Docket No. SA-533

Exhibit No. 13C

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C.

ATR Presentation – Aircraft Performance Monitoring System

(16 Pages)

Aircraft Performance Monitoring (APM)

Aircraft Performance Monitoring

Background

- ATR in Service Experience
  - Cues and procedures established for severe icing encounters are adequate but not always followed by flight crews.
- Recommendation from investigation authorities
  - Low speed warning for Saab340, Cessna Caravan and Citation, EMB120.
- Rulemaking Activities
  - IPWHG tasked by the ARAC
    - ✓ Review the icing envelope (Appendix C + SLD)
    - ✓ Means to tell the crew when to activate ice protection systems
    - ✓ Means to tell the crew when to leave the icing environment

Aircraft Performance Monitoring

ATR Response

- **Objectives:**
  - **Provide information to the crew about a/c performance degradation**
  - **Alert the crew about compliance with minimum required IAS**

ATR developed the Aircraft Performance Monitoring as an advisory system to further enhance the flight crew awareness

Aircraft Performance Monitoring

APM Principle

- The APM uses FDR recorded parameters and A/C weight selected by crew to:
  - Compute and compare the expected and actual aircraft drag
  - Compute and compare the expected and actual cruise speed
  - Compute the Minimum Icing Speeds
  - Compute A/C weight during T/O run and initial climb (if not selected by the crew)
- The APM elaborates gradual signals at predefined thresholds according to A/C performance degradations

Aircraft Performance Monitoring

APM Principle

- APM is active during the entire flight from take-off to landing
- APM delivers alerts to the crew only when:
  - Flaps and gears are retracted, and
  - Both engines are operating, and
  - the SAT is lower than 10°C, and
  - Icing conditions are present
    - ✓ Level 2 or 3 engaged, or
    - ✓ Icing signal given by the ice detector

Aircraft Performance Monitoring

Signal triggering

- **In Climb and descent 2 levels of alerts**:
  - **DEGRADED PERF**
  - **INCREASE SPEED**

- **In cruise 3 levels of alerts:**
  - **CRUISE SPEED LOW**
  - **DEGRADED PERF**
  - **INCREASE SPEED**

Aircraft Performance Monitoring

Signal triggering

- **"Speed-not-nominal" advisory:**

CRUISE
SPEED LOW

- **It advises the crew that cruise IAS is lower than the expected value by 10kts**
- **If illuminated :**
  - **➔Monitor the icing conditions and speed**

Aircraft Performance Monitoring

Signal triggering

- **Performance loss alert:**

DEGRADED PERFORMANCE

CAUTION +  Single Chime

- **During climb, cruise and descent it alerts the crew that :**
  - **Performance is being degraded (speed decay or RoC decrease)**
  - **Probable cause may be an abnormal ice accretion**

Aircraft Performance Monitoring

Signal triggering

DEGRADED PERFORMANCE

CAUTION + 

Single Chime

Check de-icing ON
Red bug + 10 Kt
~~Auto Pilot OFF~~

Severe icing cues or IAS < (red bug +10kts) or abnormal handling

YES

Severe Icing Procedures
Apply

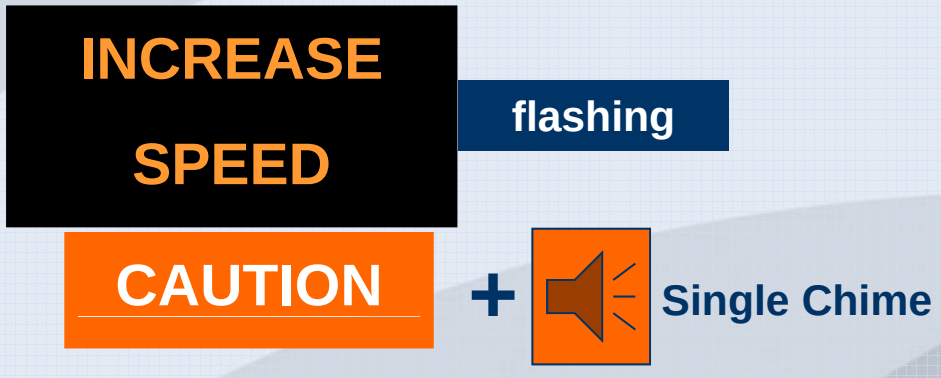
NO

Continue Scheduled flight
Monitor Speed and Icing condition
AP may be re-engaged

Aircraft Performance Monitoring

Signal triggering

- **“SPEED” alert:**



- It alerts the crew that minimum icing speed is reached. Active during climb, cruise and descent.
- This alert triggers after a «Degraded Performance» warning and when IAS < MSIS
- It should not trigger if the «Degraded Performance» procedure is properly observed.
- No specific procedure other than increase speed up to red bug + 10kts then Severe Icing procedure (AFM Emergency Section)

Aircraft Performance Monitoring

Signal triggering

flashing

INCREASE SPEED

CAUTION + Single Chime

IAS < Red bug + 10 Kt

YES

Push the stick to increase speed

Severe Icing Procedures Apply

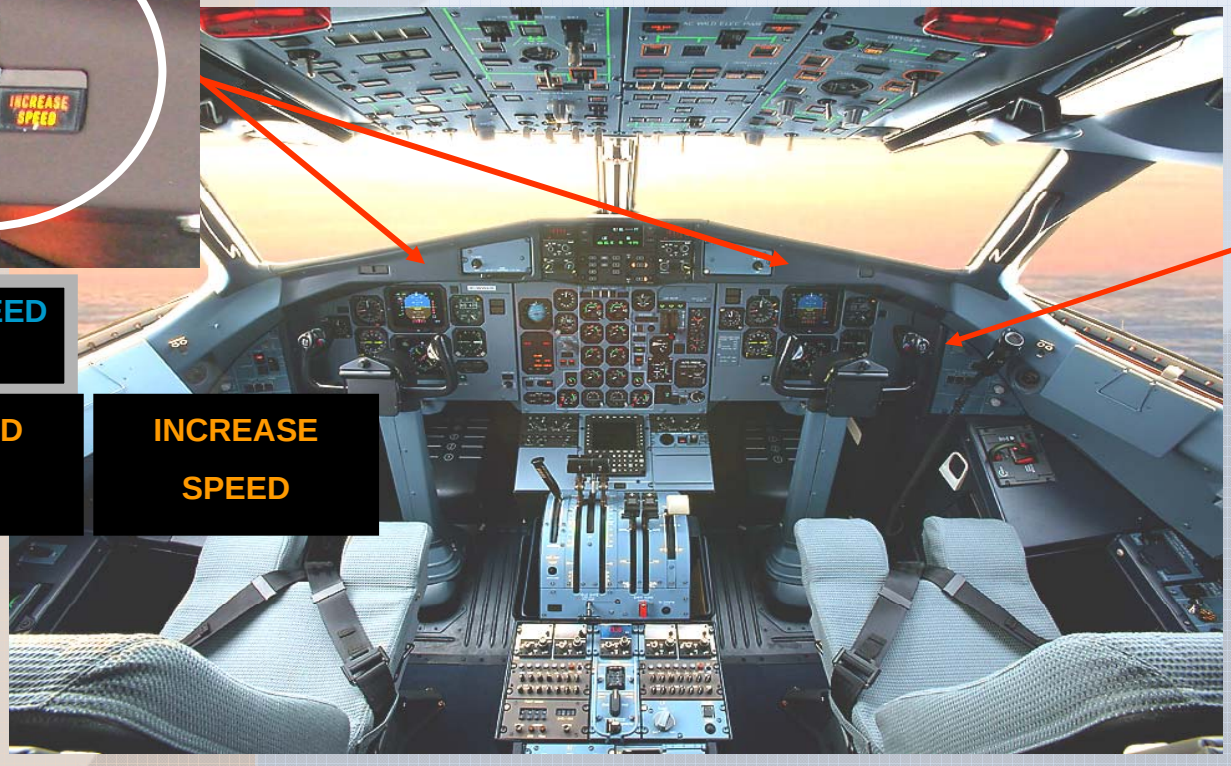
Aircraft Performance Monitoring

Cockpit Layout

CRUISE SPEED LOW

DEGRADED PERF

INCREASE SPEED



Weight selector with 12 positions

Aircraft Performance Monitoring

APM validation

- The APM has successfully been evaluated during 14 months (2571 commercial flights) with strong winds and icing conditions.
- The APM has been tested by simulation on past recorded flights with severe ice encounter
  - ⇨ The APM would have delivered the appropriate alerts for timely procedure application in these events.
- APM Alerts on flight 8284 if installed
  - At FL180:
    - "CRUISE SPEED LOW" after 10mn
  - At 5000 ft:
    - "CRUISE SPEED LOW" 70 seconds before flap extension
    - "DEGRADED PERF" 40 seconds before flap extension

Aircraft Performance Monitoring

APM approval and status

- Approval from EASA granted on July 2005 (including AFM, MMEL revisions).
  - APM is installed on production airplanes since November 2005.
- Service Bulletin available for retrofit since June 2006
- ATR voluntarily retrofit airplane of its asset during pre delivery refurbishment.
- 250 ATR already equipped with APM (780 A/C in service)

Aircraft Performance Monitoring

Worldwide Promotion

- **French DGAC**

  French DGAC issued on October 18th, 2005 a recommendation bulletin towards the operators related to the Aircraft Performance Monitoring.

- **FAA and NTSB**

  The APM has been presented to the FAA/NTSB (September 2006) as the most adapted response to the project of airworthiness requirement related to severe icing encounter and detection.

  ⇒ Detect the effects on the aircraft rather than the conditions

Aircraft Performance Monitoring

Worldwide Promotion (cont'd)

ATR Operators

- Offered to all ATR operators
- Operator Conferences (Athens 2006, Miami – Toulouse - Bangkok 2008)
- Flight Operations Conference (Cancun – Toulouse - Kuala Lumpur 2008)

International Committees

- Ice Protection Harmonization Working Group: Dec. 2004
- SAE AC-9C conference in Seville: Sept. 2007
- AFRASCO (African Safety Council) : Cairo 2007
- IFALPA: Bogota 2008