Director's Corner

Recently, I was privileged to be invited to help the Columbia Accident Investigation Board (CAIB). The CAIB hosted a safety seminar with nationally recognized safety professionals from industry and academia, April 27-28, 2003 at the CAIB headquarters to raise their awareness of industry and organizational safety standards and practices.

As part of their investigation into the cause of the Columbia Shuttle mishap, the board met with Dr. Nancy Leveson, Dr. M. Sam Mannan, Allan McMillan, James Wick, Dr. David Woods, and Deborah Grubbe to discuss NASA's safety management and programs, decision-making processes, and safety culture. They also reviewed risk analysis and risk management in addition to accident investigation models, safety culture, metrics, indicators, and decision-making processes.

The Columbia disaster earlier this year caused many to ask tough questions. I believe that such questions need to be asked so that improvements can be made to help prevent such disasters. The safety requirements for space flight are quite demanding and require a multi-layered approach. In the first layer, one must build in the technology and procedures that provide an appropriate level of safety for manned spacecraft. The second layer consists of management systems that ensure that procedures are followed and proper standards are implemented at all times. Finally, the third layer consists of creating a healthy and strong safety culture. The increasingly higher levels are harder to define and implement but they are very important. In fact, safety culture is very elusive and varies according to the activity and the mission of the organization. It is quite difficult to identify objective characteristics of a good safety culture. However, some known characteristics include:

- Commitment AND involvement of the highest level personnel
- Open communication at all levels of the organization
- Everyone's responsibilities and accountabilities regarding safety is clearly defined and understood
- Safety is second nature
- Zero tolerance for disregard of management systems, procedures, and technology
- Information systems allow all parties access to design, operational, and maintenance data

As part of the multi-layered approach discussed above, safety-conscious organizations use analysis of trends to spot problems. Trend analysis should be focused on leading as well as trailing indicators. A trailing indicator is a downstream measurement of the outcomes of safety and health efforts. These indicators reflect successes or failures of the system to manage hazards. Examples of trailing indicators include fatalities, injuries, and incidents. A leading indicator is an upstream measure that characterizes the level of success in managing safety systems; measurement of activities toward risk reduction prior to occurrence of incidents. While every effort should be made to measure and track trailing indicators, relying on the trailing indicators to assess safety performance is self-defeating. Thus, it is very important to measure and track leading indicators, particularly for high-risk activities such as space flight. Leading indicators however are more difficult to define and measure and vary according to the activity and the

mission of the organization. Examples of leading indicators might include:

- The level of near-miss reporting
- Effectiveness of incident investigation and corrective action
- Management of change
- Emphasis on inherently safer design
- Effective application of risk assessments
- Level of deferred maintenance
- Level of repetitive maintenance
- Number and severity of faults detected by inspection, testing, and audits
- Number and nature of unresolved safety issues.
- Participation in continuing education and symposia
- Employee morale, level of expertise

As the CAIB completes its work, we hope they are able to determine the root and especially the contributing causes of the Columbia disaster. Most importantly, we hope they are able to identify and address systemic issues that may have led to the shuttle disasters. If they only determine and fix the specific cause of this specific failure little will have been done to improve the overall safety of the program.

The ultimate sacrifice made by the seven brave astronauts will not have been in vain if we are able to significantly reduce such disasters in the future as we continue our space program and look towards the bright future brought about by the scientific advances possible because of space flight and research.

M. Sam Mannan

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