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PROFESSIONALISM IN AIRLINE OPERATIONS?...AND ACCIDENT INVESTIGATION?

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When we read the findings of NTSB report AAR-07/06, Southwest Airlines flight #1248, we felt transported to a parallel universe whose occupants seem to be lacking any ability to reason analytically. These “findings” seemed to turn logic on its head, were insufficient in scope and incorrect as to causation. This paper will analyze the SW accident using the ODM model; will show the deficiencies in the NTSB report and finally, a. Indicate how to design line oriented flight training (LOFT) scenarios that reflect actual operating conditions and are aircraft type-specific. b. Show where/how a separate DM crew training module should be placed in flight crew training. The result would be training that provides both instruction and simulator practice for all Captains in such a way as to make timely and accurate decisions, thus avoiding the very accident we are discussing and, truly meet the requirements of an Advanced Qualification Program (AQP) of pilot training and certification.

Complex systems behave counter-intuitively:
That is the plausible tends to be wrong.
___ J. W. Forrester

Purpose

We will be questioning and critical. However, we will go beyond somewhat facile critiques and raising questions that seem not to have been asked. We will offer solutions, some of which we believe should have been in place already. Before we begin: the 6 page limit for papers has resulted in some condensing of our original paper. We believe that this version of the paper still "fills the bill."

Why Now?

We have, as do all in aviation, a deep concern for safety. To that end, we have been heavily involved for over 15 years with early, middle and later CRM, LOFT and other flight crew human factors training and evaluation. In the early through mid-2000’s, we were pleased to see the recognition of what we had said many times, beginning in 1993: The pilot’s main function and responsibility is that of risk manager and that the pilot and crew’s main functions were risk identification, assessment and mitigation. This recognition is true, at least, in military aviation with its Operational Risk Management (ORM); a checklist completed prior to launch, which can result in mission planning changes and even aborting the mission. However, there is one problem with this proactive approach: it does not provide for changing conditions and factors aloft that can result in a rising risk after launch. The entire purpose of risk identification, assessment and mitigation is to enable the pilot to make the most timely, and accurate decision, in real time, in a time-compressed and unforgiving environment. More later on this.
The Tipping Point

When we read or observe something so outrageous and devoid of logic, we think we have somehow been transported to a parallel universe whose occupants seem to be lacking any ability to think and reason in a coherent way. Such was the case when we read the bizarre findings of the NTSB report AAR-07/06. We remain completely amazed and puzzled that pilots and other aviation experts have not risen as a group and demanded this report be revised...or, better, almost completely re-done in order to have congruence with the reality and facts of the accident. This, as yet, not having occurred, we now feel constrained to explicate our objections and recommendations to prevent another accident of this type...as well as other accidents where risk identification/assessment and the decision-making needed to deal with high risk are involved. In aviation, accurate operational decisions must be made, often with incomplete or conflicting information, in a time-compressed environment that is unforgiving of error. (Smith, Hastie, 1992). In this case, all the information needed was available and still incorrect decisions were made.

The Accident

On December 8, 2005, a Southwest Airlines flight #1248, attempted a landing at Midway International airport in adverse conditions, rolled through a blast fence, an airport perimeter fence, and onto an adjacent roadway striking a passenger automobile. One innocent bystander’s (outside the airport perimeter) life was lost, people on-board seriously injured, and property destroyed. The weather at the time of the accident was such that only the most carefully flown aircraft had even the slightest chance of landing safely at this airport and that prospect was rapidly fading when the plane was well out of the approach phase to Midway.

The NTSB inexplicably determined that the probable cause was the pilot’s failure to stop the airplane on the runway (under conditions that would almost guarantee that this could not even be possible). So, the accident happened because the pilot did not complete the landing within the confines of the runway. What an enlightening piece of information; one supposes that, under this logic, when a CFIT happens, the cause is that the plane hit the ground. While superficially plausible to an uninformed observer, this NTSB finding is manifestly wrong. As an oblique afterthought, the NTSB made some reference to the fact that perhaps a diversion to another airport was in order. These findings turn logic on its head; they imply that it is somehow perfectly acceptable if an airline sends flights from both coasts to the Midwest in wintertime, into a snowstorm, and then “hope for the best.” Thus, the NTSB tosses the accumulated of knowledge of more than 50 years of flying military and civil aircraft out the window.

A Re-Look at the Conditions and Events

a. Weather and Adverse Conditions.
Low visibility and falling snow were compounded by the fact that the runway was slippery and braking action advisories were in effect. Since there are only two types of advisories issued to pilots and dispatchers, (wind shear and braking action ) we ask this question: what are these good for? Should they be seriously considered in the Mission Planning phase, or since it is not “illegal” to operate under these conditions, do we relegate them to the dustbin? Further, at the time of the accident, an 8 knot tailwind did exist...beyond acceptable limits...and, when coupled with the poor braking, a recipe for disaster. Were these devastating facts beyond the science of weather prediction? We think not. Many of the unsung heroes of aviation are the meteorologists, and their predictive accuracy in our 40 years of aviation experience is, to say the least, exceptional. Armed with the latest forecast of wind and weather, we
wonder why this flight was even attempted...and, even more telling: why was there not an in-flight diversion to a designated, alternate field, or, as a last resort, a rejected landing?

b. Dispatch and Mission Planning.
Part 121 Carriers are not permitted to launch airplanes into the wild blue yonder any time they feel like it, but must comply with Dispatch protocol and constraints. Some conditions make successful completion of some flights so improbable that they cannot be attempted. For example, if the forecast weather at the intended destination is below landing minimums, the flight should not and cannot be flown... period! A meaningful conference call between Dispatch, the Captain, and the weather expert would have resulted in the decision that attempting to land in low visibility conditions, with breaking action advisories in effect, with a tail wind on a short runway and with no real overrun is inadvisable. Why did not the captain abandon the approach, reject the landing and proceed to the alternate?

c. The Decisions of Both the Pilot and Dispatch.
In 1993, we proposed the concept of “Pilot as Risk Manager”, and further proposed that this is the quintessential Captain’s activity, super ordinate to all others. We developed an operational decision-making model, to be used in flight. The end-result of using our ODM paradigm is taking the actions needed to keep the risk level low: 1. If the risk is low, continue with the mission plan. 2. If the risk is moderate, modify the mission plan in order to prevent the risk from rising. 3. If the risk is high, abandon the mission plan and/or cancel the mission (Smith, Lofaro 2003, Smith, Lofaro 2001; Lofaro, Smith 2008, 2000, 1999, 1998, and 1993). The question remains: why did the Captain continue?

d. A Brief Look at ODM
In order to deal effectively with the challenges of AQP, we developed an Operational Decision Making (ODM) paradigm. It deals with risk: Its identification, quantification and management as the basis for making decisions in the operational environment...decisions based on a precise and accurate understanding of risk. All flying can be visualized as operating in a four-sided figure, the operational envelope, where the sides consist of the critical factors to safe flight. The actual envelope is 3-D as the plane can fly in any direction as well as climb or descend. The continuous task of the pilot is risk identification and location by using situational knowledge. Situation(al) knowledge is that part of the ODM consisting of the continually changing set of elements (knowledge bits) that comprise the Captain’s awareness of (a) the area of the ops envelope where the captain perceives the aircraft is located and (b) which of the critical factors of the ops envelope boundaries are in play. In this way, the pilot can ascertain what is the cumulative effect of these factors and thus, re-locate the aircraft’s actual position in the ops envelope. The pilot can then use the rising risk scale as a decision for action responses. See Figure 1
To return to the accident: The Captain of flight 1248 was clearly faced with a rapidly rising risk he either did not understand or was constrained in his decision by other, non-safety of flight, issues. But, rising risk is non-linear. While we tend to think of one thing at a time, like wind or visibility, the reality is a cumulative effect can, and often does, occur where the real impact of the conditions taken together result in a much higher risk than the conditions taken as discrete events. Take, for example low visibility operations. The Captain was faced with about a 200 foot ceiling and ½ mile visibility, close to CAT 1 minimums. But he also had to deal with unfavorable wind conditions, and runway contamination reducing breaking effectiveness on a short runway. When the factors are combined, the risk trajectory moved from moderate to high risk. Clearly, the Captain had an aircraft that was outside normal conditions and into non-normal operating conditions (again, see Figure 1)…and, therefore at high risk. Using the concepts of Operational Decision Making, we assert here that the Captain should have abandoned the approach and proceed to the assigned alternate. Let us emphasize this point: A landing should have never been attempted.

e. The Landing.
As we said before, the conditions were such that only the most perfectly executed landing could possibly have brought the aircraft to a safe stop on the existing runway. That this was not done is obvious. While the NTSB report highlighted this fact, it failed to acknowledge one of the most important rules of aviation: “Never ever get yourself in a situation where extraordinary piloting skills are required.” Had the crew done so, a completely different result and report would have emerged.

What Do We Posit As The Real Cause?

The accurate “most probable cause” of this tragedy was the failure of the Captain to make a timely and accurate decision to abandon the approach and landing and proceed to the assigned alternate, given the deteriorating weather conditions, marginal breaking action and adverse wind conditions. This set of conditions and their cumulative effect, show the plane to be in a rapidly rising risk spiral, where the risk had gone to the highest level. In aviation systems, if decisive actions are not taken concerning critical events, risk will continue to rise to a point beyond which catastrophic mission failure results. Such a point is called the Critical Event Horizon (CEH); the Captain and his plane had passed through their CEH.

What of the NTSB finding that the fault was in the SW training that was either not received or not tested as to engine thrust reversers and auto brake systems? Not the real culprits as with the time/distances/speed
needed before they would/could be deployed, they would have had little effect. However, we do not mean
to say that SW did not (does not?) have training deficiencies. The Captain did lack some needed training,
both in winter ops, in his 737 model…and in risk identification, management and, most importantly,
decision-making. These should be both SW and FAA concerns. More importantly, such training applies
to all situations.

But, the real deficiency is somewhere else. Some history: In the early ‘90s a national task force was
formed, which we were a part of, to develop the next generation Airline Pilot Training program.
Originally promulgated by SFAR 58, it is called AQP. Guidelines for an AQP program were developed
and all carriers were invited to design and implement such a state of the art curriculum. The major feature
of AQP is to provide “mission realistic” training and evaluation, concentrating not only on flight
maneuvers, but on higher order skills like decision-making needed in actual line operations. Indeed,
Captain’s authority, workload management, and decision-making are the three underpinnings of any
successful AQP. (Captains Kevin Smith and Bill Hamman of United were key players in much of the
United AQP R&D). These higher order skills can and must be taught and evaluated by any airline that
wants to produce and maintain quality, trained pilots. As said, accurate risk location is the key, when in a
(rising) risk situation, to making the optimal selection of a course of action, i.e., an action response that is
an alternative to the original mission plan.

Recommendations and Questions

The first one is that SW (and all carriers) develop and use LOFT’s that reflect actual operating conditions
and are aircraft type-specific. Event sets can be obtained from the carrier’s accident/incident reports as
well as using input from line pilots. A template for the development, and crew evaluation, of such LOFT
scenarios can be found in the 14th Chapter (“Flight Simulators and Training”; Lofaro, R.J. and Smith,
K.M., 2008) of Human Factors in Training and Simulation. This chapter also includes the Mission
Performance Model (MPM) that is the template for specifying the critical components of flightcrew
“effectiveness” (effective performance). Secondly, since the apex of crew responsibilities is decision-
making, it should be made a separate crew training module, not a part of CRM. Plainly put: The
requirements of an AQP must be properly implemented.

Finally, was the penultimate cause of this accident the failure, at the most senior levels of management, to
develop, install and implement a quality, state of the art pilot training program: AQP? Such a program
would provide both instruction and simulator practice for this Captain (and all other Captains) in how to
exercise Captain’s Authority in such a way as to make timely and accurate decisions and avoid the very
accident we are discussing. The January, 2008 B-777 accident at Heathrow is another example of a
decision-making process that boggles the mind and gives rise to the question: What is the type, quality
and evaluation of training being received by airline aircrews?

References

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