LaRC B-200 Unpressurized Flight on July 2, 2018

Mishap Investigation Debrief
Initial: Close Call, Final: Type D
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Greg Slover
Langley Aviation Safety Officer, Mishap Investigation Team Lead

This and previous presentations are archived at https://sma.nasa.gov/news/safety-messages
What Happened—Pilot Report

• Aircraft failed to pressurize following an unplanned stop at Atlantic City Airport:
  – Condition identified following a Qualified Non-Crewmember (QNC) who “nodded off or fainted and dropped a laptop”
  – Event reported as occurring in the climb at approximately 14,000-16,000 feet Mean Sea Level (MSL)
  – Following re-pressurization, crew assessed personal conditions, and with no perceived hypoxic effects, jointly decided to continue mission
  – Mission was completed uneventfully

• Pilot reported:
  – Flight sequence of events
  – Missing checklist steps
  – Malfunctioning nadir portal shutter doors
  – High workload
The Investigation

• A close call Mishap Investigation team initiated:
  – Lead/Aviation Safety Officer, Human Factors, Industrial Safety, Aviation Medicine, and Mishap Manager
• Investigation determined:
  – One researcher temporarily lost consciousness (expert opinion from follow-on interviews and medical screenings)
  – Cabin altitude reached 19,000 feet MSL (from science instrument data, see next chart)
• Classification changed to Type D due to Occupational Safety and Health Administration-recordable lost consciousness:
  – However, potential Type A remained a greater Undesirable Outcome
• Identified 4 Proximate Causes, 7 Intermediate Causes, 15 Contributing Factors, 7 Observations, and 2 Root Causes
• Thirteen recommendations
Data: Aircraft vs. Cabin Altitude

Pilot reported cabin reached 14,000 feet, actual data shows over 19,000 feet, crew exposed to potential hypoxia altitudes for 13 minutes.
Causes, Observations, Factors, and Conditions

Human Factors
- Self Imposed Pressure (Mission, Time)
- Improper Checklist Design/Utilization
- Workload

Process & Risk Management
- Some aircraft conditions not communicated to pilot
- Informal risk management applied
- Two off-nominal approvals required

Latent Conditions
- Nadir portal shutter doors
- Sun Angle washout of “Cabin” Warning Light
- “Sticky” Master Warning Light

- High workload led to operational errors:
  - Bleed Air Valves—Closed
  - Crew Oxygen Bottle Valve—Closed

- Organizational Root Causes:
  - Processes for off-nominal approvals
  - Communicating full aircraft condition to pilot
Conclusions and Recommendations

• Operational errors, as a result of increased pilot workload, led to hypoxia in the crew of NASA529 on July 2, 2018:
  – Pre-existing time constraints generated perceived mission pressure
  – Single-pilot operations increased pilot workload
  – An anomalous aircraft research system resulted in a mission change that drove an untenable mission timeline
  – Accumulation of these conditions culminated in human errors

• Organizational Root Causes:
  – Off-nominal management approval process
  – Some aircraft conditions not communicated to pilot

• The Mishap Investigation Team presented 13 recommendations to reduce the probability and/or severity of this mishap from recurring:
  – Revise checklists (3), evaluate warning systems/shutter doors (3), review risk mitigation process, review QNC training/medical clearance process (3), review policies (2), update pilot training
Key Crosscutting Leadership Takeaways

- Balance the “pressure to perform” with safety mindset:
  - Internal pressure within the team to get mission done
  - External pressure from customer to deliver results
  - Either can lead to increased workload and contributing factors

- Maintain equipment and know the condition:
  - Operational workarounds increase workload

- Continuous Risk Management at tactical, operational, and strategic levels

- Cultivate a culture of self-reporting:
  - Perpetuate willingness to share our mistakes with others
  - Demonstrate a healthy openness to scrutiny