Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A09O0117

ERRONEOUS INSTRUMENT INDICATIONS RESULTING IN AIRSPEED AND ALTITUDE DEVIATIONS

LOT POLISH AIRLINES SA
BOEING 767-300 SP-LPA
NORTH BAY, ONTARIO
19 JUNE 2009

Canada

Aviation Investigation Report

Erroneous Instrument Indications resulting in Airspeed and Altitude Deviations
LOT Polish Airlines SA
Boeing 767-300 SP-LPA
North Bay, Ontario
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Report Number A09O0117

Summary

The LOT Polish Airlines SA Boeing 767-300 (registration SP-LPA, serial number 24865) operating as LOT 2 departed from Chicago, O'Hare International Airport and was destined for Warsaw, Poland. At 2203 Eastern Daylight Time, while the aircraft was in level cruise flight in the vicinity of North Bay, Ontario, the captain's airspeed indicator suddenly increased above the maximum operating speed, and an overspeed warning was triggered. The flight crew reduced thrust to flight idle and initiated a climb. As the aircraft slowed, the overspeed warning stopped. The flight crew maintained the nose-up attitude with the reduced thrust setting but the captain's indicated airspeed suddenly increased again, causing a second overspeed warning. As the flight crew reacted to the second overspeed warning, a simultaneous activation of the stick shaker occurred. During the incident the aircraft climbed from 33 000 to 35 400 feet above sea level (asl) and then descended to approximately 27 900 feet asl. The crew diverted to the Toronto/Lester B. Pearson International Airport where the aircraft landed safely. There was no damage to the aircraft and none of the 10 crew members and 206 passengers were injured.

Ce rapport est également disponible en français.

Other Factual Information

Sequence of Events

The aircraft was cruising at flight level (FL) 330 in the vicinity of North Bay, Ontario. The captain was seated in the left seat and was the pilot flying. The autopilot and autothrottles were both engaged. The aircraft was in instrument meteorological conditions, in light to moderate turbulence for which the crew had requested FL350.

At 2203 [1] the captain's airspeed indicator increased from 276 to 320 knots and the captain's altimeter increased 450 feet in approximately 5 seconds. To re-capture altitude, the autopilot commanded pitch down approximately 2 degrees. An overspeed warning activated whereupon the captain retarded the throttles to idle. The autothrottles disconnected automatically but the autopilot remained engaged. The autopilot pitched down another 2 degrees before pitching up approximately 8 degrees. The overspeed warning remained on for about 41 seconds.

The captain disengaged the autopilot and manually initiated a climb. Thrust remained at idle and the captain's airspeed indicator decreased to 297 knots. The captain increased pitch to 12 degrees nose up, his airspeed indicator rapidly increased to 324 knots producing a second overspeed warning. The aircraft climbed to an altitude of approximately 35 400 feet above sea level (asl) [2], then started to descend. The captain's indicated airspeed reached a maximum of 339 knots, before decreasing as the aircraft started to descend.

The aircraft was descending through 34 700 feet asl with the captain's airspeed indicator decreasing through 321 knots and the overspeed warning on when the stick shaker activated (a stall warning device that noisily shakes the pilot's control column as the stalling angle of attack is neared). The overspeed warning remained on for the next 20 seconds, became intermittent for 26 seconds, then stopped. The stick shaker activated intermittently for about 1 minute and 50 seconds from its initial activation. When the aircraft had descended through approximately 30 000 feet asl with the captain's airspeed indicating 278 knots, the captain increased thrust and within 9 seconds the stick shaker stopped. As the aircraft descended through 29 100 feet asl, the captain's airspeed indicator rapidly decreased from 255 knots to 230 knots and the airspeed fluctuations stopped. The aircraft continued its descent to 27 900 feet.

Throughout this event, the first officer's airspeed indicator displayed information that was not indicative of an overspeed event.

The flight crew elected to divert to Toronto/Lester B. Pearson International Airport (CYYZ). They informed air traffic control (ATC) that they wanted to divert to CYYZ because they had experienced an overspeed and had problems maintaining altitude. The crew also informed ATC

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1 All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

2 Altitudes refer to the recorded values on the flight data recorder and displayed on the captain's altimeter.

that they would need to dump fuel; however they did not declare an emergency. No further anomalies with the aircraft or its systems were encountered during the remainder of the flight.

In order to reduce the landing weight, fuel had to be dumped en route. As this aircraft is only able to dump fuel from its center tank, the flight crew requested a hold to burn off fuel.

The autopilot was engaged but autothrottles were not. Upon entering the hold, the aircraft was at 10 000 feet asl and the flight crew manually reduced thrust to idle. As the aircraft slowed, the autopilot commanded an increase in pitch to maintain altitude. When the pitch reached 7.6 degrees nose up, the stick shaker activated. As the aircraft descended to approximately 9600 feet asl, the flight crew manually increased thrust (a maximum of 111% was recorded on the FDR) and the aircraft began to climb. As the aircraft was climbing through 9860 feet asl the flight crew disconnected the autopilot. The aircraft continued to climb to 10 500 feet asl, which resulted in a loss of separation with another aircraft that responded to a Traffic Collision Alerting System Resolution Advisory (TCAS RA) to avoid the conflict. ATC was aware of the altitude deviation and inquired with LOT 2 as to the nature of the problem and if they could assist in any way.

After landing, the flight crew filled out an aircraft technical report, which included the overspeed indication, unusual buffet, vibration, stick shaker, stall, contradiction in indications between the captain's and first officer's airspeed indicators, and the Electronic Engine Control (EEC) left and right illumination on the Engine Indication and Crew Alerting System (EICAS). There were no further EICAS messages reported on the technical report, and it could not be determined what EICAS messages were present during the overspeed and stick shaker event. When the aircraft was inspected, there was no structural damage to the aircraft nor were any faults in the air data system identified. The aircraft was released back into service.

Engine Indication and Crew Alerting System

The EICAS consolidates engine and subsystem indications and provides a centrally located crew alerting message display. The system alert messages are associated with aircraft system failures or faults and are displayed in both prioritized and chronological order. The priority in descending order is:

- warning (red);
- caution (amber); and
- advisory (amber, indented).

Warnings, cautions, and advisories are displayed from the top down in the EICAS display message area. The most recent message is displayed at the top of its respective level.

An overspeed message is a warning accompanied by an aural siren and a Master WARNING light. The IAS DISAGREE and ALT DISAGREE are both cautions and are accompanied by an aural beeper and a Master CAUTION light. The Master WARNING/CAUTION lights remain on as long as the warning/caution exists, or until either the Master WARNING or CAUTION reset switch is pushed.

When an airspeed difference of 5 knots or more is detected between the left and right air data source for 5 seconds, the EICAS airspeed/altitude disagree logic generates an IAS DISAGREE caution message and illuminates the Master CAUTION light. Similarly, an altitude difference of 200 feet or more for 5 seconds will generate an ALT DISAGREE caution and activate the Master CAUTION light.

These features were part of Boeing Service Bulletin (SB) 767-34A0332, revision 2 (30 September 2004), and were installed on SP-LPA in February of 2006. However, revision 2 did not require changes or amendments to the Flight Crew Operations Manual (FCOM). Changes to the FCOM were also not required with revision 3 and 4 that followed. Subsequent revision 5, (18 December 2008) states that the FCOM Chapters 10 and 15 and non-normal checklist Section 10 are affected publications. However, the SB does not state what changes should be made to the FCOM.

Following the occurrence, with the assistance of Boeing, LOT Polish Airlines performed a functional test of the aircraft which confirmed that the IAS DISAGREE and ALT DISAGREE messages would be displayed on the EICAS if the above-mentioned parameters were met.

Flight Data Recorder

The flight data recorder (FDR) installed on the aircraft was manufactured by Honeywell. The FDR contained approximately 52.5 hours of data which included the occurrence and 5 previous flights. The overspeed event and the subsequent stick shaker activations are plotted in Appendix A.

Based on FDR data, airspeed and pressure altitude were calculated by Boeing to determine actual airspeed and altitude values. There was no change in calculated airspeed when the overspeed warning occurred, but the calculated airspeed did subsequently increase to approximately 280 knots before slowly decreasing briefly to 190 knots then increasing and stabilizing at 265 knots after the event.

Stick shaker trip angles were also calculated for the occurrence conditions to determine which vane angles of attack would be expected to activate the stick shaker. The results showed that for the recorded stick shaker activations, the trip angles had been reached or exceeded and that the system worked as designed.

Cockpit Voice Recorder

The cockpit voice recorder (CVR) was a Fairchild model A100S, and was a 30-minute unit. The aircraft landed approximately 72 minutes after the initial overspeed. The start of the recording was determined to be approximately 35 minutes after landing, which indicates that the recorder remained powered for more than one hour after landing.

The LOT Polish Airlines Operations Manual (OM) states that the captain must not permit a CVR to be disabled or switched off during flight unless it is believed that the recorded data, which otherwise would be erased automatically, should be preserved for incident or accident investigation. It also states that the captain must not permit recorded data to be manually erased during or after flight in the event of an accident or incident.

Subsequent Event

On 21 July 2009, the occurrence aircraft, with a different crew, was on a similar flight from Chicago to Warsaw. Approximately 2 hours into its cruise segment at FL340, with the autopilot and autothrottle engaged, the captain's airspeed abruptly increased from 278 to 336 knots in approximately 11 seconds. At the same time, there was an increase of 990 feet on the captain's altimeter. An overspeed warning occurred; the flight crew reduced thrust and disconnected the autothrottles. Shortly afterwards, the left and right EEC EICAS messages were displayed. The autopilot was disengaged and the aircraft was flown manually.

The flight crew on that flight noticed a discrepancy between the captain's airspeed indication and both the first officer's and standby airspeed indicators. The flight crew completed the AIRSPEED UNRELIABLE checklist. The overspeed warning, which lasted for approximately 3 minutes and 20 seconds, stopped when the captain changed his selected Air Data Computer (ADC) from normal to alternate. The captain's altitude indications also returned to normal and remained normal for the rest of the flight. Unlike the 19 June 2009 occurrence, the aircraft did not pitch nose-up and there were no stick shaker activations.

The EICAS messages received during this event were:

- Overspeed;
- Autopilot;
- EEC L;
- EEC R;
- Aileron Lockout; and
- Rudder Ratio.

Training and Company Procedures

The LOT Polish Airlines Boeing 767 (B767) initial type rating course includes overspeed warning and instrument source selector training in the ground school. Practical training for instrument source selection and unreliable airspeed indications are accomplished in the cockpit system simulator (CSS). There is no practical initial training for an overspeed event, either in the CSS or the flight simulator.

The Boeing Flight Crew Training Manual (FCTM) states that, when correcting for an overspeed during cruise at high altitude, flight crews must avoid reducing thrust to idle. This causes the engine to accelerate slowly back to cruise and may result in over-controlling the airspeed and a loss of altitude. In both events, the immediate reaction of the crews to the overspeed warning was to reduce the throttles to flight idle.

LOT Polish Airlines recurrent training consists of 6 sessions every 3 years (2 sessions per year), and includes normal, emergency and other procedures. There is line-oriented flight training (LOFT) and a check ride after each session.

Unreliable airspeed recurrent training occurs during session 2, and is completed in a B767 flight simulator. It includes a scenario where the captain's airspeed indicator has a lower than normal indication. The flight crew must accomplish the AIRSPEED UNRELIABLE checklist located in the Quick Reference Handbook (QRH).

Overspeed warning training is not in the recurrent training syllabus; however, it is encompassed in the AIRSPEED UNRELIABLE checklist. According to the QRH (see Appendix B) the airspeed is considered to be unreliable if one or more of the following exists:

- speed/altitude information not consistent with pitch attitude and thrust setting;
- speed/airspeed/Mach failure flags;
- blank or fluctuating airspeed displays;
- variation between captain and first officer airspeed displays;
- amber line through one or more attitude display indicator (ADI) flight mode annunciations;
- overspeed indications;
- radome damage or loss;
- simultaneous overspeed and stall warnings;
- display of one or more of the following EICAS messages:

  AILERON LOCKOUT
  ALT DISAGREE
  CAPT PITOT
  F/O PITOT
  IAS DISAGREE
  L AUX PITOT
  OVERSPEED
  PROBE HEAT
  R AUX PITOT
  RUDDER RATIO

The QRH guides the flight crew to cross-check the captain's and first officer's indications and standby airspeed indicator, and states that an airspeed differing by more than 15 knots from the standby indicator should be considered unreliable. If the reliable airspeed data source can be determined, the flight crew is to select the reliable source (i.e., the other ADC).

The LOT Polish Airlines B767 Flight Crew Operations Manual (FCOM) states that aircraft SP-LPA (the occurrence aircraft) does not have an IAS DISAGREE or ALT DISAGREE EICAS message, and that an overspeed warning is activated when maximum operating speed (Vmo) or maximum operating Mach (Mmo) is exceeded. The overspeed warning includes:

- Master WARNING lights illuminate;
- OVSPD light illuminates;
- the EICAS warning alert message OVERSPEED is displayed; and
- aural warning siren sounds.

Flight Crew

The flight crew was certified and qualified for the flight in accordance with existing regulations. At the time of the occurrence the captain had accumulated approximately 19 000 flight hours, 8000 of which were on the B767. He was off duty for 5 consecutive days prior to starting his pairing 2 days before the occurrence, and had a rest period of approximately 20 hours prior to departing on the occurrence flight. The captain's most recent training was accomplished on 22 January 2009. His last unreliable airspeed training was accomplished on 26 March 2008.

The first officer had accumulated approximately 7000 flight hours, 1800 of which were on the B767. He was off-duty for 3 consecutive days prior to starting his pairing 2 days before the occurrence, and had a rest period of approximately 20 hours prior to departing on the occurrence flight. His most recent training was accomplished on 31 March 2009. His last unreliable airspeed training was accomplished on 13 March 2008.

Air Data System

The air data system consists of:

- the pitot–static system;
- one total air temperature probe (TAT);
- two angle of attack sensors (AOA);
- two ADCs; and
- electric flight instruments.

The system provides pitot and/or static pressure information to various flight instruments and airplane systems. There is also a standby airspeed indicator and altimeter.

The ADCs process the air data information to provide digital input signals to certain flight instruments such as the electric Mach/airspeed indicator and electric altimeter. The left instruments normally use the left ADC and the right instruments normally use the right ADC. The opposite ADC is available as an alternate air data source. Both the captain and first officer have an air data instrument source select switch. This allows either pilot to switch over instruments and use the opposite side ADC.

Air Data Computer

The left ADC (part number 4040800-906, serial number 88091436) was manufactured by Honeywell and installed on SP-LPA in 1998. It had accumulated 92 302 operating hours since manufacture and 48 296 hours since overhaul. After the overspeed event of 21 July 2009, the ADC was removed and examined by the Transportation Safety Board at the Honeywell facility in coordination with Boeing and the National Transportation Safety Board.

During the initial examination and disassembly of the ADC, a large build-up of dust and dirt was noticed inside the unit; such a build-up could result in an increase in the internal temperature and might cause it to operate outside the specified ambient temperature envelope.

When tested at pressure altitudes between 34 000 feet and 45 000 feet, at temperatures between 45°C and 60°C (estimated operating environment for the unit) the ADC would intermittently produce erroneous data similar to that seen on the 2 flights of SP-LPA. The fault was traced to the phase locked loop (PLL) circuitry on the A3 circuit card assembly (CCA).

In the PLL, there is a relationship between the voltage-controlled oscillator (VCO) input and the phase comparator output. If the VCO input to the PLL is unstable, it can cause the comparator output of the PLL to start oscillating as it tries to keep the PLL frequency locked. If this VCO input moves out of the comparator's range, the PLL may lose its frequency lock. When this occurs, there is a sudden increase in the signal to the multiplexer, resulting in a sudden jump on the airspeed indicator above Vmo, and an overspeed warning.

Two amplifiers in the PLL circuit were replaced with similar components with tighter tolerances. The ADC was tested multiple times after this modification without any failures. It is likely that the initial failures were caused by variances in the amplifiers' performance due either to the original installation of components that were close to the edge of their tolerance bands, or to the ageing of the components.

TSB Aviation Safety Recommendation A99-02

On 02 September 1998, Swissair Flight 111, a McDonnell Douglas MD-11 aircraft struck the water near Peggy's Cove, Nova Scotia fatally injuring all 229 occupants on board.

One of the shortcomings identified during the investigation was the limited recording capacity of the aircraft's CVR. The CVR was able to record only 30 minutes; therefore it did not capture the time frame when a fire started.

On 09 March 1999, the Board released interim safety recommendations as part of its investigation. Its Recommendation A99-01 to Transport Canada stated that:

> As of 01 January 2003, any CVR installed on an aircraft as a condition of that aircraft receiving an original certificate of airworthiness be required to have a recording capacity of at least two hours.

On 04 March 2004, Transport Canada advised that the *Canadian Aviation Standards* were being amended. They now state that: "A CVR installed on board an aircraft manufactured after December 31, 2002, shall retain all information recorded during the aircraft's operation, or all information recorded during the last two hours of the aircraft's operation, whichever is less." [3]

The response to Recommendation A99-01 was assessed as fully satisfactory and this file was assigned an inactive status.

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3 *Canadian Aviation Standard* 625.33.

On 09 March 1999, the Board also issued Recommendation A99-02 to both Transport Canada and the European Joint Aviation Authorities, asking that:

> All aircraft that require both an FDR and a CVR be required to be fitted with a CVR having a recording capacity of at least two hours.

On 07 June 1999, Transport Canada's response indicated support for this recommendation with the provision that the United States Federal Aviation Administration (FAA) and Canadian requirements remain harmonized.

On 07 March 2008, the FAA issued its final rule entitled Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Regulations stating that by 07 April 2012, CVRs on all turbine engine powered airplanes must have a 2 hour recording capacity.

Since its first response dated 07 June 1999, Transport Canada has stated its intention to initiate NPA action in order to address the deficiency identified in Recommendation A99-02. With each subsequent update it has repeated its original intention. Almost 12 years after its initial response, the oft-promised NPA has yet to be tabled at a CARAC Technical Committee Meeting which means the actual changes, if adopted, are many years away; this despite the FAA's 07 March 2008 directive.

At no time during the past decade has TC provided TSB with sufficient detail regarding its mitigation strategy. Without such details, TSB is unable to conduct an accurate assessment beyond stating that TC remains intent on proposing changes to its regulations to align with those of the FAA. Consequently, TSB has continued to reassess TC's responses as Satisfactory Intent in the expectation that TC was working towards a satisfactory mitigation of the risks associated with Recommendation A99-02.

The benefits of longer CVR recordings are well known. The lack of longer periods of recorded voice and other aural information continues to inhibit occurrence investigations and delay or prevent the identification of safety deficiencies. The Board is not satisfied that TC's intentions have been supported with the necessary degree of action. This means there is no assurance that aircraft requiring both an FDR and a CVR will be fitted with a CVR having a recording capacity of at least 2 hours.

While TC has promised action, the inordinate time taken to implement changes to the CARs has maintained the status quo and allowed the safety deficiency to potentially put persons and property at risk. Therefore, the assessment is changed to **Unsatisfactory**.

The European Aviation Safety Agency has not yet changed its regulations.

TSB's Watchlist

On 16 March 2010, the Transportation Safety Board released its Watchlist [4] that identifies critical safety issues in Canada's transportation system. One of the issues raised relates to data recorders. Data critical to understanding how and why transportation accidents happen are frequently lost, damaged, or not required to be collected. Global efforts are required to build better recorders, to enhance the quality and duration of their recordings, and to ensure they keep recording when the power supply fails.

The following TSB Laboratory reports were completed:

LP083/2009 - FDR/CVR Analysis
LP136/2009 - ADC Examination and Analysis.

These reports are available from the Transportation Safety Board of Canada upon request.

Analysis

Tests conducted on the LOT Polish Airlines left ADC revealed a fault within the PLL circuitry of the CCA, likely caused by variances in the amplifiers' performance. As a result, there was a sudden increase on the captain's instruments, exceeding the Vmo airspeed limit, and causing an overspeed warning.

The conditions under which the fault would occur materialized on both 19 June 2009 and 21 July 2009, which resulted in the temporary failure of the ADC and the subsequent display of erroneous indications on the captain's instruments.

On 19 June 2009, in response to a sudden and erroneous increase in indicated airspeed, the captain reduced thrust to idle and raised the nose of the aircraft to initiate a climb in order to reduce airspeed. This caused the aircraft to slow down and pitch up to the point of activating the stick shaker. The speed anomalies continued for about 4 minutes, with approximately 40 seconds of simultaneous overspeed warning and stick shaker.

The lack of CVR information precluded any analysis of crew decisions, actions or overall crew resource management. The first officer's airspeed indicator did not display the same erroneous overspeed information as the captain's. However, it could not be determined at what point the first officer became aware of the contradiction in airspeeds, if at all, or if this contradiction was ever communicated to the captain. The AIRSPEED UNRELIABLE checklist was not accomplished, and the airspeed indicators were not compared as stated in the checklist. Therefore, in all likelihood, the airspeed anomaly was not noticed.

When a similar event happened on 21 July 2009, the flight crew noticed the airspeed disagreement and followed the AIRSPEED UNRELIABLE checklist. As a result, after switching to the alternate ADC, the flight continued to destination without further incident.

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4 http://www.tsb.gc.ca/eng/surveillance-watchlist/index.asp.

EICAS data is not recorded on the FDR. Neither flight crew reported the IAS DISAGREE or ALT DISAGREE messages. A functional test confirmed that the IAS DISAGREE and ALT DISAGREE messages would be displayed on the EICAS when the parameters were met. This suggests that the messages were likely displayed on the EICAS but not noticed by the flight crews of both events.

Revisions 2, 3 and 4 of SB 767-34A0332 do not require an operator to amend its FCOM. Although revision 5 requires changes to chapters of the FCOM, it does not specifically state what the changes should be. LOT Polish Airlines had not yet incorporated revision 5. Therefore, the FCOM was not updated and incorrectly stated that the IAS DISAGREE and ALT DISAGREE EICAS messages would not be displayed on the occurrence aircraft when, in fact, they would.

Although revision 5 of the Boeing SB 767-34A0332 requires changes to chapters of the FCOM, it does not specify what the changes should be. Therefore some manuals may not be properly amended, thereby increasing the risk of crews being ill-informed of the status of the aircraft they operate.

The Boeing FCTM provides guidance on how to train flight crews to correctly identify an overspeed warning and react to it. However, the LOT Polish Airlines initial and recurrent training syllabus does not specifically include practical training for an overspeed warning. Unreliable airspeed situations, including overspeed indications and simultaneous overspeed and stall warnings, are included in the AIRSPEED UNRELIABLE checklist. The flight crew of the 21 July 2009 event carried out the AIRSPEED UNRELIABLE checklist. The lack of practical training for an overspeed warning increases the risk that flight crews will lack the necessary knowledge to safely respond to certain overspeed warning situations.

During the hold, the aircraft was being flown on autopilot while the autothrottles were not engaged. The thrust was manually reduced going into the hold; however, the airspeed was not monitored by the flight crew and thrust was not increased. Consequently, the autopilot increased the angle of attack in order to maintain the selected altitude. The angle of attack increased to the point where the AOA trip angle was exceeded, causing the stick shaker to activate. When thrust was increased and the stick shaking ended, the autopilot was disengaged; however, the flight crew did not stop the aircraft from climbing and it subsequently came into conflict with another aircraft also inbound to Toronto/Lester B. Pearson International Airport.

The CVR was not disabled after the occurrence; therefore, all CVR information regarding the incident was overwritten. The lack of information from the 30-minute CVR hampered the investigators' ability to obtain a timely and complete understanding of the event, and hindered the investigation. The installation of CVRs with less than 2 hours of recording capacity creates the risk that relevant information will not be available to accident investigators and that significant safety issues may not be identified.

Findings as to Causes and Contributing Factors

1. There was a fault within the phase locked loop (PLL) circuitry of the ADC which resulted in sudden and erroneous airspeed and altitude indications on the captain's instruments.

2. The readings on the captain's instruments were not compared to those on the first officer's or the standby instruments. Consequently, the crew believed the captain's instruments to be correct and made control inputs that resulted in significant altitude and airspeed deviations.

Findings as to Risk

1. LOT Polish Airlines initial and recurrent flight training syllabus does not include practical training for an overspeed warning event. Consequently, flight crews may respond improperly and exacerbate the situation.

2. Although revision 5 of the Boeing SB 767-34A0332 requires changes to chapters of the FCOM, it does not specify what the changes should be. Therefore some manuals may not be properly amended, thereby increasing the risk of crews being ill-informed of the status of the aircraft they operate.

3. The LOT Polish Airlines FCOM incorrectly states that the IAS DISAGREE and ALT DISAGREE EICAS messages will not be displayed on the occurrence aircraft during an unreliable airspeed incident. This increases the risk of a crew misidentifying a problem.

4. The installation of CVRs with less than 2 hours of recording capacity creates the risk that relevant information will not be available to accident investigators and that significant safety issues may not be identified.

5. During the initial examination and disassembly of the ADC, it was noted that there was a large build-up of dust and dirt inside the unit, which could cause an increase in the internal temperature.

Other Finding

1. In the hold, with thrust at idle, the flight crew did not monitor the airspeed. In an attempt to maintain altitude, the autopilot increased the angle of attack until the stick shaker activated. During the recovery, the crew allowed the aircraft to climb through the flight's cleared altitude, resulting in a loss of separation.

Safety Action

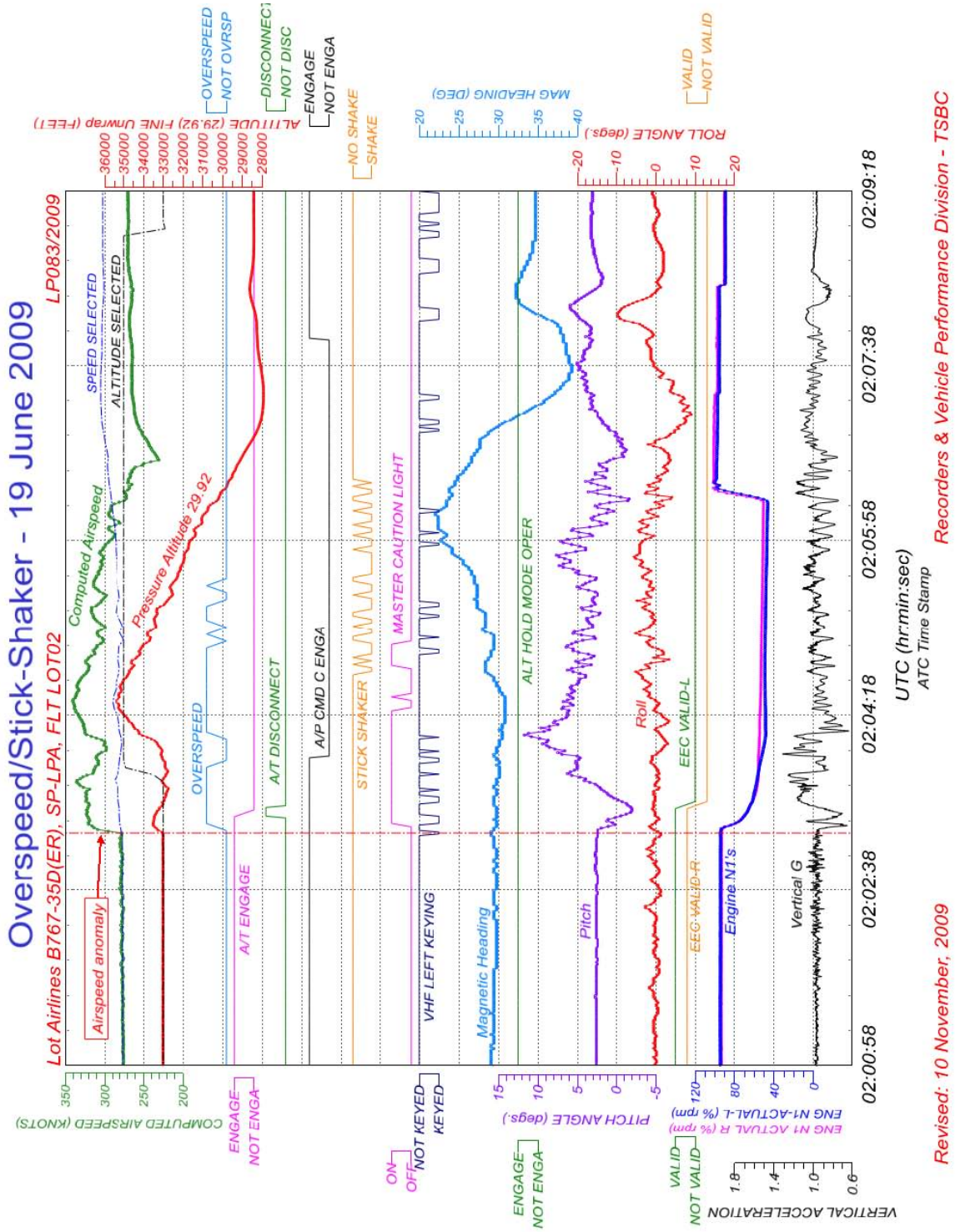
Polish Airlines has taken the following safety action:

- Published Flight Safety Bulletins for all B767 flight crews regarding the two incidents.
- Initiated the process of changing the operational documentation (FCOM and QRH) regarding the IAS and ALT DISAGREE messages.
- The "airspeed unreliable" failure is discussed in more detail during recurrent and simulator training for B767 crews.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 08 March 2011.

Visit the Transportation Safety Board's website (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – FDR PLOTS



Appendix B - AIRSPEED UNRELIABLE

AIRSPEED UNRELIABLE

Condition: **Airspeed/Mach indication is suspected to be unreliable.**

One or more of the following may be evidence of unreliable airspeed/Mach indication:

- **speed/altitude information not consistent with pitch attitude and thrust setting**
- **speed/airspeed/mach failure flags**
- **blank or fluctuating airspeed displays**
- **variation between captain and first officer airspeed displays**
- **amber line through one or more ADI flight mode annunciations**
- **overspeed indications**
- **radome damage or loss**
- **simultaneous overspeed and stall warnings**
- **display of one or more of the following EICAS messages:**

AILERON LOCKOUT	L AUX PITOT
ALT DISAGREE	OVERSPEED
CAPT PITOT	PROBE HEAT
F/O PITOT	R AUX PITOT
IAS DISAGREE	RUDDER RATIO

PITCH ATTITUDE AND THRUST . . . . . CHECK

If pitch attitude or thrust is not normal for phase of flight:

AUTOPILOT . . . . . DISENGAGE

AUTOTHROTTLE . . . . . DISCONNECT

FLIGHT DIRECTORS . . . . . OFF

ATTITUDE AND THRUST . . . . . ADJUST

Establish normal pitch attitude and thrust setting for phase of flight.

Note: Normal pitch attitude and thrust settings are available in the FLIGHT WITH UNRELIABLE AIRSPEED table in the Performance–Inflight chapter.

Continued on next page

Continued from previous page

Altitude information, vertical speed information, limit N1, Reference N1, and N1 bug may be unreliable.

SPEED INDICATIONS . . . . . CROSS CHECK

Cross check captain and first officer airspeed indications and standby airspeed indicator. An airspeed display differing by more than 15 knots from the standby indicator should be considered unreliable.

If the reliable airspeed data source can be determined:

AIR DATA SOURCE SWITCH
(Unreliable side) . . . . . .SELECT RELIABLE SOURCE

Invalid overspeed warning and invalid input to AFDS and autothrottle may occur or continue.

■■■■

If the reliable airspeed data source cannot be determined:

ATTITUDE AND THRUST . . . . . ADJUST

Maintain normal pitch attitude and thrust setting for phase of flight. Refer to the FLIGHT WITH UNRELIABLE AIRSPEED table in the Performance–Inflight chapter.

----------DEFERRED ITEMS----------

==> APPROACH CHECKLIST

Maintain visual conditions if possible.

Establish landing configuration early.

Use electronic and visual glideslope indicators, where available, for approach and landing.

Refer to IRS ground speed on the CDU POS REF page and reported wind on approach.

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