PRISM Solutions, LLC

Research Brief

Research Request:

Aircraft Fleet Change Risk Management

Research Response:

A proactive approach to managing the risks associated with adding a new aircraft type to a company fleet can be a critical function of a safety management system. Described below are various risk factors worthy of consideration, separated into categories. An objective measurement of these and other identified risks is crucial for ensuring the assessment is accurate.

OPERATIONAL RISK

Airports (suitability)

- Aircraft landing distance performance requirements.
- Runway dimensions and weight bearing capacity.
- High altitude airport operations.
- Obstruction clearance and climb performance.
  - Standard Operating Procedure (SOP) example: A Part 91 operator has specific requirements for all aircraft operating into Aspen, KASE. However, there are specific requirements for the Hawker that state:
    "In a case when only the second segment needs to be considered, and particularly when the obstacles are close in as in a straight climb out, it may be more convenient to obtain points on the flight path by using the second segment net gradient charts. There are no close in or distant obstacle charts available for the Hawker. However, using a formula will give us the obstacle height above ground. "
- Familiarity bias– new aircraft may differ significantly in compatibility and performance when operating at a familiar airfield.
- Ramp, hangar, and parking considerations, if new aircraft dimensions/weight differ significantly.

Aircraft Contamination

- Review of SOPs may be necessary to determine if operator risk controls and procedures require modification.
  - For example, a T-tail aircraft presents non-visible areas for contamination inspection.

Single Pilot

- Will there be any single pilot IFR or VFR operations?

TECHNICAL

Powerplant

- Analyze differences in type and amount of power compared to existing aircraft.
- Analyze hot weather / high elevation performance.

Avionics

- Instrument approach capabilities and equipment– i.e. WAAS, CAT II or III ILS, etc.
- Differences in safety enhancing equipment- GPWS, TCAS, Enhanced Vision System, Synthetic Vision System, etc. may increase or decrease capabilities

First Aid Kits/ Survival Equipment

- Is the proper equipment per company policy onboard?
- Is the crew familiar with the equipment location on the new aircraft?

FACILITIES

Aircraft Security

- For a larger aircraft, there may be limited hangar space to secure the aircraft at other bases, or the home base. This may change the SOPs and/or require the purchase of tamper-evident devices.
- Any aircraft specific vulnerabilities such as access points must be assessed.

Aircraft Servicing Support

- Evaluate existing support equipment capabilities integral to the facility compared to new aircraft support requirements.

HUMAN AND ORGANIZATIONAL

Pilots

- Number of pilots in the company assigned to operate the different aircraft.
- Extensive flight time capabilities and fatigue management.
- Reduced scheduling availability during transition training.
- Potential periods of time with limited aircraft specific experience.

Maintenance

- Number of mechanics assigned to work on the different aircraft.
- Mechanics with relevant specific aircraft expertise.

<u>Training</u>

- Simulator training specifically adapted for the operator's SOPs.
- Identification of aircraft-specific 'trouble' spots such as: rejected take-off (RTO), single engine climbs procedures, etc.
- For example, the aircraft 'X' may require a significant amount of force on the rudder during single engine climb and RTOs as compared to aircraft Y.
- T-tail icing susceptibility and recovery.

Accident Example– Training: (click here to download the full report)

On February 12, 2009 a Colgan Air, Inc. Bombardier Q400 was on an instrument approach to KBUF Buffalo, New York, when it crashed about 5NM northeast of the airport. The NTSB determined the probable cause of this accident was the captain's inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover. The NTSB referenced training as one of the many factors contributing to the crash. Three factors pertinent to training are listed below:

(1) SOPs: The NTSB recommends the FAA require operators of airplanes susceptible to tailplane stalls to provide an appropriate airplane-specific tailplane stall recovery procedure in their training manuals and company procedures. Operators of those airplanes that are not susceptible to tailplane stalls must ensure that training and company guidance for the airplanes explicitly states this lack of susceptibility and contains no references to tailplane stall recovery procedures.

(2) Stick Pusher Training: Most of the company pilots interviewed after the accident reported that they had not received a demonstration of or instruction on the stick pusher. Company training personnel and Q400 check airmen stated that demonstration of the airplane's stick pusher system was not part of the training syllabus for simulator training at the time of the accident. *<u>"The captain's response to stick shaker activation should have been automatic, but his improper flight control inputs were inconsistent with his training and were instead consistent with startle and confusion."</u>*- NTSB

(3) Contamination Training: The video "Icing for Regional and Corporate Pilots," (NASA) was shown during winter operations training. It discussed the possibility of a tailplane stall, which results from an ice contaminated horizontal stabilizer. According to the video, the wing stall recovery technique requires pilots to reduce the AOA by lowering the nose, adding power, and maintaining the flap setting, whereas the tailplane stall recovery technique requires pilots to pull back on the control column; reduce flap setting; and, for some aircraft, reduce power. A Bombardier engineering manager testified that the Q400 was not susceptible to tailplane stalls. The Bombardier engineer further stated that this maneuver tested "the most severe condition" (that is, the most negative tailplane AOA) and that the airplane showed no evidence of tailplane stall characteristics, even at -0.2 G.

Aircraft Familiarization

- Potential pairing of crewmembers with limited time in type.

Accident Example– Avionics Familiarization: (click here to download the full report)

On November 22, 2004 a Gulfstream G-1159A (G-III) crashed during an approach to landing in Houston, TX. The aircraft struck a light pole 3SM southwest of KHOU while in IMC. The crew was failed to monitor and select the correct navigational settings. Although there were multiple factors that led to this accident, a lack of familiarization with the aircraft's avionics was a significant factor. There were four major avionics familiarization factors cited by the NTSB:

(1) According to the CVR, neither the first officer nor the captain was initially able to activate the APR mode on their flight directors.
(2) The CVR transcript also indicated the first officer did not switch the VHF NAV receivers from the HUB VOR frequency to the ILS frequency until the airplane was at an altitude of about 1,000 feet, nor did he identify or monitor the frequency. An aural glideslope alert would have been generated and repeated every 3 seconds if the airplane deviated below the glideslope by more than 1.3 dots and if the altitude was below 1,000 feet.
(3) The GPWS also generates a minimums alert when the airplane descends to the decision height (DH) selected by the flight crew. The CVR did not record any GPWS alerts during the accident flight.
(4) The aircraft EADI was configured with the glideslope indicator on the left side and the fast/slow indicator on the right side. The NTSB stated, "Five other company airplanes flown by the accident pilots were configured with the glideslope indicator on the left side. Of these airplanes, four had fast/slow indicators on the right side, and one had no indicator on the right side. Three of the company airplanes flown by the accident pilots had the glideslope on the right side. The fast/slow indicator would have remained visible on the EADI even after the ILS frequency was selected, which may explain why the pilots did not immediately notice the glideslope indicator deviation after the first officer selected the ILS frequency. *Therefore, the pilots most likely mistook the fast/slow indicator for the glideslope indicator throughout the approach sequence."*

Accident Example– Systems Familiarization: (click here to download the full report)

On June 4, 2007 a Cessna Citation 550 impacted Lake Michigan shortly after departure from KMKE, Milwaukee, Wisconsin in marginal VFR conditions. Although the exact nature of the initiating event could not be determined, the Captain experienced either an unintended autopilot activation or electric pitch trim anomaly before the crash. There are four potential systems familiarization factors the NTSB issued recommendations for:

(1) The design and location of the yaw damper and autopilot switches on Cessna Citation series airplanes do not adequately protect against inadvertent activation of a

system.

(2) If circuit breakers that a pilot might need to quickly access during an abnormal or emergency situation were equipped with identification collars, pilots would be able to locate them more readily and pull them more easily during such a situation. The First Officer could not identify the location of the circuit breakers.

(3) If Cessna Citation pilots and operators were informed of the potential hazards related to the sensitivity and responsiveness of the airplane's aileron trim system, they would be better able to avoid problematic aileron trim inputs until a more permanent solution (an aileron trim system retrofit) is in place.

(4) The pilots' lack of discipline, in-depth systems knowledge, and adherence to procedures contributed to their inability to cope with anomalies experienced during the accident flight.

Flying Characteristics

- *"With all due consideration for aircraft type, size, and speed, other factors – rate of climb, stability and control, stall reaction, slow and high speed response, landing and takeoff speeds, and other aerodynamic characteristics – are measures of safety."*- NBAA

Accident Example– Aircraft Characteristics and SOPs:
(click here to download the full report)

- On Nov 11th, 2007 a Bombardier Global 5000 touched down seven feet short of the runway at Fox Harbor, Nova Scotia, Canada. The landing gear collapsed, and the aircraft skidded off the runway. Crew and passengers escaped with some serious and minor injuries. The aircraft was a new addition to the company fleet and several factors such as SOP documentation and lack of experience in the specific type aircraft contributed. The company's operator safety risk profile indicated a heavy reliance on their extensive experience in Bombardier aircraft as a mitigating risk factor. TSB stated, "Jetport did not develop an accurate company risk profile. This precluded identification of systemic safety deficiencies and development of appropriate mitigation strategies." Relevant risk factors cited by the Transportation Safety Board of Canada (TSB) are listed below.

(1) Aircraft size: The TSB cited, "General lack of knowledge of the safety margins provided by visual glide path indicators and how they are affected by the size of the aircraft." Both crewmembers were accustomed to operating the CL604, a smaller aircraft. Additionally, the TSB cited many pilots lack knowledge of eye-to-wheel height (EWH) and how it applies to VGSIs. The Global 5000 has an EWH of 17.2ft. and the Challenger 604 is 12.2ft.

(2) Pilot Experience: After training in the Global 5000, the First Officer went back to the Challenger exclusively for 3+ months. He flew the Global 5000 3 segments in 5 days before the crash. The Captain had completed two recent approaches plus 43 hours with a Bombardier pilot.

(3) SOPs: The company adapted Challenger 604 SOPs to the new aircraft (Global 5000). Company SOP example- "When operating on short runways, landing as

early as conditions permit is generally considered to be good airmanship"- not an accurate statement for Global 5000. The Captain flew intentionally below the on-path indication because he planned on landing short due to the short runway length.

(4) The Captain used wing-low/ side-slip method for crosswind landing. He should have used crabbed approach, as per the ORM. The Global 5000 uses an automatic roll-assist feature that deploys the multifunction spoilers on the wing that is being held low.

MAINTENANCE

Reliability

- *"New state-of-the-art aircraft and equipment may have advantages, but also may experience an unusual failure rate until the "bugs" have been worked out of the design. Another aircraft in its prime may not be the latest design, but it may be well-supported and have low failure rates; conversely, equipment may be obsolete and have inadequate support."*- NBAA
- Aircraft reliability history– i.e. is this a completely new aircraft to the industry? Is there a history of maintenance problems with extensive down-time?
- Away from home base maintenance procedures and availability

SUMMARY

A well prepared Aircraft Training / Transition Plan that thoroughly outlines requirements for flight crew and maintenance training prior to introducing operating capability is essential to effectively manage risk associated with introduction of a new aircraft type.
Coordination between operating schedule requirements and training timelines is necessary to meet existing commitments with minimal impact and confusion.

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