The role of aviation safety information in accident prevention
Contents

- How safe is aviation in this day and age?
- Aviation safety information and accident prevention
- Challenges in aviation safety information
Contents

• How safe is aviation in this day and age?
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• Challenges in aviation safety information
Fatal airliner accidents and moving ten-year average

- 1st generation
- 2nd generation
- Widebodies
- 3rd generation
- 4th generation

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2013 - at 1973 accident rate

6446 fatalities
214 accidents
2013 - at 1993 accident rate

2225 fatalities
99 accidents
2013

265 fatalities
29 accidents

16 Passenger
8 Cargo
4 Ferry
1 Training

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Contents

• How safe is aviation in this day and age?
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Safety information

March 1989

- Fokker F-28
- Dryden, Ontario, Canada
- 24 dead
March 1992

- Fokker F-28
- New York-La Guardia
- 27 dead

A report on an Air Ontario Fokker F.28 accident in 1989 in circumstances similar to those of the 22 March loss of a USAir F.28 was not sent to the US Federal Aviation Administration, as is accepted practice. The “special nature” of the investigation — by a Commission of Inquiry rather than the Canadian Aviation Safety Board — is blamed for the departure from procedure.

The Canadian judge who led the Commission investigating the accident at Dryden, Ontario, criticised USAir sharply for apparently ignoring the December 1990 interim report’s recommendations on de-icing. It has emerged since that no copies of the report were forwarded to any US agency or airline.
**Accident**

An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

a) a person is fatally or seriously injured as a result of:
   - being in the aircraft, or
   - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
   - direct exposure to jet blast,

   except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stairways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which:
   - adversely affects the structural strength, performance or flight characteristics of the aircraft, and
   - would normally require major repair or replacement of the affected component,

   except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

**Incident**

An occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation.

Note.—The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in the Accident/Incident Reporting Manual (Doc 9156).

**Occurrences**

**Incident reporting systems**

8.1 A State shall establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies.

8.2 **Recommendation**.— A State should establish a voluntary incident reporting system to facilitate the collection of information that may not be captured by a mandatory incident reporting system.

8.3 A voluntary incident reporting system shall be non-punitive and afford protection to the sources of the information.

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ICAO Annex 13

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False glideslope report
False glideslope report

**HISTORY OF FLIGHT**

Note: the history of flight has been digitized and made available for download and use by the aircraft operators' voice recorder (CVR) certified by the BEA.

The crew took off from Bordeaux (BOD) for Paris Charles de Gaulle (CDG) with a scheduled time of 12:15. The flight was on a precision approach.

The aircraft was at FL 310. The autopilot 1 was engaged in HDG mode. The speed was steady at 250 kts (in contact with CDG at 310 kts). At 04:58, the controller changed the approach to CDG, with a new target altitude of 250 kts. The crew observed a steady climb in the altitude, and the speed was maintained at 250 kts.

The crew selected 220 kts and 3,000 ft. The DF15 mode remained active. The aircraft's speed and rate of descent decreased, resulting in increasing the deviation from the glide path. The crew corrected the approach. When the aircraft speed reached the target speed of 220 kts, the rate of descent increased again to a value of -1,600 ft/min.
A narrative search was performed on the ASRS database with the key words: ‘False Glide Slope’, ‘False Glideslope’ and ‘False GS’. The result was 57 occurrences related to False Glide slopes. These occurrences were analysed further.

**Example ASRS report number 1054754**
Boeing 737-300, 20 December 2012, altitude 3,000 feet

This event occurred during approach to Runway 28L. The ceiling was approximately 1,500 ft MSL, requiring ATC vectors to the approach. There was other traffic in the area and we were vectored to final behind them. ATC had slowed us to 150 KIAS, which, in our type of aircraft, requires landing gear down, and flaps 15. This is a high amount of drag to have, especially in level flight. I was the pilot flying. I was given an intercept heading to join the localizer, and cleared for the approach. The autopilot was engaged, and I armed the VOR/LOC mode. It was clear that the localizer was going to capture at about the same time as the Glide Slope was intercepted. As soon as the FMA changed VOR/LOC to green (captured), I selected the approach function, and the Glide Slope indication went to green (captured) almost immediately. The Glide Slope indicator then trended downward, showing that we were getting high on the desired path. The autopilot, instead of pitching down to follow the Glide...
False glideslope report

SAFETY ALERT

Date: November 18, 2013

UNEXPECTED AUTOPILOT BEHAVIOUR ON ILS APPROACH

Potential severe pitch-up upset when intercepting the instrument landing system (ILS) glide slope from above, which can lead to approach to stall conditions.

The particulars

- Different types of Instrument Landing System (ILS) glide slope systems are used worldwide. Signal characteristics in the area above the (standard) 3 degree glide slope are system dependent.
- Similar glide slope capture logic in automatic flight control systems (autopilots) is used for the majority of aircraft types currently in service worldwide.
- While intercepting the ILS glide slope signal from above the 3 degree flight path with the automatic flight control system engaged, the aircraft can capture a false glide slope resulting in an unexpected rapid pitch-up command (autopilot surprise).

Preliminary investigative findings

The Dutch Safety Board is investigating a severe and sudden pitch-up upset during an ILS approach to Eindhoven Airport in 2013. The aircraft dropped rapidly to a near stall situation (stall alarm). The crew carried out a go-around. During the investigation the Board has become aware of similar events. Analysis revealed that the common factor linking these events is the ILS antenna type: Murray Capture effect (ILS antenna). The Murray ILS antenna type is used around the world, including at major airports and military air bases in the Netherlands.

Regulations mandate that ILS systems be periodically checked with a Flight Inspection in order to be certified for operational use. The Flight Inspection focuses especially on the 3 degree glide slope area. The signal characteristics in the area above the 3 degree glide slope were examined as part of the Dutch Safety Board’s investigation. Flight tests were conducted to measure the Murray antenna signal and determine the “glide slope field” characteristics above the 3 degree glide path as established on the localizer.

6 RECOMMENDATIONS

Based on the findings and conclusions the Dutch Safety Board made the following recommendations:

The Dutch Safety Board made the following recommendations to the regulators involved with the manufacturing of transport category aircraft: European Aviation Safety Agency (EASA), Federal Aviation Administration (FAA), Agencia Nacional de Aviación Civil (ANAC), Civil Aviation Administration of China, Federal Air Transport Agency (Russian Federation), Japan Civil Aviation Bureau, and Transport Canada.

1. Information and awareness

   Ensure that the established False Glide Slope characteristics and the possible associated consequences for aircraft are made widely known and are modified accordingly in the published manuals and training material used in the aviation sector. This specifically refers to:
   a. the area above and below the published or nominated ILS Glide Path;
   b. the absence of warnings in the cockpit when flying with the automatic flight systems engaged in the area above the published or nominal ILS Glide Path.

2. Short term measures

   Ensure with oversight that aviation operators, manufacturers, and Air Navigation Service Providers take mitigating actions to prevent pitch-up upsets due to aircraft exposure to False Glide Slope Reversal as a result of flying with the automatic flight systems engaged in the area above the published or nominated ILS Glide Path. This can be achieved by means of:
   a. operational measures;
      - raising the issuance of the ILS Glide Slope from below to a Standard or in the event of an interruption from above;
      - developing additional operating procedures;
   b. technical measures;
      - automated on-board systems when in use should not cause a pitch-up upset, at least not without a preceding clearly recognizable warning and with ample time for flight crew intervention.

3. Long term measures

   Stimulate that aircraft manufacturers in the long term develop new landing systems to accommodate new approaches for aircraft with automatic flight systems engaged and ensure that airports are equipped with these landing systems.
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Challenges

Aviation safety information

Spectrum of Safety model (adapted) from J. Burin, FSF

Identify hazards as they appear in accidents

Study past accidents and normal operations to identify hazards and reduce risk

Use data from incidents and normal operations to identify trends and reduce risk before an accident happens.

Reactive  Proactive  Predictive

Single accident data  Consolidated accident and incident data  Accident, incident, operational data
Challenge 1 - use of data available

Aviation safety information

- **Reactive**
  - Identify hazards as they appear in accidents
  - Single accident data

- **Proactive**
  - Study past accidents to identify hazards and reduce risk
  - Consolidated accident and incident data

- **Predictive**
  - Use data from incidents and normal operations to identify trends and reduce risk before an accident happens
  - Accident, incident, operational data

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Challenge 2 - data entry

Quality of data entry

<table>
<thead>
<tr>
<th>Accident Database &amp; Synopsis</th>
<th>Download XML</th>
<th>Download Delimited Text</th>
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<tr>
<td>Error</td>
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

8 found
8 records met your search criteria.

**Notes:**
- On Jan. 1, 2003, dynamic access to the accident data repository was implemented. Static files are no longer available.
- On Oct. 2, 2001, minor cases which do not fall under the definition of "Accident" or "Incident" were removed from the database; these entries were previously identified with "EA" in the accident number.
- On Sept. 10, 2002, data from 1962-1963 were added to the accident database. The format and type of data contained in the earlier briefs may differ from later reports.
- Do not use these fields as selection parameters if your data range includes pre-1982 data, as they did not exist prior to 1982 and their use may falsely limit the data returned.

Aviation Page | Switch to Monthly Lists

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Challenge 2 - data entry

Quality of data entry

41 found

Search: Fokker 28

41 records. Meet your search criteria.

<table>
<thead>
<tr>
<th>Accident Database &amp; Snapshots</th>
<th>Incident Date</th>
<th>Location</th>
<th>Make/Model</th>
<th>NTSB No.</th>
<th>Event Severity</th>
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<td>Foreign</td>
<td>7/2/2010</td>
<td>Warsaw, Poland</td>
<td>Fokker F28</td>
<td>EN511WA008</td>
<td>Incident</td>
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<td>Foreign</td>
<td>5/4/2010</td>
<td>Bogota, Colombia</td>
<td>Fokker F28</td>
<td>DCA05WA058</td>
<td>Incident</td>
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<td>Probable Cause</td>
<td>9/22/2008</td>
<td>Quito, Ecuador</td>
<td>Fokker F28-600</td>
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<td>9/4/2003</td>
<td>Flemington, NY</td>
<td>Fokker F28 Mk.0100</td>
<td>N1450A</td>
<td>Nonfatal</td>
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<td>1/17/2003</td>
<td>Quito, Ecuador</td>
<td>Fokker F28</td>
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<td>Nonfatal</td>
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<td>1/9/2003</td>
<td>Chachapoyas, Peru</td>
<td>Fokker F-28 MK 1000</td>
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<td>3/9/2002</td>
<td>Dallas, TX</td>
<td>Fokker F-28 MK 1000</td>
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<td>FTW02FA003</td>
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<td>10/3/2001</td>
<td>DFW Airport, TX</td>
<td>Fokker F28 Mk 0100</td>
<td>N1419D</td>
<td>FTW01FA127</td>
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<td>Probable Cause</td>
<td>9/15/2001</td>
<td>Belo Horizonte, Brazil</td>
<td>Fokker F28 Mk 100</td>
<td>EN510RA010</td>
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<td>Foreign</td>
<td>7/16/2001</td>
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NTSB online database

Aviation safety information

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## Challenge 3 - taxonomies vs mapping

Do we need a common taxonomy or a common mapping?

<table>
<thead>
<tr>
<th>ECCAIRS 4</th>
<th>Aviation Operations</th>
<th>Data Definition Standard</th>
</tr>
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<tr>
<td>1000000</td>
<td>Commercial Air Transport</td>
<td>Commercial Air Transport</td>
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<tr>
<td></td>
<td>Commercial air transport operation. An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire. Annex 6 Part 1, Chapter 1.</td>
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</tr>
<tr>
<td>1010000</td>
<td>Scheduled air service</td>
<td>Scheduled revenue ops</td>
</tr>
<tr>
<td></td>
<td>Scheduled air service: an air service open to use by the general public and operated according to a published timetable or with such a regular frequency that it constitutes an easily recognizable systematic series of flights which are open to direct booking by members of the public. ICAO DOC 9626.</td>
<td></td>
</tr>
<tr>
<td>1010100</td>
<td>Scheduled international</td>
<td>International</td>
</tr>
<tr>
<td></td>
<td>International air service: A flight with one or both terminals in the territory of a State, other than the State in which the carrier has its principal place of business.</td>
<td></td>
</tr>
<tr>
<td>1010101</td>
<td>Scheduled international passenger flight</td>
<td>Passenger</td>
</tr>
<tr>
<td></td>
<td>A flight carrying one or more revenue passengers. Note: this includes flights which carry, in addition to passengers mail or cargo.</td>
<td></td>
</tr>
<tr>
<td>1010102</td>
<td>Scheduled international cargo flight</td>
<td>Cargo</td>
</tr>
<tr>
<td></td>
<td>This is to be used for all-freight services only. Cargo includes freight, unaccompanied baggage and mail.</td>
<td></td>
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<tr>
<td>1010200</td>
<td>Scheduled domestic</td>
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<td></td>
<td>A flight not classifiable as international. Domestic flight include flights flown between point within the domestic boundaries of an air carrier whose principal place of business is in that State. Flights between a State and territories belonging to it, as well as any flights between two such territories are also classified as &quot;domestic&quot;. This applies even though a flight may cross international waters or over the territory of another State.</td>
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<td>A scheduled flight carrying one or more revenue passengers. Note: The flight may also carry mail or cargo.</td>
<td></td>
</tr>
</tbody>
</table>
Challenge 3 - human vs system

Systems & taxonomies have to adapt to their users, not the other way around
Challenge 4 - formal reports

No easily accessible/searchable repository of formal investigation reports
Challenge 4 - formal reports

Not all formal reports in an ICAO language

Aviation safety information
Challenge 5 - level of investigation

Funding and available manpower determine number of investigations

Recommendation 3

4.43 The committee recommends that the ATSB move away from its current approach of forecasting the probability of future events and focus on the analysis of factors which allowed the accident under investigation to occur. This would enable the industry to identify, assess and implement lessons relevant to their own operations.
Challenge 6 - transparency

Availability of accident information for research

![Image of ECCAIRS for Taiwan Island, ASC-AOR-06-03-001]
Challenge 7 - timeliness

Media and public demand immediate incident information
Aircraft accident prevention

Challenge 8 - safety oversight

Investigation

Interim Safety Recommendations

Final report with Conclusion & Recommendations

- (Emergency) Airworthiness Directives
- Changes in regulations
- Service Bulletins
Challenge 8 - safety oversight

How sharing accident and incident information results in a.o. AD's and effectiveness also depends on country's EI.
Challenge 9 - Safety Recommendations

Safety recommendations of previous investigations regarding safety information

Consequently, the BEA recommends that:

☐ EASA improve the feedback process by making mandatory the operational and human factors analysis of in-service events in order to improve procedures and the content of training programmes; [Recommendation FRAN-2012-052]

and specifically,

☐ that the DGAC take steps aimed at improving the relevance and the quality of incident reports written by flight crews and their distribution, in particular to manufacturers. [Recommendation FRAN-2012-053]
More information:
http://aviation-safety.net

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Aircraft accident prevention

Visualisation missing airliners