“Terrain, Terrain Pull-up!”

Air Carrier Controlled Flight Toward Terrain Incidents Reported to the NASA ASRS

InfoShare – Flight Operations

Seattle, WA

Capt. Gary Brauch
ASRS Pilot Analyst, Metis Technology Solutions

Linda Connell
Program Director, NASA ASRS

March 2014
Seattle, WA
ASRS Reporting
ASRS Report Volume Profile

- 37 years of confidential safety reporting
- Over 1,150,000 reports received
- Over 5,800 alert messages issued
- Over 6,700 reports per month, or 323 per working day
- Total intake for 2013 was 80,840 reports
- Current estimate for 2014 is over 90,000
ASAP Reporting to ASRS

- **Overall ASAP Intake**
  - 181 Total Programs
  - 76 Air Carriers

- **Reporting Groups**
  - 74 Pilot
  - 44 Mechanic
  - 39 Dispatch
  - 19 Flight Attendant
  - 5 Ground Crew

- **Secure Electronic Data connection protocols between airline and ASRS**
  - 179 Programs
  - 75 Airlines

ASRS Electronic Transmission Methodology compatible with numerous software platforms

More airline programs being added continuously

26% of all reports are matched to unique events in 2013
ASRS continues to receive reports describing autoflight issues resulting in a Low Altitude condition, often accompanied by a GPWS warning or ATC alert.
Examples of Reports

- Line Selectable Modification Issues
- Company Approach Procedures
- Automation and Controlled Flight Toward Terrain (CFTT)
An MD-11 flight crew, cleared to fly an RNAV approach, modified the line selectable procedure when cleared direct from their transition route to the FAF.

The crossing restriction at the FAF was thereby deleted and the aircraft descended directly toward the set DA per SOP.

Tower transmitted a low altitude alert and the flight returned to the published approach.

(ACN 1114573)
An air carrier crew was cleared for approach at or above 6,100 FT. Passing the IAF, they set field elevation in the altitude window as called for in the LAV procedure.

In VNAV Path mode, approaching the FAF, the Pilot Monitoring (PM) pointed out towers and told the Pilot Flying (PF) that they need to climb.

Shortly thereafter, they received a GPWS call for “Obstacle” and the PF initiated a more aggressive climb.

(ACN 1107021)
B737NG crew, descending in Level Change, accomplished a LAVS procedure. VNAV would not engage since they were below the G/S intercept altitude. Crew descended to 400 FT AGL outside of the FAF before a low altitude alert was issued by ATC.

- “Approaching the FAF something didn't feel right and I started re-checking/cross-checking the MCP when the ‘Low Altitude’ alert was issued by ATC.” (Flight Crew Report)
- “By my estimate, this aircraft was 4 radar hits (22 seconds) from hitting the ground.” (ATC Report)
A B737NG crew, distracted by wind speed concerns, identified the loss of VNAV mode inside the FAF

At the DA, seeing only trees, the Captain called for a Missed Approach, but the aircraft continued to sink as power was applied

“\textit{I thought we were critically close to the trees and within seconds of contacting them… Passengers were commenting on how close the trees were.}”
A B747-400 was vectored inside a RNAV initial approach waypoint which the PM put on top of the final approach waypoint; thus removing the waypoint from the approach.

Inside of initial waypoint at 2,200 FT in VNAV, the crew set minimums 1,100 FT in MCP panel.

“VPI started to come down; aircraft followed VPI. We saw it was going below the VASI about the same time the Tower gave us a low altitude alert.”

(ACN 1053959)
Cleared for the ILS while descending through 3,500 FT with the MCP set at 3,000 FT, PM reset the MCP altitude to 800 FT.

“We were well below the G/S with it coming down to us, but the problem was [we were] still in LVL CHG and following the FD down to 800 FT.”

“Later, we discussed the pitfall of following the FD in LVL CHG right into the ground.”
While at 5,000 FT on vectors to intercept the final approach course

- “…the PF performed the LAVS procedure; but instead of pressing the VNAV button after selecting the MDA of 2,100 FT on the MCP, he accidently pressed the FLCH button.”

As a result, the airplane started an immediate descent before the final approach fix.”
PF and PM confirmed that the 4,100 foot restriction was in the MCDU, so the PF switched to FLCH to expedite descent.

When cleared for the ILS, PF put 2,500 in the MCP.

Just prior to FAF, they noticed the aircraft descending through 4,100.
Contributing Factors

- Workload, confusion, situational awareness, distractions and fatigue are some factors found in many of these reports and may have contributed to autoflight related issues.

- Company SOPs have also been cited in several reports.
CFTT Data set information

- http://asrs.arc.nasa.gov/search/reportsets.html
CONTACT INFO

Capt Gary Brauch
ASRS Pilot Safety Analyst
Gary.J.Brauch@nasa.gov

Linda Connell, NASA ASRS
Program Director
Linda.J.C.Connell@nasa.gov
(408) 541-2827