HUMAN FACTORS: A TRIFOCAL APPROACH

Thesis/Project work submitted in partial fulfillment of the requirements for the MSc in Human Factors and System Safety

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Big thanks to my parents who always motivated me to see the importance of knowledge. My wife, who put up with my busy work schedule, and cheerfully accepted my busy study schedule. Thank you all.

ABSTRACT

Creating and maintaining safety in a high risk organization is a very difficult task. Operators work to mitigate and reconcile many juxtaposed variables in a system, and experts have suggested many solutions in form of theories, models, and analysis etc to improve safety. This thesis looks at the present day human factors situation at West Air organization from three different angles.

First chapter outlines and discusses some major human factors theories for high risk organizations with their applicability to West Air organizational situation. This is meant to be a comprehensive study for the people in management to learn from; and hopefully see the implications of these theories on decision making process directly or indirectly affecting human factors.

Second chapter elaborates on the existing reactive and proactive safety methods. It examines the reporting culture's strengths and weaknesses in the organization and presents expert views and suggestions to make reporting effective and fruitful as a safety tool. The significance of systemic safety evaluation through a well functioning reporting system, feedback from line checks, OPCs/LPCs and any other source is of utmost value in this regard the importance of an honest and willing reporting culture is often underestimated. Hurdles in creating a sound reporting system may lie in fear of retributions, poor awareness of importance of reporting, people not receiving adequate feedback to their reports. All this conspires against the loss of valuable data in an attempt to understand challenges to safety (Dekker, 2007).

Third chapter seeks to revive the CRM training based on the latest research and practices by arguing for a more tailored and more assimilated program with the organizational needs and challenges. CRM training is much more than few hours of annual classroom session, it is the product of an overall safety culture and values. Therefore its concepts are to be emphasized during everyday operations through training and feedback. There is a need to foster a healthy application of human factors concepts understanding, application and correlation during simulator sessions, line checks and pre and post flight briefings (FAA, 2000).

This paper closely examines the safety culture at West Air organization, and attempts to integrate and sew together above mentioned areas within an organizational context to suggest steps in improving human factors approach from present thinking. This is meant to be a suggestive study based on contemporary human factors literature, observations, interviews, discussions and research.

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HUMAN FACTORS FOR MANAGEMENT

The purpose of this chapter is to give the top management a concise and condensed study into the role of human factors in managing a high risk organization like an airline. It will highlight the leading theories, and models of human factors based on available literature and research. The aim is to integrate human factors as an overall management strategy to help harmonize, and mitigate often competing ends of production and safety.

High risk organizations are defined as where errors result into significant economic losses and/ or loss of lives. Airlines, hospitals, nuclear plants, and shipping are prime examples of high risk organizations. Understanding an accident's underlying causes is important in an organization's advancement towards a safer system. The approach should be to prepare for contingencies and constantly address systemic weaknesses, as well as having sound response plans in the aftermath of an accident or serious incident. The challenges to safety often stem from regular juggling of production and safety goals within an organization. Majority of experts reject the idea of quick fixes in pursuit of safety, hence removing the few "bad apples" very likely will not fix the root cause of a problem (Dekker, 2002; Federal Aviation Authority, 2000; Snook, 2002; Vaughan 1996;).

Shawn Pruchnicki 8/24/09 1:25 PM
Comment: I think that this is weak. He needs to explain to management that it is not the inevitable human error that causes these events but rather the systems inability to absorb the daily negotiations that practitioners face.

The success and effectiveness of top management is mainly judged by shareholders, public, and media by their ability to show positive economic results. This becomes even more desirable when times are tough, and there is a looming financial crisis across the globe. Economic results are more easily judged, and the future of organization depends on this positive result. Continuous economic losses are akin to ultimately a complete wipe out of an organization. This argument helps us establish an important postulate in management of most high risk organizations like an airline where production goals often are more readily judged and evaluated than a deteriorating safety situation which might not always be evident until a serious accident takes place in a system. Safety may also be judged by a lack of accidents, and misleading and overly optimistic statistics which fail to underline systemic deficiencies and impending disasters. These past successes are seen as a resilient guard against future failures, which is exactly the opposite of how resilient organizations don't see past successes as a guarantee of safe future and are constantly seeking to improve themselves (Dekker, 2008).

Shawn Pruchnicki 8/24/09 2:27 PM
Comment: Yea, but no one ever makes this a conscious choice. The way that this is written it will be immediately dismissed by management because I'm sure they do not think that they do this!

A brief overview of historical evolution of human factors concepts in aviation is appropriate. The US military felt a need to have selection procedures in place to pick the most suitable candidates for flying positions. Otherwise the civilian aviation world was mainly money driven where there were no formal selection criterion or human factors training. After the Second World War there was an increasing research and effort to improve the technical reliability, and ergonomics of an aircraft to reduce pilot workload. During the sixties till nineties there were great advances in electronics which helped providing more information in a timely manner to flight crews, simulator training, and introduction of non-technical skill, and CRM training. From nineties there has been a greater emphasis on developing methods for organized oversight of flight operations like LOSA to improve flight safety. A diminishing increase in safety also led many experts to suggest shifting a main focus of safety from individuals, technical, ATC to an overall organizational approach where legal systems, regulations, SOPs, production goals, cultural issues, and organizational weaknesses are all seen as related and contributing factors in creating safety (OGHFA, Flight Safety Foundation).

Shawn Pruchnicki 8/24/09 2:37 PM
Comment: This is not true. Maybe in the military (U.S. 1920 and later). But early on if you had the money, you could buy an airplane from the Wright factory. Even after WW1 you could buy surplus aircraft for pennies on the dollar. Esp the JN-4 Jenny.

Present day human factors approach seeks to investigate and understand many of the salient and benign relationships at a systemic level which may hide a deeper understanding for improving the existing level of safety achieved through human factors concepts rather than relying on simplistic explanations which often heavily relied on blaming individuals. Therefore, the management's prioritization and interest in a safer system through concrete actions has a great impact on how these attitudes trickle down in rest of the organization. There is a need for a "navigation aid" and "regular health checks" in an organization to reduce vulnerability to accidents (Reason, 1997).

Shawn Pruchnicki 8/24/09 2:47 PM
Comment: This is an awkward sentence. I know what he is trying to say but there are two different interrelated ideas here. Written the way it is, it begs the question – ok, so how does understanding these relationships improve safety? And what is the application of human factors concepts?

Management's legal and ethical role in influencing a direction towards a safety culture is hard to overemphasize. Here is an example of a situation perceived as a total lack of understanding for safety by flight crews in an airline, an airline pilot told me this, *My phone rang as I was driving to work, on the other end it was the Human Resource manager. We exchanged pleasantries and she asked where I was headed I told her I was driving to work for an evening flight. She told me that sadly they had decided to lay off another batch of pilots because of less production demand, and I was going to be one of those who will be loosing their job. I felt emotionally disturbed after receiving this call because of its obvious consequences, and especially during these rough economic times. I decided to call in "not fit for flight" that day because of flight safety reasons. I simply didn't want to fly that day and be distracted by all the negative thoughts of just having lost my job. The airline had to call another standby pilot to replace me, and this led to the delay in scheduled departure time for the flight. This delay due to the nature of contract again resulted in a harsh economic penalty for the company. During a weekly meeting the managing director of the company questioned the integrity of the pilot calling in "not fit for flight" by saying that if he could safely drive back home, then he could have flown as well.*

This kind of rhetoric obviously discourages the safety culture from maturing and growing in an organization where the top management doesn't perceive the threats to safety the way pilots do. It shows a serious gap between words and actions when it really matters. Instead of the pilot getting praised for his self awareness, and taking a decision in the interest of flight safety, he was damned for delaying the flight which resulted in a penalty for the company. Human Resource department's wisdom to call while he was headed to work is also questionable in the context of flight safety. This example elucidates a clear need for understanding of human factors in flight operations to help them reach better managerial decisions. Diane Vaughan in her account of *Challenger Launch Decision* also points towards very phenomenon where organizational culture gets focused on the production goals (1996). Meeting production goals and "getting the job done" are considered the hallmark and sign of good workers, and cancellations and delays are seen as undesirable features of a production oriented system. These norms and practices often make it very hard for the management to see any incentive in a cancellation.

Justly, one should ask the question whether anyone has a recipe to a perfect balance between safety and production, the answer is an emphatic "no". Production goals are the very reason for the existence of most profit making organizations like an airline. Safety goals are mainly established to safeguard the wellbeing of human beings inside and outside the system and their property. An airline is responsible for the safety of all onboard, as well as to the people living around the airports and airways not directly participating in the flying activity as crews or passengers. Safety goals serve also to prevent or at least minimize the damage to property, and wasting of valuable resources. Accidents inevitably lead to a bad reputation of an airline

as unprofessional and even unethical. This loss of reputation may have an adverse effect on productivity, and competitiveness due to bad media publicity. Focus on safety is therefore a genuine challenge and opportunity for the management to lay firm ethical foundations in the way they conduct their business, which again pays off in lower costs of accidents and a better media image in the market. Public's general perception of an airline as being safe is often determined by what kind of publicity it may have received after incidents, accidents and how frequently they occur to a particular airline (airsafe.com).

Normal Accident Theory

A scheduled West Air flight with a BAe ATP aircraft from Oslo to Trondheim was due to depart on a round trip flight. A regular procedure for fuelling is to plan sufficient fuel from Oslo in order not have to fuel in Trondheim to avoid extra night time fuelling costs at Trondheim. Minimum required fuel for the round trip according to the flight plan was 2700 kg, crew decided to take 3000 kg for an extra buffer "just in case" reason. On its way to Trondheim, crew had 35 knots more headwind than what flight plan had based its calculations on, and they were restricted to a lower altitude than filed due to traffic congestion. Therefore, burning more fuel than planned; reaching Trondheim the flight was cleared for an approach 18 miles out.

At the same time an SAS A340 requested taxi, and was cleared for line up and to report ready. A340 was a highly uncommon aircraft at this regional airport. This aircraft was a technical diversion on its way from Stockholm to Chicago. A340 entered the runway and after a slight back track started lining up with the assigned runway. During the turn A340 crew realized that their aircraft's turn radius will be too wide for the space available, and they decided to stop and requested tow truck assistance to get them out of the situation. Due to the regional nature of the airport, it took the ATC 55 minutes to coordinate with the ground crew to get the A340 towed and lined up for departure.

In mean time the ATP was put in a hold, and crew realizing lower fuel than required minimums upon landing for a return flight promptly asked ATC to call fuelling company. After landing no fuel truck turned up for some time, and the captain called tower to ask. Tower had forgotten to call while he was busy with the stuck aircraft on the runway. When fuelling company was called their phone was turned off. Flight was delayed resulting in a penalty by the contractor. Delay was resulted by things which were beyond crew's control.

Welcome to the world of normal accidents, where complexity and coupling are the inherent components of a system. Perrow defines *Complexity* or *Complex interactions* as a natural, but hard or impossible to anticipate property of a human designed system (1984/1999). Many subsystems may interact and cause situations which weren't possible to foresee. Above example emphasizes the many unpredictable and unforeseen interactions in a complex system coming together at the same time like, stronger winds, lower than optimum assigned altitude, and an unusual aircraft at the airport, ATC forgetting a message, turned off phone. *Linear interactions* is the opposite of complex interactions, and where the role of one part malfunctioning has clear and obvious implications, which makes it easier for the operator to take corrective action and rectify the fault, and keep the system up and running or repair it without any serious consequences.

Coupling is *Loose* or *Tight*, *Loose coupling implies* a system where demands of on time performance, order of task completion, alternative means to complete the task are flexible,

and safety measures aren't necessarily built in but rather taken advantage of according to the situation. An example is of a post office where letters and packages can stack without any particular order for some time without it causing a disruption in system safety or efficiency. *Tight coupling refers* to a system where there may only be one correct way to accomplish the task, time constraints are part of the process, high accuracy required in doing the job, safety and redundancy is artificially built in the system (Perrow, 1984/1999).

NAT in West Air: West Air system as whole is complex where pilots and mechanics juggle between staying profitable by being on time due to penalties incurred as part of the contract. Flying fast approaches, a request to crews to show "good judgment" in fuelling, pressures to release an aircraft which may be legal but may not be in ideal condition in icing, low visibility conditions with few diversion alternates etc. But it seems to be a dilemma for all commercial operators, and everyone does a reasonable job at juggling these tasks most of the time, but system is far from ideal, and may throw some unexpected surprises because of our otherwise "normal practices" and "efficient operation". There is a benefit in developing a better understanding of these conflicting goals, and impact of accidents in our system at all levels of company to be better prepared for contingencies. There is not any hard evidence to point that system has either improved or worsened over the time for the past two years. As of now it is somewhat stagnant at being quite complex, and somewhat tightly coupled. Decentralization in decision making for frontline operators is helpful in the system to cope with complexity, and reducing tight coupling to an extent. Figure a below depicts different aspects of flight operations from a NAT perspective,

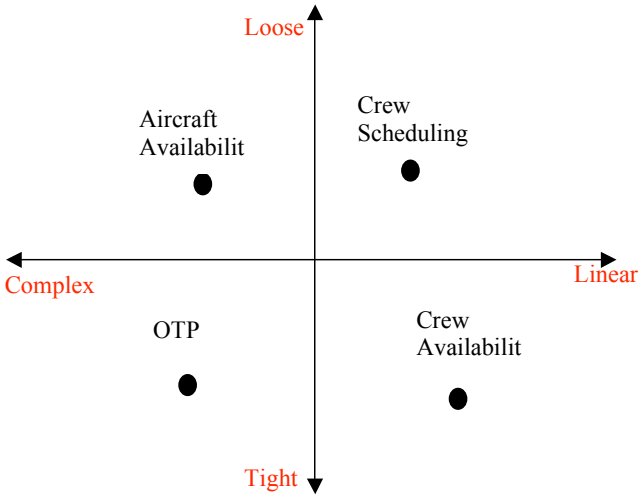

Figure a - OTP: On Time Performance. A possible NAT scenario in West Air

Shawn Pruchnicki 8/24/09 3:08 PM
Comment: Boy, I'm not sure I agree with this categorization of this flight operation. I think one could make an argument for some of these being differant. Is this really needed in this thesis would be my first question. What does it really contribute?

West Air is to perform a demonstration cargo flight for a potential customer as part of their evaluation process. Company needs to show an on time scheduled flight to make a grade.

We have scheduled with an extra stand by aircraft, crew, mechanics, and spare parts to meet a contingency.

During pre-flight the captain complains of not feeling well and has to be replaced by the standby captain, which slightly delays the preparations.

The aircraft is loaded forty minutes before the scheduled time, and one engine is started; second engine won't start.

Technicians eventually declare the aircraft unserviceable. It's decided to reload to standby aircraft.

Standby aircraft is parked inside the hangar, and there is sweeping in progress due to heavy snowfall. ATC tell of a 10 minute delay before it can be towed.

Hangar door is stuck in locked position, and won't open.

The flight has to be cancelled, and the company loses the contract by failing to show on time performance. The above example shows how complex interactions like the captain getting unwell, the technical engine malfunction, the weather, the hangar door mechanism relate with tightly coupled system requirement of an on time performance to throw up many unexpected surprises. On the other hand linear and loose coupling properties of the system helped minimize the detrimental effects of the complexity and tight coupling.

Shawn Pruchnicki 8/24/09 3:07 PM
Comment: So now that we gave this example, show how it relates to NAT.

High Reliability Theory

High Reliability theory is considered the opposing theory to NAT because humans are the centre of focus when creating safety and resilience. Rochlin in his article "Safe systems as a social construct" (1999) points to several properties found in High Reliability Organizations (HROs), one of them is "duality" where HROs constantly juggle several contradicting goals as their routine business. He further points to the fact that "even external constraints as regulations, procedures etc are incorporated in the system to further strengthen safety". High reliability theory also incorporates the concepts of *sensitivity to operations, commitment to resilience, and deference to expertise* as main tools to deal with paradox faced in the NAT theory where interactive complexity requires decentralization, and tight coupling requires centralization. HRT is more fluid in its approach, and focuses on the human ability to overcome the complex challenges through knowledge, adaptation, vigil, and renewal of risk assessment as the essence for safety design.

The major characteristics of a high reliability organisation as outlined by the HRO definition at highreliabilty.org are briefly explained as,

1. *Preoccupation with failure:* An organisation dealing with complex, and hazardous activity is constantly is on outlook for improving its safety and effectiveness while minimising the risk through better training, awareness development, adaptation to new environment and situations etc.

2. *Reluctance to simplify interpretations:* HROs avoid generalizing and taking lightly the matters concerning safety, they invest resources in developing safety and detecting and correcting the threats.
3. *Sensitivity to operations:* HROs realize the conflicting goals, and tasks in a complex operation, and are on lookout for methods to improve smooth running of operations at different levels, they give due authority to their front line operators

4. *Commitment to resilience:* As Sidney Dekker in his video on youtube.com points, organizations and teams which show good resilience don't take past successes as a guarantee for future success, constant awareness of risk is maintained even when things look safe, people holding different opinions than mainstream are encouraged to participate in their discussion of safety planning, they dedicate resources to safety development (Sidney Dekker Sep 2008, Resilience, www.youtube.com).

5. *Deference to expertise:* People with most knowledge and experience of a situation or operation are given the authority to take decisions..

6. *To reduce degradation of quality:* There is an effort put into keeping the system on what is considered a desirable way of conducting operations, it is done through regular, training sessions, inspections, audits etc

7. *Command and Control:* Leaders in HROs keep themselves updated from bottom level and up in their operations to have an overall picture. Carolyn Libuser 1995 divides it into several segments including, authority gradient, migration decision making as discussed in point five above, redundancy to back different systems and processes up, senior managers who see the big picture, and don't "micromanage", rule and procedures exist to define hierarchy, but not necessarily to create what Libuser calls a "negative bureaucracy".

Shawn Pruchnicki 8/24/09 3:12 PM
Comment: Why are items 4 and 7 referenced here and the others are not? These are not or are they with the "highreliabilty.org" mention just prior to number one.

High reliability theory application in West Air: West Air has an interest in being *preoccupied by failure* due to the consequences it has if safety is jeopardized, it may result in loss of life, property, and action from the authorities may result in loss of its Operator's certificate, last one probably being the most serious in the eyes of the management. But not necessarily a reason which helps create an optimum level of preoccupation with failure since many times safety concerns are not well understood and incidents not responded to learn from them as they are not deemed to result into a regulatory violation. This element of preoccupation with failure is most evident in the way training sessions are planned and designed in the West Air training department. A thorough analysis of previous sessions and weak areas is addressed in the follow up training efforts.

Shawn Pruchnicki 8/24/09 3:14 PM
Comment: This reads like the author thinks this is bad? Isn't this what we want?

Reluctance to simplify somewhat lacks mainly due to probably people in higher management, operations, and maintenance not understanding the overall complexity behind errors, mistakes and failures. West Air at an organizational level has a weakness of not seeking to dig deeper in the occurrences, and having a dedicated and organized effort to avoid simplistic interpretations of complex problems.

Sensitivity to operations is good in a sense that pilots/ mechanics are encouraged by the chief pilots/ instructors to prioritise safety before production pressures, there is usually no "punishment" for cancelling a flight, diverting etc if pilots see that as the most appropriate course of action. *Deference to expertise* This is an essential ingredient of the CRM training which for instance deals with the captain and first officer communication and interaction. It doesn't only give the captain an authority to take a final decision but also empowers the first officer to speak up and be freely express his concerns when needed. West Air safety culture in this regard has overall healthy authority and expertise deference

Commitment to resilience does exist but not necessarily explicitly communicated and always acted upon. The safety group in organization hardly ever releases their activities, and findings to rest of the company, there is no systematic incident reporting system and analysis in place, recommended practices from good and safe operations are not consistent among certain senior pilots resulting into a trickledown effect on more junior crews. It can be improved by higher

quality and reality based CRM courses and seminars and putting more effort into remedying above mentioned weaknesses. This lack of feedback causes the organization to miss out on a lot of valuable information which might have been of help to other crews facing similar operational trade off challenges. *Avoiding degradation of quality* is mainly accomplished through twice a year training sessions in simulators, and line checks. Otherwise, there is little formal effort put into maintaining a high quality of operations, mainly due to higher management being bogged down with many other important tasks to keep the system running. *Command and Control* has a normal authority gradient; management is often open to hearing concerns and opinions though they may not materialize into a desired change, chief pilots actively fly with different crews and different bases resulting in a better overall picture, but more knowledge of HRO concepts and "system understanding" is desirable on their part to better manage the organisation.

Shawn Pruchnicki 8/24/09 3:23 PM

Comment: So, why is this bad? Explain why this "failing" is dangerous. In fact, I suggest that for each of the 7 items, if good explain why and if bad, also explain why. Show the reader how you arrived at your conclusions and judgments about this company.

STAMP Theory

A West Air ATP is on approach into an airport with first officer flying at 0200 local time after a winter weather flying evening. On their approach the crew was assigned a descent to 4,000 ft and maintain. Crew flew through their altitude by 250 ft before correcting back to their assigned altitude. On surface it looks like a simple case of crew not paying attention, but there is more to it. The mode control panel in the ATP allows each pilot to select his own flight director modes. The autopilot functions off the system one or two and hence only follows the commands given by the flight director commands from the respective system. Usually the procedure is to have autopilot selected to system 1 if captain is the flying pilot and system two if the first officer is the flying pilot.
The aircraft doesn't give any aural or attention getting warning if a selected function on the flight director panel falls off. This aircraft had a history of erratic falling off the selected functions randomly. During the altitude capture mode the pre-selected altitude mode started levelling off the aircraft and made the descent shallower by pitching up which was acknowledged by the crew as part of a standard call out. But right after that the mode selected for altitude capture fell off on the first officer side which was giving commands to the autopilot, but the captain's flight director mode remained normally lit giving an indication of all normal since he was monitoring his instruments to crosscheck while aircraft surreptitiously still in a descent, crew didn't catch it while also carrying out checklists and ATC communication.

This engineering shortcoming where both pilots independently select their own flight director modes, while the aircraft only follows one selected system may deprive crew of a valuable cross check, since it falsely may lead one pilot into thinking that all is normal while the other pilot may not have noticed a vital function falling off due to lack of adequate warning design. An example of an engineering and design weakness compounding the human weaknesses, STAMP theory addresses these constraints and weaknesses in control at a systemic level.

Traditional models are inadequate at explaining systems containing software and complex human decision making. Above mentioned case study in light of STAMP may be analysed using following STAMP ideas (Leveson, 2003),

Table a is relational attributes of the case above and how it may be understood through STAMP concepts,

Table a - Relational attributes understood through STAMP concepts

STAMP foundational ideas	Applied STAMP to the case
STAMP views failures as a lack of constraints on design and control	A loss of altitude mode without a clear warning if it falls off is a inherent system weakness and combined with a human monitor which is also inherently a weak monitor over time is an overall system constraint
Understanding of constraints is more important than the event	Factors which caused this situation are more relevant than focusing on the altitude bust
Safety is seen as a control problem of system weaknesses	Pilots failed to notice an important altitude mode falling off on one side
Accidents often occur in boundary areas where an overlap of control exists giving room for ambiguity and confusion of who may be the controller	Both altitude preselect capture modes functioned normally and the aircraft initially reduced the descent to capture the altitude. Then pilot flying lost his mode without any conspicuous warning which was actually controlling the altitude while monitoring pilot had his mode lit normally and he was busy talking to the ATC and completing a checklist
STAMP also emphasizes the importance of making a local change in a system without completing understanding its effects on the system as a whole	The monitoring pilot shifting his attention to other tasks is an example of local change in the system which had unforeseen consequences
Safety control structure changes with time, and opens up for small deviances to cause major disasters	A normally functioning system during previous flights the same day may have caused crews to depend more on the altitude mode's reliability

Nancy Leveson in her Systems- Theoretic Accident Modelling and Processes, abbreviated STAMP suggests a systematic analysis of the whole system rather than relying on generalizations. STAMP model utilizes the emergence and hierarchy, and communication and control properties as a main tool of analysis. Focus is on the system as a whole rather than fixating on parts of it. Accidents occur because of inadequate control or enforcement of safety-related constraints as opposed to simple component failures (Leveson *et al.,* 2002). Leveson gives an example of what she in her book refers to the counter-productivity of blaming on human errors as the sole cause during a DC-10 incident where loader was blamed for not properly locking the cargo door which failed to result in remedial action for an inherently faulty design, and which further resulted in fatal crash of a DC-10 aircraft due to the faulty cargo door design. She proposes a Systems- Theoretic Accident Modelling and Processes STAMP model for a system's approach which needs to be applied with regard to organisations specifics like nature of operation, safety structure, safety constraints to be maintained by each component, model of the dynamics and pressures resulting in degradation of safety, mental models used by those controlling systems, cultural and political build up of an organisations (Leveson *et al., 2002*).

Shawn Pruchnicki 8/24/09 3:31 PM
Comment: So, where is the STAMP application to the West Air operation? This is what was done for the other models.

STAMP model applied to West Air flight operations

STAMP concepts of safety requirements, control, process model, and feedback are listed as sub factors for different internal and external influences on achieving a safe flight operational environment (Nelson, 2008).

Operational Safety

External Factors

National Government
Mandates civil aviation authority to ensure and work to improve aviation safety in a state
Holds the CAA accountable for the task it is assigned to accomplish
Keeps track of authority's work and how it may be affected by the political picture
Continuously gives feedback to the authority about progress and goals

Civil Aviation Authority/ EASA
Has a major task of ensuring safety of aviation related activities within its jurisdiction
Achieves this end through a complex set of tools in form of regulations, inspections, directives, safety field work etc
Conducts inspections, audits, and other feedback work to ensure compliance and functionality

Air Traffic Control
Primary objective is to safely manage the air traffic in airspace under its control
Has several tools to manage a safe traffic flow through radars, regulations, procedures etc
Maintains a two way communication to ensure constant updates to aircrafts in form of clearances, advisories, and warnings

Environment
Weather, Terrain, Day, Night, aerodrome facilities, work environment etc

Organizational Factors

Company Management
Has an objective of running a profitable and safe operation
Allocates resources and duties to employees to run the operation
Keeps a check of work progress by a staying in touch with different working groups
Sets goals and communicates the strategies to employees to adapt to changes

Training and evaluation
Supplies the operations with safe and efficient crewmembers
Provides crews with relevant and adequate training with clear aims and standards through CRM, LOSA, TEM etc
Ensures regular refresher training and evaluation of crews
Crews are made aware of their strengths and weaknesses

Regulations, SOPs, and MELs
Seek to develop a set of guidelines with main focus on control, constraints and hierarchy
Compliance is considered mandatory with few exceptions
Rigidity is prevalent and may not take into account many conditions which make compliance difficult
SOPs are easier to amend, than regulations and MELs when they may be considered too rigid or irrelevant

Maintenance
Makes sure safe and airworthy aircraft are available for flight operations
Has a number of methods and resources to fix the technical problems
Has the authority to ground unserviceable aircrafts

Receives and gives feedback to inform about problems

Normalization of deviance and practical drift

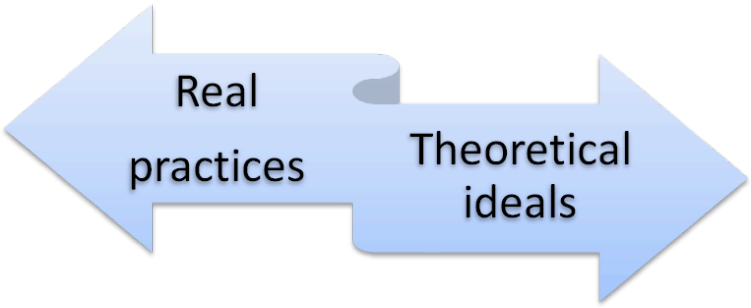

Figure b - The possible divergence between local rationality and ideal behaviours

Shawn Pruchnicki 8/27/09 10:37 AM
Comment: Does this graphic really contribute to the thesis and the research? Is it needed?

Also, in my opinion, local rationality and ideal behavior can in fact be the same or at least converging at times. To imply that they are always divergent is incorrect in my opinion.

Normalization of Deviance and *Practical Drift* are somewhat similar concepts dealing with differences between the real practices and the theoretical ideals in form of regulations, directives, SOPs, checklists, etc within high risk organizations (Figure b). An investigation into NASA's culture prior to the Challenger space shuttle crash revealed a phenomenon of *"Normalization of Deviance"* which is best defined by an adjustment of practices based on production targets and economic constraints (Vaughan, 1996). Normalization of deviance in NASA culture forced people to take innocent shortcuts, which weren't deemed hazardous to the safety of operations. *"Practical Drift"* is a term used by Snook (2002) in his account of friendly fire incident of two unarmed US helicopters shot down by US fighters over northern Iraq. Snook laboriously navigates through the maze of complex procedures and regulations to explain a breakdown of coordination and people at top loosing awareness of how local rationality was practiced while the system as a whole gradually got comfortable with the "deviant" practices until the accident occurred.

A captain during an approach to a small airport was given the choice between a NDB approach, and a visual approach if he had the airport in sight. At that time aircraft was 2400 ft above the airport approximately 4 miles out. The captain who was the pilot flying quickly stated to the trainee pilot that "NDB approach will take us too long, we can make a visual". Aircraft was set up for a left base for the runway but was high on speed, and altitude for a stable approach. The captain initially pitched down fifteen degrees to get the descent going, and then at the same time tried to get the speed decreased by pushing the prop levers full forward. Ground proximity warning came on fairly quick, and stayed on until very late part of the approach. Non flying pilot once exclaimed "approach not stable" but didn't get any response. According to the non flying pilot there was not a danger of aircraft impacting the terrain due to CFIT, but he felt uncomfortable, and didn't see any justification in such a rushed maneuver. After landing flying pilot looked at the non flying pilot and said "didn't mean to scare you". There was also a new first officer sitting on a jump seat observing the whole maneuver. Weather was visual meteorological conditions.

A captain on downwind for runway 36 at ENZV during vectors for an approach was asked if he would be interested in a straight in for runway 29. Captain who also was a flying pilot

without consulting the first officer under line training asked him to tell ATC that it will be fine. ATC cleared the aircraft for a straight in approach for runway 29. Aircraft at that point was also "hot and high". The whole approach was unstable with constant GPWS warnings, and aircraft crossing threshold at 15-20 knots above the reference speed. Upon landing the captain told first officer that "now you have seen that it is possible, if you ever have to". Weather was visual meteorological conditions.

A new first officer in the company while flying for the first time with a captain felt uncomfortable with his general attitude towards SOPs and short cuts he took during flights. First Officer brought that to the attention of another senior captain in the company, and was told that "that's the way he is". The first officer felt that this was implicating towards adjusting his attitude depending on who he flew with rather than following the proper procedures.

These three cases above tell a story of a drift and deviance from what is considered "standard operating procedures". People who showed this "deviant" behaviour in our cases are training captains; they may feel a certain degree of impunity because of their seniority, an unwritten but practically accepted culture of making deviance a normal practice where deviance is only a deviance when "hindsight bias" is used in case of incidents or accidents. As long as things go fine no one really points a finger or sees the practice as "deviant". Figure c shows four contributing factors towards practical drift and normalization of deviance.

Figure c - Four observed factors contributing towards practical drift

Confidence and previous experience in having done such approaches before and knowing the flying characteristics of a turboprop is a contributing factor. A turboprop can handle high speeds and high sink rates, and still be able to land from reasonably established approach on glide slope and airspeed towards the end of an approach (Dismukes *et al.*, 2007). The increased knowledge and skills through experience may not have been considered by the regulatory authority and standardization department when standard operating procedures are

developed and implemented. Therefore, it is possible than certain SOPs are considered a hindrance in conducting smooth and efficient operations.

Production pressures play a role in people's desire to make a flight shortest possible distance and time wise. If people know that there aircraft can handle a steep approach from high speeds and still be able to land then why bother wasting precious time and fuel to fly a laborious instrument approach in reasonably good weather conditions (Vaughan, 1996). There are several reasons for people adapting their behaviours to best meet the production end requirements. These pressures are emphasized from top down, and sharp end operators may feel a moral obligation to do their utmost to meet these ends.

Accountability is an interesting factor here, and how top management reacts to these "practical drifts" and "normalized deviances" in reality, it seems to be a prevailing attitude that common sense should prevail in sense of safety and production goals. If life is not directly at risk, company appreciates those who are pragmatic and "get the job done". People in top positions are less likely to be put under same scrutiny as "junior practitioners" when mistakes are made during the normal course of work. An example is the absolute power and judgement of line training captains responsible for training new pilots on the aircraft type. This authority is most evident when there is a new and inexperienced first officer trained by a highly experienced captain with high seniority in the company. There is very little a trainee can do to counter argue his senior's judgment and conclusions. This is not necessarily a bad thing in maintaining a system responsible for producing competent and safe individuals, and washing out individuals they deem too inexperienced and/or show lack of skill and judgment. It also seems to be an ingredient of high reliability theory where deference to expertise is considered good to maintain safety and smooth running in a system. The trainers are also judged by the company by the product they approve and bless. This authority is granted as a result of several things an individual has done and proven to his employer, this proof of competence comes in the form of experience, seniority, knowledge, contacts, and many other more benign and ambiguous factors. The problem arises when seniors while exercising their authority do things well outside the norms and standard operating procedures while juniors fearing the consequences of "telling on them" never dare to disclose the wrong or unsafe practices. And there could also be an element of more subjective preferences than professional judgments which decide the future of an individual (Bosk, 2003).

Shawn Pruchnicki 8/24/09 3:40 PM
Comment: This section of the four is far better developed then the other three.

Knowledge of the impact and consequences of these deviances is also a factor worth more research and understanding, if people don't see an adverse outcome of their action on other people's learning and habit formation than they are more likely to continue with their practices which may not be very conducive to safety culture. Here human factors training and an honest reporting system will help improve people's knowledge of the "malpractices" and adjusting their practices to be more compliant and vigilant towards deviant practices.

Summary

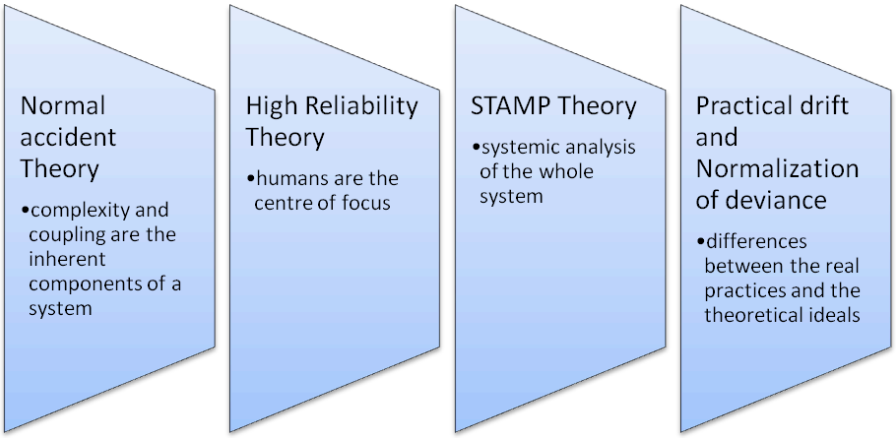

Figure d - Theories for high risk organizations

The top management all too often finds itself bogged down with the administrative tasks to keep the production going. It struggles to find time or resources to dig into the safety and production relationships at a more intimate level. Safety management and establishment is delegated to the lower echelons of hierarchy and compliance with authority regulations and nomination of certain post holders is seen an adequate measure in developing a safe organization. As mentioned earlier safety work goes far beyond the formal regulatory complying work. It is about the understanding of the messy details and connections as expressed in NAT, and how humans work to juggle contradicting goals and expectations as mentioned in HRT (Nemeth *et al., 2004*).

Safety management is also about constantly watching out for the drifts and deviances which become unwritten part of daily work practices as discussed in Normalization of Deviance, and Practical Drift. Safety work should seek to understand why deviations occur, and how best system should keep up with these challenges. A vital step in this endeavour is to develop an overall safety culture is to have people at all levels in organization openly confess and give feedback, and respond constructively to their feedback by informing, adapting, and making necessary changes which are visible throughout the system. Hopefully, this will further encourage more open feedback to help bolster safety and resilience. In next chapter we will look at the importance of an open and well functioning reporting system.

PROACTIVE AND REACTIVE SAFETY WORK

Proactive and reactive safety measures are both cornerstones in safety management work in a high risk organization. Proactive safety work is pre-emptive in its nature and follows the paradigms laid out by high reliability theory, and resilience engineering. It seeks to remain a step ahead of the adversities faced by the overall safety situation, and relies on early warning signs and symptoms to a developing weakness to the safety web. Proactive measures in dealing with safety work are usually a result of observations made during simulator training, line checks, a trend in reporting, and also to a smaller extent crews own desires to focus on areas of weaknesses and safety related matters pertaining to their duties. Purpose of regular courses like CRM, emergency and survival etc is also built in the system to achieve safety. The objective is to highlight the constraints and trade off dilemmas faced by the crews in carrying out their duties

Reactive safety work relies heavily on its learning and reactions to *after the occurrence* situations. It has a role to play in the light of normal accident theory, where there are many hidden and unpredictable connections which don't allow for any planning and precautions beforehand.

Reactive measures in safety work in the organization usually are a result of post incident steps to prevent further occurrences from same individuals. They may take the form of a friendly conversation, grounding of an individual until the "reasons" for an incident are figured out, probable loss of position from captain to first officer, and in worst cases legal actions and/ or loss of job. Reactive safety work has main focus on "underperforming individuals" to maintain system safety rather than a systemic approach to build resilience in the system. Overreliance on reactive safety reactions compared to proactive measures may be indicative of a passive and weak safety system, where misjudgements are made by few bad apples in an otherwise well functioning system. Many wrong or poor decisions remain unnoticed until sharp end operators like pilots or mechanics commit a mistake which turns into an accident or an occurrence. Reactive approach to safety can serve as a beneficial tool if efforts are made to learn from an occurrence at system level instead of considering getting rid of weak individuals as a sufficient step in pursuit of safety.

There was a set of questions sent to manager of safety committee, and chief pilot. Questions were mainly dealing with the West Air's relationship with proactive safety vs. reactive safety, reporting culture, pertinence of CRM training to West Air organizational needs, safety vs. production pressures, below are the answers received from the safety officer, and training manager. Table b shows postholder's perception of safety management in West Air.

Table b - Postholder's perception of safety management in West Air

How do you see the relationship between reactive and proactive safety work in West Air?
Safety Officer: Earlier West Air has been more reactive. The last year the focus has been to be more proactive. It is worked out by giving new instructions to management personnel within OPS, a modified meeting structure with a change in focus, and closer co-operation between the Quality management and the Safety officer.
What can be improved in an attempt to make safety work more proactive in the organization?
Safety Officer: One way of improving the safety work is to motivate all employees in West Air to give us more reports. To make that happen we need to be better in the communication and give the employees a better tool of reporting.
How is the reporting culture in West Air?
Safety Officer: Overtime it varies. Overall it is a good culture of reporting. It is most important to keep a constant high flow of reports coming in and communicate the results. Not just to the reporter. This has to be improved within West Air.
What can be done to make more people submit reports?
Safety Officer: To make it easy to file reports and West Air has to be clear in the communication of results and reactive/proactive actions
What can organization do to make better use of reports to build a safer and more resilient system?
Safety Officer: Steps are already taken. Today there exists a good co-operation between the Quality management and the Safety officer. Also a meeting structure is created to handle different kind of reports. The purpose is to be more proactive.
How is CRM training planned to suit our operations?
See separate PDF with CRM syllabus and CRM update procedure.
How are simulator scenarios and areas of emphasis determined?
Training Manager: Refresher training is performed on a 3 year cycle; this covers all the technical systems of the aircraft. Scenarios are based on: which technical systems that is to be covered, statistics from opc/pc and line checks and any relevant reports that are submitted to QM. Training Department has statistics of all opc/pc´s and line checks. The statistics covers all items on the opc and line check protocols, including CRM. Through the statistics we can instantly identify weak areas, which also give us the possibility to change an ongoing opc/pc period. Being asked by EASA during an audit what we do to be proactive, we presented the way we work with our statistics. This was a new point of view for them and they were impressed!
What are the major threats to safety in West Air organization?
Safety Officer: The biggest threat is too many changes and reduction of required personnel. In time of changes it is very important that we keep focus on the started work.

Reporting culture

While being vectored for ILS 07 at ENML by ATC, we were cleared to descend on QNH 1004 to 5000 ft. while descending through approximately 5200 with TAWS on at 10 mile range, radio altimeter came alive and counted down very fast, we received a GPWS warning " Terrain Terrain" immediately followed by "PULL UP PULL UP" at that time pilots noted radio altimeter to read 1360 ft, the Pilot Flying immediately initiated a climb to 6000 ft, and told FO to notify ATC, crew was later vectored again for the ILS and landed at ENXX. PIC rang ATC, and controller told him reluctantly that she would make an internal note about the GPWS warning. But she didn't "see any need to file a report about this occurrence since she hadn't done anything wrong". She also told that several other planes had also received GPWS while in descent "probably" due to the high mountain at aircraft's position west-south west of ENML.
ENML is a small regional airport surrounded by high mountainous terrain on both south and north of the runway in a valley. Airport elevation is very close to sea level with an MSA of 7300 ft. West Air operates daily flights in and out of this airport. The glide slope intercept altitude for an easterly runway according to the instrument approach procedure is 5000 ft at approximately 15 miles final. Highest terrain is marked at 3900 ft approximately two miles south of the localizer course at around 17 DME. This practically means that while being vectored for final approach track during descent there is a potential for GPWS warnings especially during descents. Corrections for high winds and lower than ISA temperatures are of utmost value in maintaining a safe separation from terrain in the area.

Prevailing meteorological conditions at the time of occurrence at ENML were broken clouds at approximately 1500 ft, with approximately 8 knots wind from east south east, QNH 1004, temperature 2 Celsius. ATC had not made any corrections to their minimum vectoring altitude since the set criteria for temperature correction was temperature below freezing. Winds at altitude were between 30-40 knots. All this combined may have to the aircraft at a lower true altitude by as much as 400 feet, and reduced separation from the high terrain.

The response from the company after several weeks of admitting this report was "good report about a GPWS warning at ENML, we have talked to the ATC in question and they will be more careful in vectoring, and so should the crews be more vigilant to the GPWS warnings". No one except the captain who submitted the report, and those who received it in the management ever read the detailed report for it to have any significant learning value. This scant feedback resulting in loss of valuable learning for the organization is a significant argument in the favour of Liang, and Dekker who suggest developing awareness among safety people about the importance of report disclosure and feedback at a systemic level. The purpose of reporting is to confess and convey the individual and system weaknesses with an aim to seek a systemic improvement.

A lack of reports doesn't necessarily indicate a safe system, just as too many reports don't automatically implicate a weak safety system. As a matter of fact, it may point towards quite the contrary. More reports mean more insight into the intimate details and relationships within a system and giving opportunities for the responsible people to respond accordingly. Thus encouraging an open and honest reporting culture should be the primary objective of safety work in a high risk organization. Equally important is to develop good and structured ways to the reporting system as whole to squeeze maximum benefit from every report. This work needs good understanding of company culture, hindrances to honest reporting, development of people's reporting skills and habits at an organizational level.

Reporting culture within West Air according to the safety officer needs improvements, and he reiterates the importance of feedback not only to the person who submits the report, but to the entire system which may benefit from the report, and their lies a serious shortcoming within the organization. There is an inadequate effort on part of the company to include everyone at a system level to communicate reports, and invite a two way feedback to genuinely take steps at a systemic level in improving safety. Part of the reason is cut downs due to cost effectiveness, fewer people doing more work, and management even considering this communication superfluous where reporting issues are not perceived as a primary task to run the company, and as a result the importance of reports rather taking a back seat in this process. In the article *Reason In The Method, Why We Need A Reporting Culture* at Australian transport safety bureau's website According to Dr Rob Lee, Director, Human Factors, Systems Safety and Communications, "if underlying organisational deficiencies are left unchanged; the same kinds of occurrences would continue to happen".

Further Dr. Assad Kotaite president of ICAO asserts the importance of reporting system, "without this essential information (reports submitted by the people in a system) the efforts of industry, aviation administrations and the ICAO cannot be effective in addressing hazards in the air transport system". This exactly is a common feeling among the flight crew in West Air organization that their reports mostly don't result into a satisfactory reply from the company, and above all the useful information and lessons which may be derived from these reports are wasted due to poor dissemination of the reports and resulting actions. Crews also suggested report processing by a neutral party rather than being controlled and evaluated by the management itself. This latter step might be crucial in gaining people's confidence in a real step towards an honest and efficient reporting culture.

Flight crews have expressed an interest in receiving regular and organized information flow from the company about the current trends in flight safety, and reports to better understand an evolving picture relating to flight safety. When one of the management pilots was asked why this information was not communicated more regularly to the pilots, he simply replied "time constraints". Time constraints are due to this work not having a priority in a shadow of all the other tasks like training, production planning, business expansion, and not least a somewhat lacking understanding of value given to report dissemination work in flight safety work within the organization. This clearly presents a problem at a systemic level where top management doesn't have the resources in terms of time, money, and knowledge to prioritize reporting culture and feedback as an integral part of the flight safety work. This again leads to another question whether CRM courses are only offered due to their mandatory requirement as part of pilot currency program by the aviation authorities? And whether annual CRM courses may have been victim of same scant interest from the management if they weren't a requirement? If the answer to this question is yes, then it may be a helpful direction to go, and make report feedback at an organizational level mandatory, just like the annual CRM courses.

Another important factor in the examination of reporting culture is people's willingness to report situations which are not a requirement by law, and after discussing with many crews it seems like that there exists a culture of underreporting in the company. When crews were asked why they didn't always disclose incidents in a written manner to the company which may have helped others learn from those situations the most common reply was that they didn't feel the need or saw any compelling reason to write a report.
This problem of underreporting "benign" deviations are addressed by Albert Wu in his paper *Is There an Obligation to Disclose Near Misses in Medical Care,* he acknowledges the obligation to disclose error by medical doctors, and health organization which leads to harm

to the patient, and may be "remediable, mitigable, or compensable (Wu *et al*. 1997; JCAHO 2002, RI 1.2.2). Further, he asks whether it is also desirable to disclose near-misses to patients. A near-miss is defined as an inadvertent action intended or carried out which doesn't lead to grievous consequences to the patient. The probability is said to be five times higher for near misses than real cases leading to patient's harm. The policy makers prefer such a disclosure to be at the discretion of the organizations, and practitioners. Wu refers to a survey which indicates that in most cases patients would like to get an acknowledgement of even minor mistakes.

Brian Liang in his article in Sharpe *et al*. 2004 also suggests the counter-productivity of shame and blame culture, and healthy effects of educating people at a systemic level in achieving a better error disclosure rate within an organization. Sidney Dekker also blames the bad apple theory as a hindrance in achieving a just culture within an organization. Interestingly, no one I talked to gave lack of feedback as a main reason for not submitting reports, although this was a clear sentiment among the crews that it would be beneficial for safety work if they could see the reports filed and actions taken by the company to address these issues.

Further, crews expressed their confidence in the management not misusing the reports to take negative actions against them. This point underscores a positive direction company has taken in there dealing with filed reports, and it has succeeded to an extent in conveying the message that reports are not to be used as a tool to discipline people through retributions in light of filed reports. Sidney Dekker in his book *Just Culture* also underlines the importance of eliminating, or at least minimizing the fear factor out of the people for them to freely submit reports (Dekker, 2007, p. 41). He goes on to suggest that "many people come to work with a genuine concern for the safety and quality of their professional practice" and if the system can encourage them to be a contributing force in this process it will be a great help in motivating people to submit report (p. 44).

Finally to the practical steps, there is a genuine need for the company to develop a more accessible electronic reporting system where reporting is highly encouraged, and feedback is guaranteed within a certain time limit. Besides that there needs to be appointed safety officers not part of management who are readily available to listen to people's concerns over safety and occurrences. Providing information to the crews through a periodical which briefly discusses the incidents and occurrences or any other matter of learning value from a technical and human factors perspective will also be considered quite beneficial as also was evident from how some other leading airlines tackle this issue. An idea may be to have a dedicated section dealing with enhancement of safety matters in a weekly company newsletter on the intranet. One concrete step to improve the inflow of reports is to have an easily accessible reporting form available electronically and in paper format to crews where they are encouraged to write in all their concerns and anything they deem report worthy. But most importantly the practical steps to achieve more fruitful reporting and processing of information remain the biggest challenges of this effort.

ShawnP 8/27/09 10:53 AM
Comment: I could not find where this was explained why this is a good idea.

ShawnP 8/27/09 10:48 AM
Comment: So, now that this section is complete – what type of reporting system do they have? ASAP?

CRM Genesis and Evolution

Since the very early stages of flight people saw the importance of safety to make aviation a sustainable activity both commercially, and militarily. These efforts towards safety were given different names like "airmanship", "good aviation practices", "flight discipline", and

many other safety slogans which were supposed to nurture a safe aviation environment for operators and public.

With the introduction of more reliable jet transport aircraft and other technological advancements there still continued to occur many major aviation accidents in late 70s like in Tenerife where two 747 jumbo jets collided with each other on the runway, a DC-8 ran out of fuel while crew was trying to figure out an indication malfunction of the landing gear system in Portland, Oregon, and Everglades, Florida, where a an L10-11 flew into ground while crew was distracted by a fused landing gear bulb, and no one was flying the aircraft, and many others(aviation-safety.net; ntsb.gov). In all these cases perfectly serviceable aircrafts were destroyed due to what commonly was referred to as "pilot error". "Pilot error" was seen as a common denominator for the inherent weaknesses in humans operating the aircraft in a dynamic environment. A common denominator for all the above mentioned accidents was inadequate communication between the crewmembers and how crews interacted with each other in face of stressful and ambiguous situations. These accidents also highlighted the importance of superordinate vs. subordinate relationships on the flight deck, and a pressing need to empower the subordinates with more assertive behaviours to maintain safety of a flight.

ShawnP 8/27/09 1:15 PM
Comment: This is a good place to say a few words about what these accident truly represent. Not "pilot error" but rather inadequate communication between crew members that resulted in the loss of the aircraft. This is the focus of CRM. This would lead in to the next paragraph better.

A need was felt to find a way to improve the human's ability to better cope with the stresses, distractions and interpersonal relations among the flight crews. CRM to start with stood for cockpit resource management; with time it was felt that a more holistic approach to CRM was essential to enhance safety and name changed to crew resource management to include the cabin crew as well. The direction CRM is headed now seems to suggest an even more inclusive concept of company resource management where all involved in management, technical, operations, cabin and all other relevant departments are considered essential in creating flight safety (Dahlström, Laursen & Bergström, 2008; Salas *et al.* 2001; Helmreich, Merritt, Wilhelm, 1999, OGHFA, flight safety foundation).

ShawnP 8/27/09 1:16 PM
Comment: Explain how? Include who else and why?

Over the almost past three decades CRM concepts have gone through many changes in evolutions. First generation CRM focused on the individual's suitability as a flight crew member and relied heavily on psychological testing. Second generation CRM emphasized cockpit group dynamics, and aviation specifics related to flight operations. Third generation CRM started taking systemic factors into account which had an impact on crew performance. Fourth generation of CRM integrated the operational and technical training, and allowed companies to build their own safety programs. CRM was also mandated to be part of LOFT exercises.

Currently, a fifth generation CRM has a main goal of "error management". Accidents are accepted as an inevitable element of a high risk endeavor (Perrow, 1984). It suggests a tri-headed approach where the first priority is to minimize the error occurrence, second to catch an error once it's occurred and regain a normal state of operations, and third is the undetected errors and how organizations may learn from them in the aftermath regardless of the outcomes (Helmreich, Merrit, Wilhelm, 2006; Salas, *et al.* 2001).

Whether CRM training really results into a higher level of safety is a difficult question to answer from a scientific point of view. The main challenge is a very low rate of accidents per million flight hours in the aviation system, and a difficult to prove relationship with CRM training and safety. However, anecdotal evidence suggests the positive effects of CRM training on flight safety. Data produced by line audits where crews were observed under non-

jeopardy environment also points towards a positive outcome of CRM training on behaviors (Salas *et al.,* 2001; Helmreich, Merrit, Wilhelm 2006).

Considering the latest research and the historical evolution of CRM training it is highly recommended that organizations develop an in house CRM program which takes into account the operational and cultural sensitivities of the company. Research from United Airlines, Alitalia, Korean, and Japan Airlines shows a greater receptiveness among the crews when people having line operational background within the company hold CRM training courses this mainly due to crews ability to more frankly discuss the related matters with a familiar crew member than people from the outside who may not possess an intimate and detailed understanding of an operation (Taggart, 1987).

ShawnP 8/27/09 1:16 PM
Comment: Why?

CRM: Developing a Multifaceted Approach

Present day situation in West Air

Present day CRM training in West Air consists of a two day course for initial operator training, and one day recurrent course which is scheduled every year. On recurrent courses different instructors from outside have rotated through the system. All instructors have varying backgrounds within psychology, operations, and even CRM instructors with very preliminary flying experience. The content and the areas of emphasis of the courses indeed varies, but is often not a result of latest research into CRM topics hence often resulting in somewhat superficial discussions and generalizations. The instructors' lack of specific knowledge of West Air culture of flying operations often reduces their ability to lead the discussions in the desired direction, and often participants have to take the lead role in this aspect to underscore their CRM challenges during their daily work experiences.

Developing CRM training

CRM culture in a company is a product of many different efforts at different levels from training and administrative point of view. As chapter one argued for making human factors concepts an integral part of top management's decision making process, and chapter two laid foundation for developing an honest and encouraging reporting culture to gain a deeper understanding of organization's safety needs. This chapter addresses the CRM culture development by utilizing the available data through an integrated planning philosophy. Goal is to develop good safety practices through different CRM techniques among the flight crew to nurture a healthy and operation's sensitive CRM culture. For example by making use of non-jeopardy line audits to observe the operations first hand and combine all these inputs to further tailor the CRM course content and LOFT exercises.

In pursuit of as holistic of CRM training in the company as possible, it is highly desirable to start with an understanding of the organization specific needs to get most benefit from such training effort. Compliance with regulations is important to meet the necessary requirements by the authorities. Developing a CRM training regime also necessitates an understanding of different training concepts available, and how they can be used to complement each other. The information extraction through the use of the reporting system, the annual CRM training, simulator LOFT exercises, line audits etc all provide vital tools in developing a favorable safety culture. All mandatory training efforts should also be supplemented by more frequent company feedback in form of reports, safety periodicals, and company weekly information. This latter effort to enhance safety doesn't have to be expensive, and is easily done through

already existing information channels. Furthermore, undertaking such extra efforts to enhance safety also underlines an organization's genuine desire and effort in developing a resilient safety culture.

New and supplementary efforts to further bolster the safety culture and CRM should always start with reasoning behind such an undertaking to the crews. Since people are more likely to accept and adopt a new concept if they see the reason behind it (FAA, *fundamentals of instruction*). It might be an idea to regularly check the acceptance of different safety efforts among the crews, and adjust and modify accordingly. It is the author's observation that mere routine efforts are often seen as rather mundane and not necessarily very safety enhancing by the crews. Therefore seeking a regular consensus to polish the routines and make them logical to people will likely generate more favorable outcomes. These inputs can easily be gained through frank discussions during line audits, simulator debriefs, CRM courses, and specially designed reports or questionnaires to gain an insight into the effectiveness of different CRM related activities.

Safety Briefings are an example of such a routine safety effort; briefings are one of the most commonly used CRM practices. To prevent briefings from becoming a boring and automated routine, it is recommended to add some novelty and challenge to the process for everyday operations. For instance, there are a certain number of memory actions to be memorized by the crews at any time in case of an emergency. Widerøe Airlines has had an approach of diversifying the regular briefs to also include statistically more frequent occurring emergencies rather than just focusing on more critical and less frequent emergencies as part of memory actions briefings. This according to captain Sagsveen ex-Widerøe helps stimulates the process and reduces the monotonousness out of regular briefings.

Concrete Steps towards a CRM strategy

Figure e shows a pyramid hierarchy of concrete steps towards an overall CRM strategy.

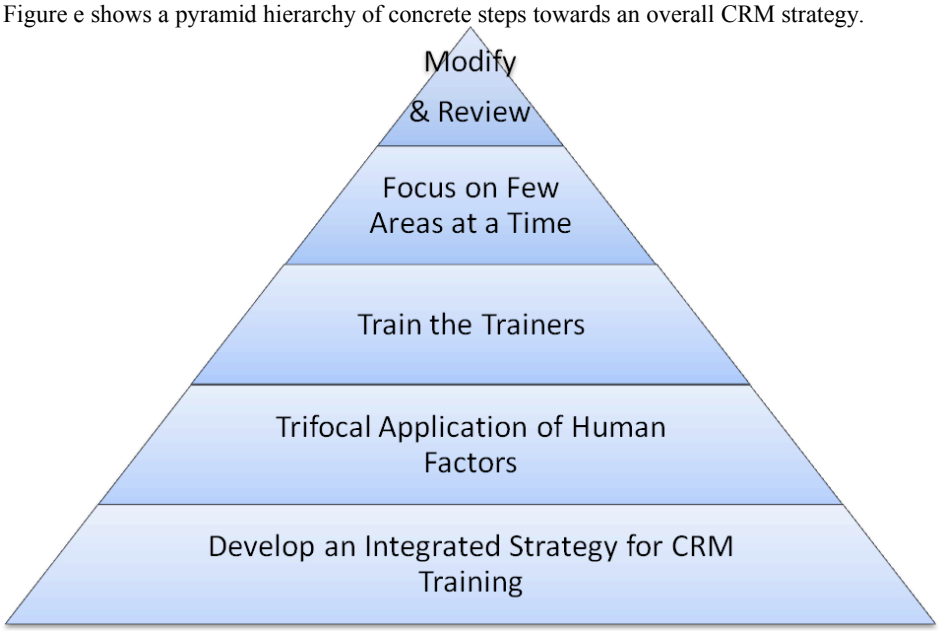

Figure e - Concrete Steps towards a CRM strategy

1. Develop an integrated strategy to develop CRM training. Influence may be taken from methods like NOTECHS, TEM/LOSA, CAMS, and many other existing methods in different airlines.

2. Monitor the application of human factors at three segments of organization; top management level, reporting, and CRM training.

3. Train the trainers. People imparting the CRM training should themselves go forward as an example.

4. Keep the focus on few areas of emphasis rather than overloading developers and recipients of training with over information. Once objectives are achieved and internalized move on to next focus areas.

5. Review the effects of training, and regularly change the areas of focus as needed.

CONCLUSION

This thesis has focused on three main areas to develop and suggest a direction towards an in-house training approach tailored for an operator. The benefits of an effective human factors training program which encompasses the organization as a whole are many, like a more resilient safety culture, employee satisfaction, operational productivity, etc. It is of essence that the people at the top managerial positions understand and value the importance of human factors knowledge and application throughout their decision making processes. Once that important element is in place then it is a matter of taking active actions to develop a safety web throughout the organization. Communicate the values of the organization often and in simple terms to the employees and especially sharp-end operators, and let people feel free to give constructive critique when they observe short cuts and deviations. This constant flow of positive criticism will help the organization stay ahead of many lurking dangers and may serve as an early warning to avert an undesired outcome. Sharp-end operators like pilots need specific training in their dealing with risks and production goals. That's where CRM training and practices play a role in giving people power and awareness to see the potential dangers, and have the mandate and authority to say "no" to unsafe practices when they perceive other goals overtaking safety.

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