National Cultures, Safety Culture and Severe Accidents

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Outline

• Introduction/My story
• The premise and personal observations on the impact of National Culture on Safety Culture
• Five Severe Accidents
• Conclusion – Closing Remarks
My life story…..

Three Mile Island
March 28, 1979

Bhopal
December 3, 1984

Chernobyl
April 26, 1986

BP Refinery
March 23, 2005

BP Deepwater Horizon
April 20, 2010

Fukushima
March 11, 2011

Chernobyl

My life story…..

March 28, 1979

December 3, 1984

April 26, 1986

March 23, 2005

April 20, 2010

March 11, 2011
Teaching and Conducting Research on Human Factors in Aviation Safety since 1989
My Premise

The ‘HOT’ Model, Safety Culture &
Major Subsystems of a Complex, Large-scale Technological System

(e.g., a nuclear power plant, an aviation system)
Personal Observations on National and Safety Culture
Culture, Facts and Theories

Facts are not pure and unsullied bits of information; culture also influences what we see and how we see it. Theories, moreover, are not inexorable inductions from facts. The most creative theories are often imaginative visions imposed upon facts; the source of imagination is also strongly cultural.

National, Corporate, & Safety Culture(s)
Foundation of the Safety Culture
Safety Culture as a Root-Cause of a System’s Common Mode Failure

• Because of their diversity and redundancies, the defense-in-depth will be widely distributed throughout the system.
• As such, they are only collectively vulnerable to something that is equally widespread. The most likely candidate is safety culture.
• It can affect all elements in a system for good or ill.

Professor James Reason, A Life in Error, 2013, Page 81
Cultural factors influencing safety need to be addressed in design and operation of technology

Human factors training is becoming a powerful tool in improving aviation safety, but it must take into account the cultural differences that exist between different parts of the world if it is to become fully effective.

Expectations that international operations will continue to account for an increasing share of air transport activity worldwide underscores the importance of designing and implementing automation technology with human factors, including cultural factors, in mind.

A recent University of Texas study of national culture and flightdeck automation, involving 2,396 pilots from a number of nations, found a "disturbing...lack of consensus in automation attitudes, both worldwide and between nations." It concluded that there is a need for development of a clear philosophy for the design of automation. More recently, the U.S. Federal Aviation Administration (FAA) human factors study team identified several "cultural biases" in flight crew management of automation and situational awareness. These evidently were caused by interrelated deficiencies in the aviation system, such as inadequate understanding and consideration of cultural differences in design, training, operations and evaluation. The FAA recommended further study of such factors as pilot understanding of systems capabilities, and how cultural and organisational background influence how pilots decide whether and when to rely on automation.

ICAO has recognised the importance of cultural issues in aviation safety, and has acknowledged that effectiveness of human factors training may be diminished or even negated by the cultural context of a situation. ICAO’s human factors and flight safety programme has shown that safety deficiencies remediable by human factors training in North America may not be addressed at all by training elsewhere. It has also been suggested that North American approaches to crew resource management (CRM) training may not be applicable in many cultures. The challenge, then, is how to ensure significant cultural differences and reflect these in training.

The Boeing Co. reported in 1987 that 55.4 per cent of all jet transport accidents since 1975 could be attributed to flight crew error. Also, 37 of 70 accidents involving U.S. airlines between 1979 and 1990 were found to be a result of flight crew actions; the U.S. National Transportation Safety Board (NTSB) found a total of 362 errors associated with these accidents.

Cultural parameters, although not probably the most subtle human factors subset in technology utilization, should be the focus of more attention in aviation safety. Cultural factors contributed significantly to the crash of Pan American Flight 822 near New York in January 1990; the NTSB determined that the probable cause was flight crew failure to manage the Boeing 707's fuel load and to communicate an emergency situation to ATC before fuel exhaustion.

An Alitalia captain testified that the first officer's use of the word "priority" rather than "emergency" may have resulted from training provided by the aircraft manufacturer, which uses "priority" in its procedures manuals. He indicated Alitalia personnel thought that "priority" and "emergency" conveyed the same sense of urgency to ATC. Controllers testified that although they would do their utmost to assist a flight requesting priority, this would not require a specific response. They also said that pilots with a fuel emergency should declare it as such.

The NTSB found that the first officer of Flight 802, who transmitted exclusively in English, never used the word "emergency" even when he realised that two engines had failed. Neither did he use appropriate phraseology to communicate the nature of fuel status.
Why Your Flight Safety Is At The Mercy Of Cultural Factors

Dr. Najmedin Meshkati
November 29, 2000

There are not pure and uncultured bits of information; culture also influences what we see and how we see it. Theories, moreover, are not invariable inductions from facts. The most creative theories are often imaginative visions imposed upon facts; the source of imagination is also strongly cultural.


Introduction

Whenever you fly an aircraft, sit in the cockpit or in the cabin, or land in a "foreign" airport your flight safety is at the mercy of cultural factors. Allowing is the above succinct epigraph, which only provides the first compelling reason. It may be amenable to many scholars and practitioners of "hard" sciences and other engineering-dominated fields, but recent rigorous research has proven that even scientific theories, facts, and practices – which determine
Macroergonomics: Theory, Methods, and Applications
Edited by Hal W. Hendrick, Brian Kleiner
(2002)
“The report is intended for use by governmental authorities and by the nuclear industry and its supporting organizations. Prepared by a highly authoritative body, it should help to promote Safety Culture. **It is intended to stimulate discussion and to promote practical action at all levels to enhance safety.**”

The cultural context of nuclear safety culture: a conceptual model and field study

Najmedin Meskati
University of Southern California, Los Angeles

The two general components of safety culture are "the necessary framework within an organization and the attitude of staff at all different levels in responding to and benefiting from the framework." Also, the requirements from individual employees for achieving safety culture at installations are "a questioning attitude, a rigorous and prudent approach, and necessary communication." Recent studies have highlighted the critical role of cultural factors in the safety of nuclear power plants. This chapter contends that an organization's safety culture, as a system composed of behaviors, practices, policies, and structural components, cannot flourish or succeed without interactions and harmony with its environment - the societal or national culture. In other words, safety culture should be considered in the context of national culture. It is concluded that the necessary conditions for creating and nourishing safety culture in a technological system include (but are not limited to):

- An understanding of systems-related factors affecting human performance;
- Determination of the extent to which systems-related factors interact with factors of organizational culture and the national culture;
- Promotion of a questioning attitude and openness in the organization;
- Development of conducive regulations and a supportive regulatory environment.

Human and organizational factors play a vital role in the safety of large-scale technological systems (Meskati, 1988; 1989a, b; c; 1991a, b). Fortunately, this fact has been almost universally recognized by the nuclear industry around the...
Culture and Accident Causation

Swiss Cheese Model
Figure 7.8. The dynamics of accident causation. The diagram shows a trajectory of accident opportunity penetrating several defensive systems. This results from a complex interaction between latent failures and a variety of local triggering events. It is clear from this figure, however, that the chances of such a trajectory of opportunity finding loopholes in all of the defences at any one time is very small indeed.
Reason’s “Swiss Cheese” Model

- Unsafe Organizational Influences
- Unsafe Supervision
- Unsafe Conditions
- Unsafe Acts

Latent Conditions

Active Failures

Mishap

Failed or Absent Defenses
Professor Reason’s “Swiss Cheese” Model
Prof Reason’s “Swiss Cheese” Model

Failed / Absent Defenses (a few could be attributed to cultural factors)
Double-Shielded, Fortified “Swiss Cheese” Model
Proposed by Prof Najm Meshkati, USC
Design by Dr. Greg Placencia, USC

Culturally-Informed Safety Culture

Strong & Independent Regulatory Oversight + Rigorous/Proactive Inspection, Enforcement & Verification Regimes

Organizational Factors

Unsafe Acts

Unsafe Conditions

Supervision & Supervisors

Bottom-up

Top-down
Culture and Accident Causation

Human-Machine System
Human-Machine System

Human

Operator A

Operator B

Interface Level

Machine

Input

Output
A Model for Nuclear Power Plant Operators’ Responses to Disturbances
(Based on Prof. Jens Rasmussen’s SRK Framework, personal communication 1992)
Control Rooms of Nuclear Power Plants
There will always be a performance gap between “work-as-planned” and “work-as-done” work performance gap ($\Delta Wg$) because of the variability in the execution of every human activity.

National Culture Implicated as a Contributing Factor to 5 Severe Accidents

• Tenerif - Runway Incursion – Canary Island, Sprain - 1977 (583 fatalities)
• Avianca 052 – Crash - New York – 1990 (73 fatalities)
• Korean Air 801 – Crash - Guam – 1997 (228 fatalities)
• The Überlingen mid-air collision – Switzerland – 2002 (71 fatalities)
• Asiana 214 – Crash - San Francisco -2013 (3 fatalities)
Asiana crash shows continued need for vigilance against CRM & cultural issues
Do you agree?

“Culture Eats Systems for Breakfast”

On the Limits of Management Based Regulation

By:

Professor Neil Gunningham and Mr. Darren Sinclair

The Australian National University

National Center for OHS Regulation, July 2009