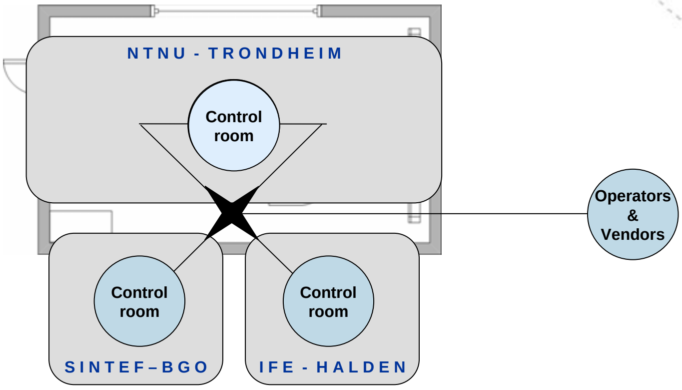
# Distributed control rooms




NTNU Innovation and Creativity



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# Summary

- Control room at NTNU for
  - Education
  - Training
  - R & D
- Provides new ways of safety training for
  - Students
  - Personnel
- Need for co-operation with
  - Research institutions
  - Operators
  - Suppliers/Vendors/etc.

NTNU Innovation and Creativity

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thank you for your attention

**Håvard Sjøvoll (sjovoll@ntnu.no)**
**Egil Tjåland (egil.tjaland@ntnu.no)**

Department of Petroleum Engineering and Applied Geophysics
Faculty of Engineering Science and Technology

HFC

**Forum for Human Factors in Control (HFC)**
**20.04.2006 IFE/Halden**

Camilla Tveiten
Stig Ole Johnsen/SINTEF



HFC

# Agenda

1. Regnskap for 2005
2. Forslag til aktiviteter og budsjett 2006
3. Møtekalender/ Neste møte 25/10 og 26/10
4. Eventuelt

HFC

# Regnskap 2005 Ligger på www.criop.sintef.no

Inntekt fra 8 medlemmer som utgjør 200.000 kr

- Medlemmer: Norsk Hydro, Statoil ASA, ENI Norge, IFE, Human Factor Solutions, Sense Intellifield, Scandpower, SINTEF

Regnskap 2005 - To medlemsmøter (a ca 50,000) totalt ca 100,000

- Medlemsmøte 27/4 og 28/4 – Trondheim Britannia Hotell – 50.000
  - Middag/Møterom 16.000
  - Kostnader foredragsholder 11.000
  - Arbeidsinnsats – Administrasjon av møtet og opptrykk og utsendelse av materialet 13.000
- Medlemsmøte 26/10 og 27/10 – Trondheim NTNU – 50.000
  - Middag/Møterom/UKE billetter 30.000
  - Kostnader foredragsholder 30.000
  - Arbeidsinnsats – Administrasjon av møtet og opptrykk og utsendelse av materialet 15.000



HFC

# Regnskap 2005 - Utviklingsoppgaver

Regnskap 2005

- Utviklingsoppgaver utgjør 100.000:
  - Norsk versjon av CRIOP sjekklisten (utvikling oversetting og validering) 70.000
  - Forenkling og gjennomgang av CRIOP. Utlegging på WEB. 25.000
  - Opprettelse av nye ePost adresser og WEB-sted – Involvering av IKT Driftssenter : 5.000

Inntekter: 200.000

Utgifter : 200.000 (Utviklingsoppgaver: 100.000, Møter 50.000+50.000)

Overskridelser for 2005,(127.655) ble dekt av SINTEF

HFC

# Aktiviteter/ Budsjett for 2006

**INNTEKTSBUDSJETT**

- Medlemsavgift:
  - 25.000 for bedrifter med mer enn 15 ansatte (dekker 3 deltakere)
  - 12.500 for mindre enn 15 ansatte (dekker 2 deltakere)
  - 6.500 kr pr møte for ikke medlemmer (og overskytende deltakere)
- Tilskudd ifbm prosjekter, avhengig av søknader

Inntekt fra medlemmer og deltakere som utgjør ca 250.000 kr

- Medlemmer / Deltakere
  - Norsk Hydro, Statoil ASA, ENI Norge, IFE, Sense Intellifield, Scandpower, SINTEF, Aker Kværner, ConocoPhillip
  - Human Factor Solutions, Human Centered Design, Kokstad Bedriftshelsetjeneste, Petrolink



HFC

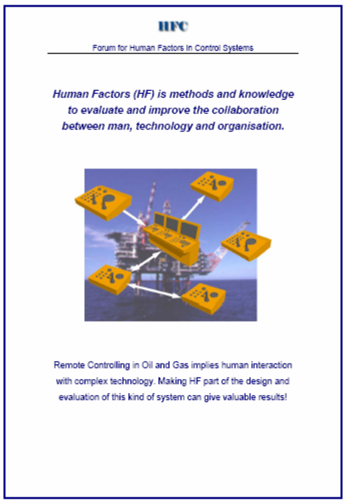
# Aktiviteter/ Budsjett for 2006

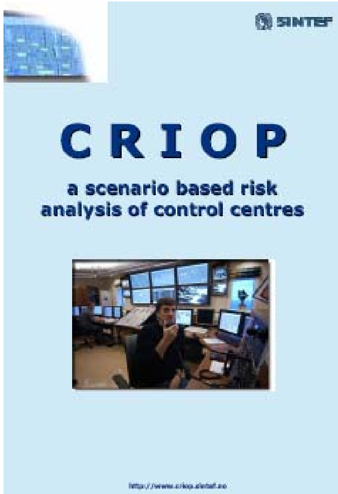
**KOSTNADSBUDSJETT**

- **Lager 2 møter i HFC forum a 50,000 totalt 100.000**
- **Brosjyremateriell, presentasjoner, info om HFC– totalt ca 35.000 -**
  - Lage poster og brosjyremateriell om HFC forum og CRIOP (PDF versjon til distribusjon). Stand på SPE/HSE 4-6.April for å informere om HFC, CRIOP og det norske nettverket (bl.a. konsulenter som kan gjennomføre CRIOP)
- **Sekretariat/Administrasjon** (15.000 - 50.000)
  - Dersom inntektsbudsjettet blir 200.000, vil SINTEF dekke kr 35.000 av sekretariatsoppgavene, slik at belastede kostnader på HFC forum blir 15.000.
  - Oppgavene er: Administrasjon, innkalling til møtene, lage referater, sekretariatsfunksjon dekkes og reise for 1 person dekkes til 4 møter, Web administrasjon , brosjyremateriell, presentasjoner som kan brukes,..
- **Forslag til F&U aktiviteter – 50.000** + avhengig av inntekter og andre bidrag
  - ISO 11064 praksis?
  - Criop oppfølging

HFC

## Brosjyremateriell (På hfc.sintef.no)






HFC

## Møtekalender

- 16.02.2006 Møte i HFC Referansegruppe
  - Planlegge neste møte i HFC forum 19/4 og 20/4
- 19.04.2006 Møte i HFC Forum
  - HFC forum  møte 19/4 og 20/4
- xx.05.2006 Møte i HFC Referansegruppe
  - Planlegge neste møte i HFC forum i oktober
- 25.10.2006 Møte i HFC Forum
  - HFC forum  møte 25/10 og 26/10

## Innspill til tema
## HFC møte 25/10 og 26/10

- Resultater fra gruppearbeidet om ISO 11064 **”Mangler og forslag til beste praksis”.**
- ….



## Agenda

1. **Regnskap for 2005**
2. **Forslag til aktiviteter og budsjett 2006**
3. **Møtekalender/ Neste møte 25/10 og 26/10**
4. **Eventuelt**

INVITASJON

# Human Factors in Control

Institutt for energiteknikk, Halden

19-20 april 2 0 0 6

## Human Factors erfaringer og utfordringer med ISO 11064

23. februar 2006

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

Møtet holdes **onsdag 19. og torsdag 20. april 2006 på Park Hotell i Halden.**
**Vi starter kl 12:00 onsdag 19. april og avslutter kl. 14:00 på torsdag 20.april.**

### Program

Endelig program oversendes når det er fastlagt. Fokus for dette møtet er Human Factors erfaringer og utfordringer med ISO 11064. Vi tar sikte på å gjennomføre en Work Shop som skal gi innspill til hva som mangler i standarden og "Beste Praksis" for bruken av denne.

### Forumets visjon og hovedoppgave

Visjon: "Kompetanseforum for bruk av HF innen samhandling, styring og overvåkning i olje og gass virksomheten."

Hovedoppgave: "Være et forum for erfaringsoverføring som bidrar til å videreutvikle HF metoder til bruk ved design og vurdering av driftskonsepter. "

For å være med må man betale inn medlemsavgift. Den er pr år:
- 25.000 for bedrifter med mer enn 15 ansatte (dekker 3 deltakere)
- 12.500 for mindre enn 15 ansatte (dekker 2 deltakere)
- 6.500 kr pr møte for ikke medlemmer (og overskytende deltakere)

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

Vi håper du har anledning til å delta, og ønsker at du fyller ut og returnerer det vedlagte registreringsskjemaet innen 10. april 2006.

Vi ser frem til din deltakelse.

Vennlig hilsen

Thor Inge Throndsen /STATOIL, John Monsen/Hydro, Jon Kvalem/IFE, Stig Ole Johnsen/SINTEF og Camilla Tveiten/SINTEF

**Vær vennlig og returner registreringen innen 10.april 2006 til:**

Jannicke Neeb
Institutt for energiteknikk
P.O.Box 173, 1751 Halden
Tel: 69 21 23 70 Fax: 69 21 24 90
E-mail: jannicke.neeb@hrp.no

# AGENDA

# HFC Møte

Institutt for energiteknikk, Halden

19-20 april
2 0 0 6

## Human Factors erfaringer og utfordringer med ISO 11064

Dag 1-19/04

| | | |
|---|---|---|
| 12:00-13:00 | Registrering, Lunch | |
| 13:00-13:15 | **Velkommen til HFC forums 3. møte** | Thor Inge Throndsen, leder HFC |
| 13:15-14:45 | **Leading Indicators of Safety in Virtual Organizations** | Martha Grabowski, Research Professor, RPI |
| 14:45-15:00 | Kaffe | |
| 15:00-15:20 | **Valhall Re-Development: Utvikling av Integrerte Operasjoner. Fra design til Implementering (ISO-11064).** | Karl Ole Stornes, BP |
| 15:20-15:40 | **ISO 11064, erfaringer og utfordringer. Snøhvit og andre kontrollromsprosjekter i Statoil.** | Svein Louis Bersaas, Statoil |
| 15:40-16:10 | **Hva er ISO 11064. Erfaringer og utfordringer** | Adam Balfour, HFS. |
| 16:10-16:30 | **ISO 11064, erfaringer og utfordringer.** | Marie Green,HCD. |
| 16:30 | Seminaravslutning Dag 1 | |
| 17:00-18:30 | **Besøk i IFEs HAMMLAB og VR-senter** | Jon Kvalem, IFE |
| 18:30- | Transport til festningen i Halden | |
| Ca 19:00 | Middag i Kongshallene | |

Dag 2-20/04

| | | |
|---|---|---|
| 08:30-09:00 | **HF-problemstillinger innen Boring** | Jarle Dyrdal, Sense. |
| 09:00-09:30 | **Arbeidssituasjonen til borer.** | Hilde Heber, Ptil |
| 09:30-10:00 | **Funksjonalitet og brukergrensesnitt i design** | Harald Langenes, Aker K |
| 10:00-10:30 | Kaffe | |
| 10:30-12:00 | **Gruppe-arbeid relatert til ISO 11064 ”Mangler og forslag til beste praksis”.** | Fasilitatorer: |
| | • KR-modifikasjonsprosjekter | Marie Green |
| | • Boring | Jarle Dyrdal |
| | • Integrete Operasjoner | Adam Balfour |
| 12:00-12:30 | **Control room in Curriculum - a new way of safety training** | E. Tjåland/H. Sjøvoll, NTNU |
| 12:30-12:55 | **HFC: Administrasjon, budsjett og regnskap** | HFC |
| 12:55-13:00 | **Avslutning** | T. I. Throndsen, leder HFC |
| 13:00-14:00 | LUNCH (Alternativt tog til Oslo kl. 13.01) | |

# REGISTRERING

# Human Factors in Control

Institutt for energiteknikk, Halden

19-20 april
2 0 0 56

## Human Factors erfaringer og utfordringer

Ja, jeg vil gjerne delta:

Navn: ______________________________

Tittel / stilling: ______________________________

Organisasjon: ______________________________

Adresse: ______________________________

__ Lunsj 19/4 __ Middag 19/4 ___Hotell 19-20/4 ___Lunsj 20/4

Tlf. : ______________ Fax: ______________

E-post: ______________________________

Vær vennlig og returner registreringen innen 10.april 2006 til:

Jannicke Neeb
Instititt for energiteknikk
P.O.Box 173, 1751 Halden
Tel: 69 21 23 70 Fax: 69 21 24 90
E-mail: jannicke.neeb@hrp.no