

## **NRC TRIP REPORT**

### **Subject**

Attendance at the 4<sup>th</sup> International High Reliability Organizing Conference held on April 20-21<sup>st</sup>, 2011.

### **Date & Location**

April 20-21, 2011  
National Transportation Safety Board Auditorium  
L'Enfant Plaza, Washington, DC

### **Traveler**

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### **Background/Purpose**

The NRC was informed of this conference through existing contacts with the high reliability research community. In August 2010, June Cai of NRC's Office of Enforcement was responsible for coordinating a high reliability organizing (HRO) roundtable at NRC headquarters for government agency officials and researchers in high reliability industries. Organizing the HRO roundtable allowed NRC staff to strengthen ties to the high reliability research community and contacts in other government agencies that are responsible for regulating high reliability industries for the purposes of sharing knowledge and operating experience. Attendance at these events serve multiple purposes: 1) they allow NRC to stay informed of current research and experience in the areas of high reliability, risk management, and safety culture, which may inform technical bases for future research and regulatory actions and 2) they serve as market research for contracting future studies that may be needed by NRC in support of its regulatory functions.

### **Summary of Trip**

I attended this conference with June Cai from the NRC Office of Enforcement. Given that there were multiple concurrent presentations, Ms. Cai and I attended different "research tracks" to maximize our ability to report on the conference proceedings.

The purpose of the conference was to bring together practitioners and academicians experience in the practice and study of high reliability with those seeking this change. During the conference, plenary speakers presented the current state of the field of HRO, while concurrent panel presentations discussed proven, practical methods to introduce HRO into any organization. Over 150 researchers and practitioners from a diverse set of industries, including nuclear, aviation, naval, maritime, rail, wildland firefighting, and healthcare, participated in the conference. Notable speakers included Karl Weick, University of Michigan, Earl Carnes, U.S. Department of Energy, Rear Admiral Tom Mercer, U.S. Navy (retired), and the Honorable Christopher Hart, National Transportation Safety Board. The conference provided a thorough overview of high reliability theory for the novice and allowed for in-depth conversation about applying high reliability in practice. The conference panelists discussed how many failures have common causes that are widely applicable across industries. High reliability theory emphasizes the importance of sharing operational experience, and the conference espoused that characteristic by providing a means for different industries to share their experiences and learn from each other.

## **Additional Information/Discussion**

### **Summary of Presentations on April 20, 2011**

#### *Keynote: Karl Weick, University of Michigan*

In his keynote presentation, Karl Weick emphasized the idea that we all notice, select, and narrate our experiences, and that process inherently results in a loss of information as we attempt to sort through and make sense out of our experiences. Applying this to systems thinking, we simply cannot know all the ways a system will fail, or all the ways to handle a failure. In general, we treat the unobserved as non-existent, but it is much, much worse to treat the unobserved as unobservable. Our ability to act improves our awareness; therefore high reliability should focus on increasing the variety of scenarios and responses through the sharing of background and experience and building confidence in improvisation. Dr. Weick quoted the sociologist Ron Westrum, "A system's willingness to become aware of problems is associated with its ability to act on them."

#### *Learning from Failure*

Moderator: Najmedin Meshkati, University of Southern California

Panelists: Peter Davidson, UK Petroleum Industry Association; Mark Griffon, Chemical Safety Board; Earl Carnes, Department of Energy.

Dr. Meshkati began this panel session by noting that the start of the conference also marked the one year anniversary of the Deepwater Horizon disaster. Each of the panelists presented case studies from their respective industries. Peter Davidson spoke about the UK Buncefield oil terminal incident, and how the investigative team used the Texas City and Baker reports to frame their investigation. Mark Griffon talked about the formation of the Chemical Safety Board, based on the model of the National Transportation Safety Board, and how these boards conduct investigations and provide recommendations to the industry, thereby contributing to a system of safety and quality checks. Earl Carnes discussed the importance of highly reliable governance as a network of relationships among formal and informal actors through means other than prescription and control. Governance should be complex and adaptive. The panelists also discussed the "safety case" approach that is used in the nuclear industry, where the industry must make the case that the operation is safe, then the regulator will review and essentially sign off on the operation. The industry is responsible for spelling out how to manage risk. The panelists note that this approach relies on a competent regulator. In the case of the Deepwater Horizon disaster, the panelists suggest that the industry's regulator may not have been well-educated on the technology being used. In addition, the regulator lacked authority and had a conflicted mission because they were both collecting fees and regulating safety. The panelists also discussed the unique role of the Institute for Nuclear Power Operations (INPO) as a fee-based watchdog organization. The INPO model relies on collaboration across competing organizations because of an underlying mindset that if one fails, all fail.

#### *Bringing it together: Uncertainty, unexpected, thinking, and sense making*

Moderator: Bert Slagmolen, Apollo 13 Consultants

Panelists: Bruce Spurlock, Convergence Healthcare Consulting; Jim Holbrook, Crafton Hills College; Randy Cadieux, US Marine Corps

Each of the panelists discussed their experiences with teaching novices in their respective industries. Bruce Spurlock noted how healthcare is different from other industries seeking high reliability because people are part of the equation. Healthcare is focused less on personal safety

or public safety and more on patient safety. In some ways this makes it more difficult to translate high reliability to healthcare because the worker is not the one at personal risk. The panelists talked about the concept of drift, or the normalization of deviance. Over time, procedures may be ignored more and more frequently until not following the procedure becomes the norm. How can organizations prevent, detect, and overcome drift? Randy Cadieux discussed how they teach individual resilience in flight school so that pilots do not succumb to frustration in crisis situations. They visualize the entire flight before getting in the aircraft, prioritize tasks, and plan for contingencies before ever leaving the ground.

*The unexpected environment and its effect on Behaviors, Beliefs, and Values: Are they situational?*

Moderator: Jim Conway, Institute for Healthcare Improvement

Panelists: Daved van Stralen, Loma Linda University; Todd Conklin, Los Alamos National Laboratory; Bruce Spurlock, Convergence Health Consulting

Daved van Stralen began the panel session with an anthropological definition of culture as a social response to the environment. An individual acts, an organization allows, and behaviors repeated become beliefs. Todd Conklin discussed Schein's model of culture as beliefs lead to values lead to actions. Long-term change relies on changing not just actions, but also values and beliefs. Dr. Conklin also noted that assessing culture is not adequate in and of itself. He referenced the Culture Maturity Model and noted that you must also assess the direction that the culture is vectoring. Is it moving toward compliance (complacency) or reliability? The panelists discussed getting away from the idea of success and failure. In the moment, everyone believes that they are doing the right thing, even when the "right thing" eventually results in a mistake. We should be asking, "Why did they think it was right?"

*Human Performance Improvement, Crew Resource Management, Operational Risk Management, and HRO*

Moderator: Earl Carnes, Department of Energy

Panelists: Ivan Pupilidy, US Forest Service; Todd Conklin, Los Alamos National Laboratory; David Christenson, US Wildland Fire Lessons Learned Center

The panelists noted that one of the biggest mistakes we can make is to rely on error-free operations. Mistakes will happen, so we must prepare for them as best we can. In addition, if a system relies on people doing the right thing every time, then it will fail. Todd Conklin noted that, from his experience, you cannot over-train managers. In fact, training leadership is more important than training front-line workers. Typically, worker training is much more extensive than executive-level training, because of the assumption that executives are too busy to sit through a long course. However, Dr. Conklin recommends reversing the typical amounts of time allotted to training. Workers might need an 8 hour training course on safety culture, mid-level managers might then need 12 hours, and senior-level managers should get a week-long course. This sort of training time is important and justified because the way management responds to failure and near-failure is of critical importance in terms of learning from events. The system drives individual behavior. David Christenson spoke at length about the importance of operational experience. Following a major wildland fire disaster, the wildland firefighting industry was tasked with setting up a leadership development center and a single lessons learned center. Mr. Christenson emphasized the importance of having just one lessons learned center so that all information would be gathered and disseminated from a single point, otherwise you may not achieve effective organizational learning.

*Keynote: Christopher Hart, Vice-Chair, NTSB*

Christopher Hart talked about his experiences in the aviation industry, particularly the success using HRO principles to improve aviation safety and productivity. He stressed that safety and productivity do not have to be, and should not be, mutually exclusive. The secret to making HRO sustainable is to make it profitable, and this is entirely possible. He talked about the formation of the Commercial Aviation Safety Team (CAST), which brings together representatives from all parts of the aviation industry, including the regulator, vendors, air traffic control, maintenance, etc. CAST allows for interactions among the stakeholders and encourages an ongoing dialogue about safety. This is markedly different from the typical model of regulation, where the regulator writes the rule, invites public comment, revises the rule, etc. Public comments do not give different stakeholders the opportunity to comment on each other's comments. There is no interaction taking place. He noted that since the formation of CAST, the aviation industry has realized a 65% decrease in fatalities and no new regulations have resulted from the process. Mr. Hart also discussed the importance of non-punitive voluntary reporting systems, particularly near miss reporting. Near miss reporting is important not just because of what went wrong, but also what went right. If you don't have information on near misses, you may never find out how close you were to a major disaster or how that disaster was averted.

Summary of Presentations on April 21, 2011

*Keynote: Mark Chassin, President of the Joint Commission*

The Joint Commission is a private, non-profit hospital accrediting organization. Dr. Chassin began his talk by noting that in the healthcare industry competition does not drive excellence. He believes that commitment to high quality cannot be done unless you have effective reporting and corrective actions programs that are non-punitive, so as to empower and encourage safe behavior. There is a cyclical feedback loop between trust, reporting, and improvement. Employees must see improvement to trust, they must trust to report, and they must report to improve. Dr. Chassin notes that one of the ongoing problems in healthcare and perhaps in other industries is the occurrence of disruptive or uncivil behaviors. Incivility disrupts and erodes trust, which breaks down the reporting and improvement process. Another concern with practicing high reliability is that some people think that one-size-fits all. There may be many different causes for the same failure, so one group cannot implement that same intervention in the same way and see improvement. Dr. Chassin gave the example of hand hygiene in healthcare. The reasons why healthcare practitioners do not wash their hands as frequently as they might can vary from issues like the physical placement of hand washing or sanitizing stations, workload, lack of accountability, distractions, or perceptions that it is not important. Each cause might require a different type of intervention in order to improve compliance. The Joint Commission has developed a "Targeted Solutions Tool" to attempt to address these differences, so that operational experience data may be aggregated and users can use the tool to find solutions to problems based on interventions that have been tested in other hospitals.

*How does organizational reliability seeking fail and what can be done?*

Moderator: Daved van Stralen, Loma Linda University School of Medicine

Panelists: Karl Weick, University of Michigan; Mark Chassin, The Joint Commission; Chris Hart, Vice-Chair, National Transportation Safety Bureau; Tom Mercer, RAdm, USN (ret.)

Karl Weick began the panel with a discussion of two case studies from the UK rail industry, which appeared in the *Journal of Management Studies* in 2006. In the Ladbroke Grove disaster 35 people lost their lives after a train went through a signal. Not long after, the Clapham Junction disaster resulted in the death of 35 people due to an incorrectly wired signal that

stayed green when it should have gone to red. The case studies present an example of an organization that was reliability seeking, yet experienced multiple catastrophic failures. These case studies illustrate a situation where the organization failed to mobilize reform. The knowledge of the potential for these kinds of failures was available, but was not converted into action. The panelists discussed the ideas of massing, where the system tends to degrade before large scale improvements begin, local empiricism, where many problems are aggregated such that the overall average leads you to believe that a problem is not significant, and lag, the idea that it takes time for interventions to be enacted and during the “lag” there may be changing circumstances resulting in a discrepancy between the initial and current state of the organization and thus the effectiveness of the corrective action.

*When good plans go bad, Wildland firefighting and planning the unpredictable*

Moderator: Todd Conklin, Los Alamos National Laboratory

Panelists: Tom Harbour, US Forest Service; Gary Provansal, San Bernardino County (CA) Fire Agency; Ivan Pupilidy, US Forest Service; Randy Cadieux, US Marine Corps

The panelists discussed the difference between a complicated system and a complex system. A complicated system is one with many parts, for example, a pocket watch. A complex system is one with many interacting parts that make up more than just their sum. Humans are complex systems. Complicated systems can be managed with checklists, but checklists are not adequate for managing complex systems. Systems should be managed differently depending on if the human in the system is a novice or an expert. Novices need prescriptive policy and may benefit from checklists. Experts need doctrine and are more likely to use judgment and adapt in novel situations. Experts have development skills that allow them to engage in complex adaptive problem solving, which can outperform compliance procedures, especially in emergency situations that require decision making in the face of uncertainty.

*Standardization and Variability: Conflict or stability?*

Moderator: Jim Holbrook, Crafton Hills College

Panelists: Karen Cardiff, University of British Columbia; Peter Angood, National Quality Forum

The panel session began with a discussion of a 2010 article by Landrigan in the New England Journal of Medicine, which suggests that the rate of adverse events in healthcare have not changed in nearly a decade. The model often used in healthcare is that accidents are thought to occur when individual components or processes fail to meet criteria. This model builds on the assumption that safety, once established, can be maintained by keeping the performance of a system's parts (human and technical) within certain bounds. In other words, people should not violate rules and procedures. Dr. Cardiff talked about her experiences in healthcare and her realization that better adherence to procedures was not the path to high reliability for healthcare. Flexibility, adaptability, and improvisation can be beneficial for safety and reliability, especially for experts in novel situations. The healthcare industry needs to acknowledge the tension between developing a robust organization and allowing for flexibility in practice.

Additional information about the conference, including agenda, biographies, and presentations can be found at [http://high-reliability.org/Conf\\_Speakers\\_2011DC\\_Short\\_Bios.html](http://high-reliability.org/Conf_Speakers_2011DC_Short_Bios.html).

**Pending Actions/Planned Next Steps**

The NRC will stay in contact with this community of researchers and practitioners via email distribution lists and attendance at future events, where possible. The next conference will be held in November 2011 in Den Hague, the Netherlands, and then again in the USA in April 2012.