Improving Control Of Work: Addressing Human And Organisational Factors And The Experience And Lessons From Early Implementation In The North Sea

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Abstract: Just because you have a permit does not make you safe. This paper describes an aviation-inspired human and organisational factors (HOF) approach to improving one major oil and gas company's Control of Work (CoW) system. The challenge was finding the right balance between control/rigour and usability/compliance. Methods included: structured baseline setting (HOF audit, incident review and survey); active user involvement; collaborative design with training and technology providers, HOF specialists; good practice review (aviation sector); system – including procedural – usability improvements. Early results are promising and the approach has already been adopted by other major operators.

Keywords: Control of work, permit to work, human factors, oil and gas, aviation.

1. Introduction

Human and organisational factors (HOF) are still too often seen as intangible within the offshore industry. However there is growing evidence of real engagement and action by some operators, drillers, contractors, designers and others. One major oil and gas company has taken an early interest and applied a HOF approach to its new Control of Work (CoW) system (such systems integrate permit to work (PTW), risk assessment and isolation arrangements). The UK Regulator, the Health and Safety Executive (HSE) and the industry highlight CoW as a key HOF topic linked to procedures and safety critical communication (HSE (undated); Step Change, 2012). The company has found that this HOF focus confers real benefits for safety and business performance.

1.1 The Continuing Contribution of Control of Work Failures to Incidents

Despite Piper Alpha and the widely-accepted findings on PTW systems of the Cullen enquiry (Cullen, 1990) improvements have been less than expected. For example, in an HSE analysis of 67 offshore incidents: "The most important underlying causes of accidents were (in order of importance): inadequate hazard analysis/risk assessment; inadequate supervision; lack of/inadequate operating procedures; and inadequacies in permit-to-work." (HSE, 2009, p(vi)). The two main guidance publications (HSE, 2005; 2006) stress the importance of the HOF contribution to preventing PTW failures (e.g. HSE, 2005, p5, para 3). HOF issues have contributed directly to many major accidents. While responsibility and accountability remain very important poorly-designed systems can set up individuals to fail. A proper design balance is needed between the needs of the individual, the job and the organisation.

1.2 The Emergence of Electronic Integrated Safe Systems of Work (ISSoW)

In the last decade, the traditional PTW view has given way to a broader CoW perspective across the industry. Many companies have now adopted electronic CoW systems such as the Integrated Safe System of Work (ISSoW). Despite this: "For some

years now evidence has been accumulating that PTWs are not providing the level of safety protection that they are intended to. DH [Duty Holders] are experiencing high potential incidents on jobs under PTW control, members of the workforce complain of unwieldy PTW systems and delays, and HSE inspections reveal a range of problems with PTWs...Too many people working onshore and offshore see the PTW as a barrier to getting the job done…" (HSE 2011, p1-3: emphasis added). The HSE found that the design of such electronic systems rarely took any structured account of HOF. Key issues identified were (1) Usability: lack of good practice in the system user interface design including an over-focus on management usability as against e.g. the Performing Authority; (2) Human error: Error types not identified or designed against; (3) Commitment: This was 'diluted' by a 'consensus' on non-compliance at all levels and a failure to appreciate the importance of hands-on supervision for compliance.

Moving to electronic versions of the previous paper systems without taking proper account of human factors leads to serious issues e.g. "Computerised systems actually generate more paper and they encourage more mundane hazards on the PTW." (Ibid p7) In contrast for paper systems: " The requirement to handwrite every hazard tends to focus the mind on the most important and the use of signatures on paper forms reminds users of their personal accountability." (Ibid p7, para 29). While the resulting electronic systems can look the same (on screen at least) this does not mean that all the key aspects of those paper systems are reliably transferred, and any unexamined or unaddressed issues are simply moved across into the new one.

2. **Method**

The company had carried out a thorough review and revision of the CoW system in 2005. This secured initial improvements in control. But, while the new system was designed to give absolute control with e.g. authorisations pushed to the highest level, this had unintended consequences over time such as over-caution in risk assessment – and if everything is high risk, then in practice nothing is. More permits meant more to manage, more people involved in the system, and more delays. There was also evidence of growing non-compliance. It is human nature to develop or find workarounds in systems which are not well designed for the user, and this can soon erode their value. Although there is often much talk about compliance issues in the industry, often the real underlying issues are those arising from poorly designed systems, plant, equipment and tasks. These issues equate broadly to Reason's latent conditions or organisational factors which can sit in the system for many years. (Reason, 1997).

The company's focus on CoW also resulted from careful interrogation of its incident and accident recording system. Despite being able to elicit this information there was still much room for improvement, not just in addressing causal factors – most of which were HOF related – but also in the discipline of investigating the incidents that produced this data. For example, investigations often stopped at the point where 'human error' had been identified and did not consider the performance shaping factors (PSFs) i.e. those factors which make error more (or less) likely on the day. So in 2011, to secure further improvements and address compliance issues, an integrated HOF approach was taken, aiming to strike the correct balance between all elements of 'the loop' but with the human central to the overall project.

2.1 The Project Approach – A Flying Start

Initially the project involved collaboration across many levels including HOF specialists (in-house and external), technology and training providers, as well as input from aviation, a sector recognised to be significantly advanced in the integration of HOF

aspects into its business. The first author is an ex-RAF pilot with flight test background and with deep topic knowledge and experience of human factors integration (HFI) into major aviation design projects, which he applied to the project from the start. This approach de-emphasised the technology and tools, and instead promoted the value and understanding of the process.

During the engagement phase of the project the findings were astounding. Local practices were rife, a 'black book' (informal and uncontrolled job aids) culture was the norm. There was 'gamification' of the system i.e. a focus on manipulating it to get a permit quickly and without fuss, and not on safe work execution. So the project team looked for exemplar industries where: procedural compliance and excellent training was the norm; systems were operated as designed; and this was all woven into the DNA of day-to-day business - aviation stood out as that exemplar, not just for the systemic aspects but on the people side. How had the aviation sector managed to pull all of these complex systems, operated in complex environments, together with such finesse? Part of the answer is a focus on Non-Technical Skills training (NOTECHs). NOTECHs is part of the Crew Resource Management (CRM) approach developed in aviation to assure flight deck safety. It is "…an approach which identifies and trains non-technical skills (e.g. decision making, teamwork and personal resource skills) to improve safety and efficiency." (Energy Institute, 2014) and is often described as the glue that holds the technical disciplines together. Although HSE had carried out research on the viability of applying CRM to offshore operations (HSE, 2003), take-up was poor. More recently, post-Macondo, guidance on CRM training has been developed for the energy sector and well operations (Energy Institute, 2014; IAOGP, 2014). In this context, the development and embedding of CRM style training in the CoW project is a significant innovation.

2.2 Workforce Involvement and Amnesty for 'Black Books'

The primary engine for the change was the company's already well-established workforce involvement programme. An extensive communications and involvement exercise involved 150 users (25%) from three offshore assets. This provided a clearer overview of the problem, identifying key existing issues, and harvesting potential solutions as well as generating momentum and support for change.

The information contained within the 'black book' culture proved invaluable. Although uncontrolled (not standardised, updated or available to all users or the organisation) the company recognised that it captured years of expert use by very experienced individuals. In contrast, the 'official' information was difficult to access and read, and was generally unfit for purpose. Simply banning the use of the black book information would have lost the chance to make more systematic use of this distilled experience and knowledge, and driven its use further underground. The ready volunteering of such information in the first place attests to the quality of the engagement process – people felt safe to table what they had.

2.3 Initial Reviews

Some initial independent (external consultant) CoW assessments proved disappointing. These were audit-based, benchmarked against regulatory requirements. The results provided paper compliance only - more a check of the existing system as a process, and not testing if the system itself was fit for purpose - and also lacked clear and prioritised improvement points. So a more focused and qualitative assessment of the existing system was carried out with expert HOF consultant support (author 2). The assessment included: platform HOF audits; an incident review; and a baseline on-line workforce survey.

2.4 HOF Audits

An audit tool was developed from existing guidance, good practice sources (such as HSE, 2005; 2006), operational experience and key document review. It was applied on two platforms through semi-structured interviews and observation to reasonable user group samples. This independent approach provided some 'triangulation' for the existing situation and a check on developing improvement plans, by structured assessment of the system, users and real performance.

The overall audit conclusion was that the existing electronic system was viewed ambiguously both as safer and conferring more control than the previous system e.g. through its additional features and controls, and also as time-consuming, onerous, rigid, and non-user-friendly. The primary issues affecting the system as a whole were universally seen as the workload and planning aspects. No system, however good or bad, can deal well with overload and inevitably, weaknesses will be found over time. Overload was partly a factor of the planning process and of on/off-shore communication and intra-departmental communication onshore; and partly of achieving a manageable balance between planned, reactive, and project/special work.

2.5 Incident Review

A sample of ten investigated incidents was analysed using Human Factor Analysis Tools (HFAT®) to determine the proportion of violation-led incidents against error-led ones, and to record the main HOF root or contributory causes relevant to CoW. The main finding was that the majority of the incidents were violation-led. While human error was involved too it was as contributory rather than root cause. The findings also supported the HOF audit findings on the issues – including non-compliance - with the current system.

2.6 Baseline Survey.

The on-line survey's aim was to capture wider workforce views and improvement suggestions on the existing CoW system. The objectives were to (a) Confirm the baseline situation before the introduction of the new system; (b) Further support the findings from the audits and reviews of the existing system; and (c) Provide a further channel for active workforce involvement. The response rate was a reasonable 27.5% (n=137). The results confirmed the key issues already identified and provided a rich source of improvement suggestions. Two of the most significant organisational issues confirmed were: workload and work management, and procedures. Organisational factors are often just 'The way things <u>are</u> round here', the organisational 'wallpaper' (Wilkinson & Rycraft, 2014). They are therefore particularly hard to identify and tackle. The initial audits, reviews and survey provided a clear problem definition and starting point for the improvement project and flushed out such organisational factors.

2.7 Refining the Change

The involvement process included a series of user workshops to test and improve the initial plans, processes, draft procedures and training arrangements. The themes of the new design were unchanged though: (1) A clear document hierarchy e.g. what document parents what; (2) Removal of information that did not refer to the 'how' i.e. how to perform the task, safely, efficiently and repeatably; and (3) Step-by-step instructions that clearly articulated who does what, in what order and when. This three-pronged approach was very clear and well received by users.

2.8 Factoring in the Human - Procedures

A key early decision was to support the revised system by providing quality, user-

friendly, hard-copy procedures for use and reference rather than relying on on-line support. Electronic systems place information in a hierarchy with access through a limited number of displays screens. If not well thought out, and without good user involvement in the design, this can quickly hide key information and make searching through the screens a challenge (e.g. EEMUA, 2010). Good quality paper-based material is handy, portable, and quick to access, navigate and read. Smaller portable handheld devices were considered but, with their one small screen, could not in this case provide the same quick access and usability of the paper version. A semiotics approach was taken to the design i.e. including signs and symbols as well as language. Used appropriately, signs and symbols can convey meaning more reliably across languages and cultures, and provide some redundancy and diversity for text. The result was written and on-screen materials that were much more useable (see Figure 1 for an example).

Figure 1: An example of a typical revised document page

2.8 Factoring in the Human – Training and Competence

Despite experience and formal competence among the users, there was something important missing - the 'glue' that held all these documents, experience and systems together. NOTECHs (introduced in Section 2.1) was developed for the oil and gas sector by the first author as Human Dynamics Training (HDT). This focuses on the non-technical and team skills required for individuals to work effectively and safely together. As applied to CoW it maintains the NOTECHs core oil and gas sector elements but focuses more on procedural compliance and organisational responsibility. This emphasis came from investigation learnings on non-compliance - responsibility and accountability were often unclear or not properly 'owned'.

3. Results, Discussion and Conclusion

The results so far look very promising and have good user endorsement. The approach has been adopted now by two other major oil and gas operators. The early experience and workforce involvement has been very positive for the company. The new CoW system is now rolling out to two assets following full training on the software, the process and procedures, and HDT (the NOTECHs-based training). Surveys on the post-training experience and early implementation are designed and ready. The project

shows that HOF issues figure large in CoW-related incidents, are critical to the success of CoW systems, need early integration and active workforce involvement, and can add substantial value. The innovative use of experience and soft-skills' (NOTECHs) training from aviation allied to user-friendly procedure and process design leverage these benefits further.

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