



AEROSPACE INFORMATION REPORT

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Loss-of-Control Mishaps in Revenue Airline Service

RATIONALE

Loss-of-control remains a major type of mishap to transport airplanes. These have included several high-profile accidents world-wide which emphasize the need to prevent and recover from loss-of-control incidents. This report reviews loss-of-control events to revenue air carrier flights occurring from 1981 through 2010. This SAE Aerospace Information Report is intended to provide a comprehensive reference and background information pertaining to in-flight loss of control mishaps. It is expected that this report will lead to ARP6149.

INTRODUCTION

Loss-of-control (LOC) is the major cause of transport airplane mishaps. According to the Boeing *Statistical Summary* (1) 20 fatal mishaps (out of 87 total) were caused by LOC during the decade 2001 through 2010. Controlled flight into terrain (CFIT) was second with 17 fatal mishaps. LOC mishaps resulted in 1756 fatalities, more than CFIT with 1007. Adoption of electronic means to mitigate the CFIT risk has reduced CFIT numbers in recent years. No such breakthrough has been evident in LOC mishaps.

Recent high profile mishaps, such as Qantas 072, Colgan 3407, and Air France 447, re-emphasize the importance of preventing LOC. For this reason, this Aerospace Information Report reviews LOC accidents with a goal of finding trends and patterns.

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1. SCOPE

The scope of this document is to provide review of recent history of loss-of-control accidents during airline revenue operations.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

General Operating and Flight Rules, Title 14, Code of Federal Regulations, Part 91; cited as Part 91

Operating Requirements: Domestic, Flag, and Supplemental Operations, Title 14, Code of Federal Regulations, Part 121; cited as Part 121

Operations: Foreign Air Carriers and Foreign Operators of U.S. Registered Aircraft Engaged in Common Carriage, Title 14, Code of Federal Regulations, Part 129; cited as Part 129

Operating Requirements: Commuter and On-Demand Operations and Rules Governing Persons on Board Such Aircraft, Title 14, Code of Federal Regulations, Part 135; cited as Part 135

Airplane Simulator Qualification, FAA-AC-120-40B, July 1991

Stall and Stick Pusher Training, FAA Advisory Circular AC-120-109, August 6, 2012

Upset Prevention and Recovery Training, FAA Advisory Circular AC-120-111, April 14, 2015

Instrument Flying Handbook, FAA-H-8083-15, 2001

Enhanced Upset Recovery Training, FAA-InFO-10010, July 6, 2010

Manual Flight Operations, FAA-SAFO-13002, January 4, 2013

2.1.2 NTSB Publications

Available from NTSB Headquarters, 490 L'Enfant Plaza, SW, Washington, DC 20594, Tel: 202-314-6000, www.nts.gov.

Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft and Preservation of Aircraft Wreckage, Mail, Cargo, and Records, Title 49, Code of Federal Regulations, Part 830; cited as Part 830

2.1.3 ICAO Publications

Available from International Civil Aviation Organization, 999 University Street, Montreal, Quebec H3C 5H7, Canada, Tel: +1 514-954-8219, <http://www.icao.int/>

Aircraft Accident and Incident Investigation, Annex 13 to the Convention on International Civil Aviation, International Civil Aviation Organization; cited as Annex 13

2.2 References cited in this document:

1. Statistical Summary of Commercial Jet Airplane Accidents, Worldwide Operations, 1959-2010, The Boeing Company, Seattle, www.boeing.com/news/techissues/pdf/statsum.pdf, Downloaded 16 January 2012
2. Airplane Simulator Qualification, FAA-AC-120-40B, July 1991
3. Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft and Preservation of Aircraft Wreckage, Mail, Cargo, and Records, Title 49, Code of Federal Regulations, Part 830
4. Aircraft Accident and Incident Investigation, Annex 13 to the Convention on International Civil Aviation, International Civil Aviation Organization; cited as Annex 13
5. B. Cheung, "Nonvisual Illusions in Flight," in Spatial Disorientation in Aviation, F. H. Previc and W. R. Ercoline (eds.), Reston, VA: American Institute of Aeronautics and Astronautics, 2004, Chapter 6
6. Instrument Flying Handbook, FAA-H-8083-15, 2001, p. 5-31-5-33
7. Airplane Upset Recovery Training Aid, Rev 2, November 2008
8. A. A. Lambregts, G. Nesemeier, J. E. Wilborn, and R. L. Newman, Airplane Upsets: Old Problems, New Issues, presented at AIAA Modeling and Simulation Technologies Conference, Honolulu, August 2008, AIAA 2008-6867
9. J. Priest, Quick Look Evaluation of Recurrent In-Flight Simulation Based Advanced Maneuver and Upset Recovery Training, Calspan TM-FRG-URT-0007-R00, September 2007
10. R. Dorsett, Aircraft Accident Reports on DVD, Flight Simulation Systems, Austin, TX, 2006
11. D. Hirschman, "The 'Panic Pull'," *AOPA Pilot*, October 2011, pp. 91-93
12. L. S. Peterson, L. A. Haworth, R. C. Jones, R. L. Newman, R. J. McGuire, A. A. Lambregts, T. McCloy, and T. R. Chidester, An International Survey of Transport Airplane Pilots' Experiences and Perspectives of Lateral/Directional Control Events and Rudder Issues in Transport Airplanes, DOT/FAA/AM-10/14, October 2010
13. R. H. Hoh, T. K. Nicoll, and P. Desrochers, Piloted Simulation Study to Develop Transport Aircraft Rudder Control System Requirements. Phase 2: Develop Criteria for Rudder Overcontrol, DOT/FAA/AR-10/17, November 2010
14. W. C. Ocker and C. J. Crane, Blind Flight in Theory and Practice, San Antonio, Naylor Publishing, 1932
15. Gleim Flight Instructor Refresher Course, Gleim Aviation, Flight Instructor Renewal Course Study Materials, 2012
16. Stall and Stick Pusher Training, FAA Advisory Circular AC-120-109, August 6, 2012
17. L. Knotts, "The NT-33A Variable Stability Aircraft -- Five Decades of Flight Test," presented at SETP Southwest Section Meeting, October 2011
18. J. Priest, Research into Reduction of Loss-of-Control Accident Rate in a Meaningful and Measurable Way Through the use of Innovative Pilot Training Technologies, presented at AIAA Modeling and Simulation Technologies Conference, National Harbor, Maryland, January 2014, AIAA-2014-1005
19. Upset Prevention and Recovery Training, FAA Advisory Circular AC-120-111, April 14, 2015

2.3 Abbreviations and Definitions

2.3.1 Abbreviations

A/P	Autopilot
AC	Advisory Circular
ACAS	Airborne Collision and Avoidance System
AoA	Angle-of-Attack
ASN	Aviation Safety Network
ASRS	Aviation Safety Reporting System (NASA)
ATSB	Australian Transport Safety Bureau
BEA	Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (France)
BFU	Bundesstelle für Flugunfalluntersuchungin (Germany)
C/G	Center of Gravity
CFIT	Controlled Flight into Terrain
ECAM	Electronic Centralized Aircraft Monitor
EFIS	Electronic Flight Instrument System
EICAS	Engine Indication and Crew Alerting System
FAA	Federal Aviation Administration
FBW	Fly-by-Wire
FFS	Full Flight Simulator ¹ ICAOInternational Civil Aviation Organization
IFS	In-flight Simulator
LOC	Loss-of-Control
NASA	National Aeronautics and Space Administration
NTSB	National Transportation Safety Board
PFD	Primary Flight Display
PIO	Pilot-Induced-Oscillation
PND	Primary Navigation Display
SDO	Spatial Disorientation

¹ Level D Simulator (2)

SMS	Safety Management System
TO	Takeoff
TSB	Transportation Safety Board (Canada)
UA(R)	Unusual Attitude (Recovery)
UE(R)	Upset Event (Recovery)
URT	Upset Recovery Training
V _{MC}	Minimum Control Airspeed

2.3.2 Definitions

ACCIDENT (NTSB): 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 and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. (3)

ACCIDENT (ICAO): 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: (4)

- (1) a person is fatally or seriously injured as a result of being in the aircraft, 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 stowaways hiding outside the areas normally available to the passengers and crew: or
- (2) 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
- (3) the aircraft is missing or is completely inaccessible.

AIR CARRIER OPERATIONS: Revenue operations that are:

- (1) Conducted under Part 121 or under equivalent foreign regulations; or
- (2) Conducted as scheduled, multi-engine operations under Part 135 or under equivalent foreign regulations.

INCIDENT: An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations. (3-4)

MISHAP: In the context of this report, an accident or an incident.

SERIOUS INCIDENT (ICAO): An incident involving circumstances indicating that an accident nearly occurred. (4)

SERIOUS INJURY (NTSB): Any injury that:

- (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received;
- (2) results in a fracture of any bone (except simple fracture of fingers, toes, or nose);
- (3) causes severe hemorrhages, nerve, muscle, or tendon damage;

(4) involves injury to any internal organ; or

(5) involves second- or third-degree burns, or any burns affecting more than 5% of the body surface. (3)

SOMATOGRAVIC ILLUSION: The false sensation of body tilt that results from perceiving the direction of a nonvertical gravito-inertial force as being vertical. (5)

UNUSUAL ATTITUDE: An airplane attitude not normally required for instrument flight. (6) It is often used synonymously with upset. Reference (7) describes an upset as an unintentional exceedance of

- Pitch attitude greater than 25 degrees, nose up
- Pitch attitude greater than 10 degrees, nose down
- Bank angle greater than 45 degrees
- Airspeed inappropriate for the conditions

Lambregts et al. (8) modified the attitude limits to match the definition of aerobatic flight found in Part 91: an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration.

UPSET: An airplane unintentionally exceeding the parameters normally experienced in line operations or a control failure or disturbance that alters the normal response of the airplane to pilot input such that the pilot must adopt an *alternate control strategy* to regain and sustain controlled flight. (9)

3. UPSET REVIEW

Air carrier upset accidents were reviewed for the period 1981 through 2010. All Part 121 and scheduled Part 135 (commuter) revenue operations were covered. Equivalent non-U.S. operations were included. Only transport and commuter categories of airplanes were considered. Single-engine airplanes used in scheduled Part 135 operations were excluded. The following databases were reviewed:

- Australian Transport Safety Bureau (ATSB)²
- Canadian Transportation Safety Board (TSB)³
- French Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA)⁴
- German Bundesstelle für Flugunfalluntersuchung (BFU)⁵
- Irish Air Accident Investigation Unit (AAIU)⁶
- National Transportation Safety Board (NTSB)⁷
- International Civil Aviation Organization (ICAO)⁸
- Aviation Safety Network (ASN)⁹

² www.atsb.gov.au

³ www.tsb.gc.ca

⁴ www.bea.aero/en/index.php

⁵ http://www.bfu-web.de/DE/Home/homepage_node.htm

⁶ www.aaiu.ie

⁷ www.nts.gov/ntsb/query.asp

⁸ www.icao.int

⁹ <http://aviation-safety.net/database/>

- Ascend Fleets from Flight Global¹⁰
- Aircraft Accident Report DVD (10)

The keywords used were "loss-of-control," "upset," "unusual attitude," "stall," "crash out of control," and "uncontrolled descent." For the NTSB search, operating rules were restricted to Parts 121, 129, and 135 (scheduled flights only). Following identification from the databases, the accident reports were reviewed. Accidents resulting from midair collisions (e.g., Gol 1907), criminal or deliberate activities (e.g., Egyptair 990), in-flight fire (e.g., UPS 006) or pilot incapacitation (e.g., Helios 522) were culled from the list.

3.1 Incident Data

Ideally, incident data, particularly serious incident data, should be used in a report of this type. A fundamental tenet of Safety Management Systems (SMS) is to make widespread use of incident data to predict accidents trends proactively. Unfortunately, this is not always possible. Many incident reports are incomplete and unverifiable. This is particularly true for the most common reporting system, the NASA Aviation Safety Reporting System. The S-7 Committee made an early decision not to use unverifiable incident reports.

Normally, accident reports present enough data, either in the report or in the supplementary material, to verify the pertinent facts. Recently, many accident investigation agencies are de-identifying accident and incident reports to the extent that they are all but unusable for trend identification.

3.2 Identification of Accidents

There are a number of identification methods used to identify accidents and incidents.¹¹ The most common is to use the geographic location (i.e., Roselawn). This is often an obscure town near a major airport. Another approach is to list the airline and flight number (i.e., Simmons 4184). A third possibility lists the airport, often by the ICAO identifier (i.e., KORD, for Chicago O'Hare). Many national investigation agencies use the aircraft registration (i.e., N-401AM). Finally, aircraft manufacturers use the aircraft serial number (i.e., 401). This multiplicity of reference formats for the same mishap is a potential source of confusion.

In this report, particularly since we confine the results to airline operations, each accident will be identified by airline and flight number. The ICAO operator code is used, where known. IATA or FAA operator codes are used if the ICAO identifier is not known or does not exist. In some cases, the flight number is not known and the flight number will use the last two characters of the aircraft registration. If the operator code is not known, then the full aircraft registration is used.

4. RESULTS

202 mishaps were identified resulting in 9072 onboard fatalities with an additional 214 ground fatalities. There were 610 serious injuries to airplane occupants and an additional 20 on the ground. Forty-four percent happened at night and 53% occurred during instrument conditions as shown in Table 1.

Table 1 - Flight conditions

Flight Conditions	Day	Night	Twilight	Total
Visual Conditions	31%	16%	1%	47%
Instrument Conditions	23%	28%	2%	53%
Total	54%	44%	3%	100%

Thirty-one percent (85 mishaps) occurred during takeoff/initial climb. Other phases of flight with large proportion of mishaps were climb (44 mishaps-16%), cruise (43 mishaps-15%), and approach (42 mishaps-15%). Figure 1 shows the distribution of mishaps by phase of flight.

¹⁰ www.ascendworldwide.com.

¹¹ All of the accident references in this paragraph are alternate references to the accident to Simmons Flight 4184, N-401AM, near Roselawn, Indiana, October 31, 1994.

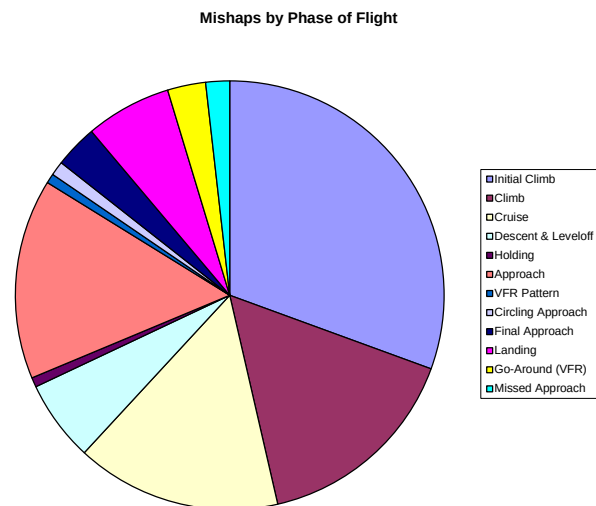


Figure 1 - Mishaps distributed by phase of flight

Details of the mishaps are shown in the two appendices. Appendix A lists and summarizes the mishaps. Appendix B shows brief descriptions of each one.

The results are summarized in Tables 2 and 3.

4.1 Aerodynamic Stalls

There were sixty accidents (2550 fatalities) involving stalls either as the primary cause or as a consequence of the upset. There were a wide variety of models:

- 36 Jet transports: 16 different models¹²
- 24 Prop transports: 14 different models¹³

Ten stalls (336 fatalities) were the result of the autopilot flying the airplane into a stall. Six different models were involved in these stalls. One model (SF-340) had three such stalls and two models, one jet (MD-80) and one turboprop (E-120), had two such stalls.

¹² Counting DC-9 and MD-80 as the same model.

¹³ Counting ATR-42 and ATR-72 as the same model and Jetstream 31 and 41 as the same model.

Table 2 - Primary cause of upset mishaps

Primary Cause	Jet Aircraft		Propeller Aircraft		All Aircraft	
	No	Fatal	No	Fatal	No	Fatal
Aerodynamic Stall Stall Autopilot-induced stall Icing stall	22	1315	21	277	43	1592
Flight Controls Flight control integrity lost Autopilot malfunction Flight control hardover Flight control disconnected Jammed/binding flight control Flight control hydraulic failure Pilot-induced-oscillation Uncommanded bank or pitch Flight control software logic	28	1225	12	95	40	1320
Pilot Involvement Vmc loss-of-control Incorrect takeoff configuration Attempt to override autopilot Failed to maintain control Abrupt/aggressive maneuver Inadvertent control input	19	1292	13	203	32	1495
Spatial Disorientation Spatial disorientation Somatogravic illusion Instrument failure	18	1329	5	58	23	1387
Atmospheric Disturbances Windshear Turbulence Wake Vortex	19	1072	3	68	22	1140
Airframe Ice Takeoff with contaminated airfoil Inflight contaminated airfoil Tailplane stall	10	473	7	169	17	642
Propulsion System	3	319	1	23	4	342
Hydraulic System	1	111			1	111
Other	6	530	8	191	14	721
Undetermined	3	228	4	94	7	322
Total	129	7894	74	1178	203	9072

Table 3 - Factors in upset mishaps

Primary Cause	Jet Aircraft		Propeller Aircraft		All Aircraft	
	No	Fatal	No	Fatal	No	Fatal
Pilot Involvement	45	2607	21	382	66	2989
Aerodynamic Stall	36	2257	24	293	60	2550
Improper Recovery	26	2175	16	306	42	2481
Flight Controls	40	2198	14	163	54	2361
Spatial Disorientation	24	1790	10	104	34	1894
Atmospheric Disturbance	23	1072	3	68	26	1140
Inappropriate Takeoff Attempt	16	864	2	51	18	915
Airframe Ice	12	473	17	206	29	679
Totals don't match. Many mishaps have multiple factors.						

4.2 Flight Control Malfunctions

Fifty-four mishaps (2361 fatalities) involved the flight control system.

- 4 autopilot-induced stalls (305 fatalities)
- 3 instances of spatial disorientation (341 fatalities)
 - 1 lack of tactile feedback from sidesticks (113 fatalities)
 - 1 control dynamics change from sensor failure (228 fatalities)
 - 1 autopilot disconnection with asymmetric thrust (no fatalities)
- 40 flight control malfunctions (such as hard-overs, runaway trim, etc.)
 - 11 non-FBW prop airplanes (68 fatalities)
 - 15 non-FBW jet airplanes (1223 fatalities)
 - 5 FBW jet airplanes (no fatalities)

Table 4 compares jet transports with propeller transports. Table 5 compares FBW jet transports with non-FBW jet transports.

Table 4 - Flight control factors in upsets

Primary Cause	Jet Aircraft		Propeller Aircraft		All Aircraft	
	No	Fatal	No	Fatal	No	Fatal
Aerodynamic Stall	3	305	7	31	10	336
Flight Controls						
Flight control integrity lost	2	630	4	57	6	687
Flight control system	2	164			2	164
Flight control hardover	3	157	1	4	4	161
Flight control disconnected	1	132	4	7	5	139
Jammed/binding flight control	2	88	1		3	88
Uncommanded bank	2	52			2	52
Pilot-induced-oscillation	4	2	1	27	5	29
Autopilot	3				3	
Flight control software logic	2				2	
Unexpected control gains	2				2	
Uncommanded pitch	2				2	
Trim controls	1				1	
Flight control mode change	1				1	
Uncommanded spoiler extension	1				1	
Flight control actuator			1		1	
Pilot involvement	3	63			3	63
Spatial disorientation	3	341			3	341
Atmospheric disturbance	2	260			2	260
Airframe Ice			1	68	1	68
Other	1	4			1	4
Total	40	2198	20	194	60	2392

Table 5 - FBW and conventional light control factors in jet transport upsets

Primary Cause	FBW Flt Cntrls		Conv Flt Cntrls		All Aircraft	
	No	Fatal	No	Fatal	No	Fatal
Aerodynamic Stall			3	305	3	305
Flight Controls						
Flight control integrity lost			2	630	2	630
Flight control system			2	164	2	164
Flight control hardover			3	157	3	157
Flight control disconnected			1	132	1	132
Jammed/binding flight control			2	88	2	88
Uncommanded bank			2	52	2	52
Pilot-induced-oscillation	3		1	2	4	2
Autopilot			3		3	
Flight control software logic	2				2	
Unexpected control gains	2				2	
Uncommanded pitch	1		1		2	
Trim controls			1		1	
Flight control mode change	1				1	
Uncommanded spoiler extension			1		1	
Flight control actuator					0	
Pilot involvement			3	63	3	63
Spatial disorientation	2	341	1		3	341
Atmospheric disturbance	1		1	260	2	260
Airframe Ice					0	0
Other			1	4	1	4
Total	12	341	28	1857	40	2198



4.3 Faulty Recoveries

Forty-two mishaps (2481 fatalities) involved faulty recovery techniques. We did not include an otherwise correct recovery that was unsuccessful because of the low altitude.

- 22 stalls (833 fatalities)
- 11 spatial disorientation encounters (833 fatalities)
- 2 wake vortex encounters (260 fatalities)
- 8 Other faulty recoveries (235 fatalities)

The most common theme is failure to reduce angle-of-attack (AoA). It appears that many pilots respond to upsets by pulling back on the stick. (11)

A second recurring theme is application of rapid rudder reversals. This appears to be much more common than previously thought. (12-13)

4.4 Spatial Disorientation

There were 34 mishaps (1894 fatalities) in which SDO played a factor.

- 19 traditional¹⁴ spatial disorientation (1040 fatalities)
- 4 occurred during or following a stall (147 fatalities)
- 4 somatogravic illusion during takeoff or missed approach (347 fatalities)
- 3 occurred following instrument failures (46 fatalities)

Ten mishaps resulted in classic spiral dives with 596 fatalities). Five models -- no FBW airplane -- were represented. Bank angle aural warnings¹⁵ were heard on the CVR in four mishaps (454 fatalities).

Three mishaps (246 fatalities) occurred where the mix of pilots with extensive experience on Russian style attitude indicators (outside-in) were flying western attitude indicators (Inside out). Early attitude indicators used a fixed horizon line with a moving airplane symbol. (14) Later, indicators with a fixed airplane symbol and a moving horizon were developed. Human factors researchers use the term "outside-in" to describe this format since the display is that of a view looking at the airplane from the rear. This format was adopted by Russia and Eastern bloc countries. An alternative approach uses a fixed airplane symbol and a moving horizon line. Human factors researchers use the term "inside-out" to describe this format since the view is that of looking through the windshield. This approach was adopted by the rest of the world. With Western cockpits becoming common among former Eastern bloc countries, many pilots experienced in outside-in displays are flying in-side out displays. This presents a problem for experienced Eastern bloc pilots who may not be able to ignore their early experience in stressful situations.

¹⁴ Excludes instrument failures and somatogravic illusions

¹⁵ Three aural warnings were automated "bank angle" warnings and one was the first officer repeating calls of overbank and wrong direction.

4.5 Pilot Involvement in Cause

Thirty-four mishaps (1526 fatalities) were caused directly by pilot actions.

- 13 involving engine failure and VMC loss of control (405 fatalities)
- 7 pilots simply failed to maintain control of the airplane (426 fatalities)
- 6 attempted takeoffs with incorrect configuration (391 fatalities)
- 4 pilot attempts to overpower the autopilot (264 fatalities)
- 2 abrupt maneuvers from both pilots providing sidestick inputs (none fatal)
- 1 in flight selection of beta (9 fatalities)
- 1 inadvertent control input (not fatal)

One of the attempted takeoffs with incorrect configuration was a takeoff with full nose-up trim. The others were flap-up takeoff attempts.

4.6 Atmospheric Disturbances

Twenty-one mishaps (1140 fatalities) involved flight through an atmospheric disturbances.

- 9 mishaps involving turbulence (333 fatalities)
- 7 mishaps caused by an encounter with a wake vortex (269 fatalities)
- 5 mishaps caused by wind shear (538 fatalities)

4.7 Takeoff Mishaps

Fifty-six mishaps (2466 fatalities) happened during takeoff and initial climb.

- 12 takeoff mishaps with ice or frost on the wings (524 fatalities)
- 10 stalls after liftoff (514 fatalities)
- 9 takeoff mishaps resulting from FCS failure (116 fatalities)
- 6 takeoff mishaps with an incorrect configuration (391 fatalities)
- 5 encounters with windshear, etc. (381 fatalities)
- 5 engine failure followed by a V_{MC} departure (168 fatalities)
- 6 other causes (250 fatalities)
- 3 undetermined causes (122 fatalities)

4.8 Airframe Ice

Thirty-one icing-related mishaps resulted in 765 fatalities. Twelve happened when takeoffs were made with contaminated wings resulting in most of the icing-related fatalities (524 fatalities).

There were twenty upsets with 243 fatalities during up-and-away flight.¹⁶

All but two of the up-and-away mishaps happened with boot-equipped airplanes.

- 16 Mishaps to Booted Turboprop Airplanes
 - 10 stalls (37 fatalities)
 - 5 non-stall icing mishaps (173 fatalities)
 - 1 tailplane stall (no fatalities)
- 2 Mishaps to Heated Wing Turboprop Airplanes
 - 1 stall (2 fatalities)
 - 1 tailplane stall (13 fatalities)
- 2 Incidents to Jet Airplanes
 - 2 PIO Incidents on Unprotected Flap Airfoils (no fatalities)

4.9 Pilot Experience

The reduction of pilot experience from 1981 through 2010 was examined. The data is sparse. While there is a downward trend in experience since 1980, low pilot experience doesn't appear to stand out as a factor. There appears to be no consistent difference between North American carriers and worldwide. Although commuter pilots in general have less time, and there were fewer commuter operations in the 1980s. Tables 6 through 8 show the data.

In reviewing the mishap reports, it appears that investigating teams are not rigorous in recording pilot experience in the factual investigation reports, particularly for second pilot, even if the second pilot was the pilot flying.

Table 6 - Pilot experience in upset mishaps by aircraft type

Aircraft Type	Pilot		Copilot	
	Total	In Type	Total	In Type
Jet Transports	12698	2648	5712	1482
Propeller Transports	8494	2164	4479	745
All Transport Aircraft	11309	2477	5339	1226

Table 7 - Pilot experience in upset mishaps, 1981-2010, North American carriers

Decade	Pilot		Copilot	
	Total	In Type	Total	In Type
1981-1990	13927	2872	6396	1234
1991-2000	10198	2278	5669	1466
2001-2010	8200	2403	3713	489
Entire Period	10927	2487	5459	1234

¹⁶ These include all upsets other than attempted takeoffs with ice-contaminated airfoils.

Table 8 - Pilot experience in upset mishaps worldwide

Operator's Region	Pilot		Copilot	
	Total	In Type	Total	In Type
North America	10927	2487	5459	1234
South America	(a)	(a)	(a)	(a)
Western Europe	10226	1929	4382	1419
Eastern Europe	9107	1350	7475	529
Asia (exc Middle East)	9890	2857	4067	1450
Africa	17317	2060	5409	3143
Middle East	15654	4114	3583	525
Australia	7804	2704	7804	1570
Oceania	(a)	(a)	(a)	(a)
Worldwide	11309	2467	5359	1239
(a) Insufficient data for a meaningful comparison				

4.10 Chronological Changes in Mishap Patterns

A significant question is "What are the changes in mishaps over the period 1981 to 2010. Table 9 shows the accident causes on a decade by decade basis.

Table 9 - Accident causes on a decade-by-decade basis

Primary Cause	1981 - 1990		1991 - 2001		2001 - 2010	
	No	Fat	No	Fat	No	Fat
Stall	12	538	10	454	21	600
Flight Controls	11	786	16	493	13	41
Pilot Involved	7	316	16	844	9	335
SDO	2	45	10	355	11	987
Atm Disturbance	10	517	7	97	5	526
Icing	6	345	7	242	4	55
Propulsion			4	342		
Hydraulic	1	111				
Other	6	222	3	207	5	292
Undetermined	1	38	2	118	4	166
Total	56	2918	75	3152	72	3002

It is difficult to make quantitative arguments considering the limited sample size and the absence of hours flown worldwide. The number of spatial disorientation mishaps is increasing as is the number of fatalities. Icing mishaps are down both in numbers and in fatalities. The number of atmospheric disturbances is decreasing although the number of fatalities does not show a consistent trend. The number of stall mishaps is increasing, but the number of fatalities appears constant.

5. DISCUSSION

5.1 Instrument Skills

Many upsets were identified where manual instrument flying skills appeared to be lacking. There clearly has been a change in emphasis from "stick and rudder" skills to "system management." This begins with initial pilot training in light airplanes. Recent flight instructor training emphasizes that decision making skills are to be emphasized over stick and rudder skills. To quote from the course material: "'Stick and rudder' skills are no longer the primary focus." (15)

Many upsets begin with disconnection of the autopilot, degraded handling, and/or systems faults. When coupled with reduced instrument skills from lack of use, it shouldn't surprise us when the crew has difficulty in regaining control.

There is a critical need to address the loss of instrument skills in pilots today. This must take into account the minimal amount of hand-flying in airline operations today. In addition, many of these upsets are a result of failure of the automation with the pilot being given manual control of the airplane in difficult circumstances.

5.2 Stall Prevention and Recovery

5.2.1 Stall Training

The primary problem is the failure of many pilots to aggressively reduce the AoA. This is very likely a result of over-emphasis on minimizing loss of altitude. Pilots are trained to “power out” of approaches to stalls, rather than actually recover from a stall. Recently, the FAA published an Advisory Circular (16) which proposes to change the criteria for air carrier stall training to emphasize angle-of-attack reduction over minimizing altitude loss. While it is too early to measure the effect of this Advisory Circular, it is clearly a step in the right direction and should be followed by similar recommendations for primary training and general aviation as well.

However, the Committee is concerned that some existing simulators cannot be reliably used for stall training, particularly in high altitude, out-of-trim conditions, or during steep turns. While simulators can potentially be useful in these flight regimes, such use requires flight test and aerodynamic data that is not always available. The AC stresses the need for motion cues to allow the pilot trainee to recognize and feel the differences as the airplane approaches the stall. These differences are subtle. Training simulators, at this stage of their development, do not have realistic motion cues. Motion cues can help, but misleading motion cues can provide negative transfer of training. For this reason, we recommend that stall and upset training should be in a fully validated simulator using data throughout the achievable flight envelope, not just the normal flight envelope. The final validation of training effectiveness must take place in flight.

5.2.2 Envelope Protection

The data clearly shows that FBW airplanes equipped with envelope protection are extremely effective in preventing stall mishaps. During the time period studies, there were no in-service stall mishaps in an airplane with a functional envelope protection system onboard. AFR 447 did become stalled, however the alpha-protection had been disabled by a sensor failure. Two airplanes¹⁷ are presently certified with retrofit envelope protection systems.

5.3 Spatial Disorientation

The problem of SDO follows from the deterioration of instrument skills. However, simply improving pilot instrument skills may not be sufficient. Pilot training should include specific spatial disorientation training on unusual attitude recognition and recovery. This should include specific illusions, such as the somatogravic illusion which may lead a pilot into perceiving a much higher pitch attitude during a go-around.

There is some indication that standby attitude instruments may not be providing adequate cues. The approval process for standby indicators should include upset recognition and recoveries from both pilot seats. Both primary and standby attitude indicators could provide graphic cues to clearly show the pilot the angular relationship of AoA. This would aid in preventing the situation where the airplane descends into the ground with the stick back as in AFR 447.

An air-mass flight path angle, such as the Klopstein format demonstrated in the Air Force variable stability NT-33, should be evaluated further (17).

5.4 Upset Training Effectiveness

Research in aircraft Advanced Maneuver and Upset Recovery Training (AM-URT) has been sponsored by a number of government and industry organizations, including NASA, FAA, US Navy, and several commercial airlines. (9, 18) One study included simulator evaluations intended to assess incremental effects of the three training venues: Classroom training, simulator training¹⁸, and flight training¹⁹, to assess the relative benefits of each.

¹⁷ The two airplane models are Cirrus SR-20 and King Air 200.

¹⁸ Ground based training in a Level D simulator.

¹⁹ All flight training was given in an in-flight simulator.

This research is summarized in the following points:

- Classroom training formed the basis of all the training programs.
- Pilots participating in these studies generally did not have the knowledge or skills to successfully recover from an upset event prior to the upset recovery training provided during the study.
- Pilots were much better at recovering from simple unusual attitudes where there were no aircraft malfunctions or extenuating factors.
- Pilots had significant difficulty and were often unable to recover from upset events which were precipitated by an aircraft malfunction or external factor and required an alternate control strategy to successfully recover the aircraft (e.g., bank to control pitch, rudder to control roll, etc.).
- Pilots' performance increased after being provided upset recovery training in a ground simulator. In the studies where simulator training was provided, care was taken to ensure:
 - The maneuvers flown in the simulator did not exceed envelopes defined by flight test or wind tunnel data
 - The simulator was evaluated for suitability for upset training by subject matter experts
 - The pilots were briefed on the differences between the simulator and the actual airplane during upset recovery events (e.g., lack of motion and "g" cues)
- For pilots who received upset recovery flight training (IFS) after simulator training, their performance increased further after the flight training. This increase was significant for upset events caused by a flight control malfunction that required an alternate control strategy.
- When one group of pilots received flight training and a second group received ground simulator training, the group that received flight training performed better than the group that received ground simulator training. The difference was significant for upset events caused by a flight control malfunction that required an alternate control strategy.

The data indicated that pilot awareness, performance, and ability to execute recoveries were distinctly different for recovery categories (UAR and UER). Consequently, these are treated separately.

5.4.1 Unusual Attitude Recovery

The contribution that each training venue made to the total improvement in recovery scores for the unusual attitude recovery maneuver set is shown in Figure 2. The classroom phase of training accounted for 19% of the total improvement. Over half of the improvement was due to the ground simulation phase of training (54%). The flight training phase of the training contributed an additional 27% improvement in recovery scores. As noted previously, the pilots came into the study with a basic knowledge of unusual attitude recovery. They all reported having accomplished such training in an aircraft at some point in their career. While they gained additional understanding during the classroom phase of the specific issues related to unusual attitude recoveries in transport aircraft, they showed the greatest improvement to their scores from receiving hands-on training in the simulator where they learned type-specific techniques. The flight training further improved their scores but, as they entered that phase of the training with preexisting aircraft experience, the incremental improvement was less.

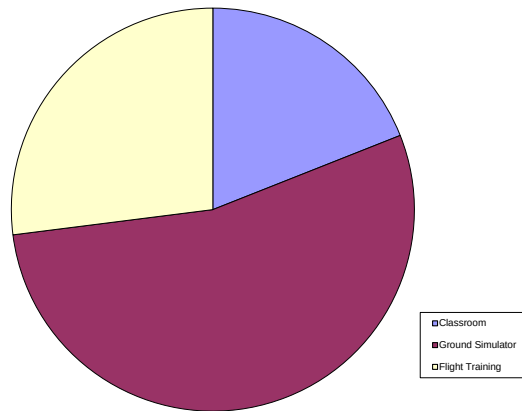


Figure 2 - Training effect for UAR maneuvers

5.4.2 Upset Recovery

None of the pilots reported more than a very limited knowledge of the issues associated with upset recovery prior to the training. This was particularly true where some internal failure or external event caused the aircraft to be upset such that the pilot had to adopt a novel control strategy in order to make a successful recovery. Consequently, the classroom phase of the training had a very significant contribution to performance improvement and increase in awareness (47%). Due to the pilots' inability to effectively utilize the limited cues provided by the ground simulator, this training resulted in only a marginal improvement in performance (17%). The airborne training provided the critical real-world motion cues necessary for accurate identification of the upset event and efficient recovery (37%). Figure 3 illustrates this.

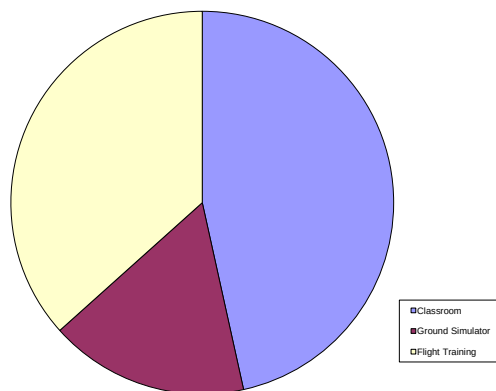


Figure 3 - Total training effect for UER maneuvers

Based on analysis of the data, recorded evaluator comments, and post-experiment review of cockpit video recordings, errors and improvements in performance noted in the two maneuver categories for each phase of training are summarized below. These observations were documented from each of the Ground Simulation evaluations.

In stark contrast to the unusual attitude recovery data, pilots were generally not able to reliably diagnose the upset events and execute the recoveries prior to the classroom training. Most pilots did not come armed with the requisite *alternate control strategies* necessary for a successful recovery. Often the roll event was misdiagnosed as a yaw event and vice versa. As the recovery techniques are night-and-day different, if not corrected, this misdiagnosis resulted in an unsuccessful recovery. Prior to the classroom instruction, most pilots did not understand the underlying aerodynamic principals governing the events. However, some pilots had a technique for recovering from the yaw event – namely input full rudder and apply asymmetric thrust. When asked, they reported that they had “picked it up along the way” from training in other aircraft or through informal channels (urban legend). Those who possessed this technique tended to implement it too aggressively. Few had the concept of loading versus unloading to increase or decrease the effect of roll due to sideslip. After the instruction, performance improved significantly but two discrepancies were noted that limited this improvement. First, the new aerodynamic concepts learned were not always correctly or fully understood. For example, those who had the critical load-versus-unload ideas backward performed worse when they attempted to apply it to their recovery strategy. Second, even armed with the knowledge, some struggled to correctly apply it to their recovery techniques having had little or no practice in doing so. Most pilots did not verbalize their analysis of the circumstance or any aspect of the recovery. However, in the case of upsets it appeared that this was more due to their not knowing for certain what was causing the upset and what exactly they should do about it.

While the level of understanding and the techniques for recovery improved with the ground simulation training, this was limited due primarily to the misdiagnosis of the events and the requisite misapplication of recovery techniques. In other words, in many cases the *wrong* technique was *correctly* applied. The roll event was misdiagnosed as a yaw event and vice versa. Misdiagnosis of the events was likely exacerbated by the cue-deficient environment of the simulator. For example, the lack of a significant lateral-kick when the rudder went hard-over (yaw upset) resulted in it being misdiagnosed as the roll event at the onset of roll-due-to-sideslip. Furthermore, in contrast to the unusual attitude recoveries, none of the pilots had ever experienced the upset events in the full-cue in-flight environment and, therefore had an incomplete picture of the event's look-and-feel. This resulted in a less efficient use of the cues that were available to execute the given recovery. Generally the magnitude and speed of inputs increased as the pilots gained more confidence in their technique. For some, this resulted in overly aggressive inputs as they attempted to keep the airplane from being at all *upset* and this proved problematic for two reasons. First, in cases where the initial inputs were incorrect this resulted in an immediate and unrecoverable loss-of-control. Second, when the risk of LOC would not have been significantly elevated had the aircraft been allowed to be slightly upset, a judicious application of recovery controls (measured response) would have been superior because it would have lessened the loads put on the airplane. Verbalization of the upset events was more prevalent following ground training. Knowledge of the causal factors and confidence in the appropriate recovery improved after the training.

By far, the largest increase in knowledge, understanding, and performance occurred during flight training. The misdiagnosis of the events and the requisite misapplication of recovery techniques were virtually eliminated. Most notably, after having felt the differences between the roll and yaw events, the pilots were able to accurately distinguish one from the other. After this phase of training, the *correct* technique was almost always *correctly* applied.

5.4.3 Final Comments on Unusual Attitude Recovery

During the final review of this report, the FAA published Advisory Circular AC-120-111 (19) which provides guidelines for conducting upset prevention and recovery training. This document makes many of the same points as are made in this report.

We are also concerned that many of the training approaches have been incompletely validated. A training syllabus is developed and the success criteria is "can the student recover the simulator from an unusual attitude?" At the very least the success of the syllabus should be based on "Can the student recover the airplane from an unusual attitude?" This means that sufficient data must be obtained in flight before releasing the syllabus to the training departments.

5.5 Takeoff Mishaps

There were six takeoff mishaps where the configuration was improperly set. While there is a certification requirement for a takeoff warning system; this requirement may be inadequate. Perhaps §25.703 should be amended to require that takeoff be prevented with an improper configuration. This would be similar to §25.670(a) for flight control gust locks.

There were thirteen takeoff mishaps where the wings were contaminated with ice or frost (546 fatalities). The Committee is concerned that these mishaps keep happening.

5.6 Up-and-Away Icing Mishaps

There were twelve up-and-away icing accidents reported (ignoring two tailplane stalls):

- 1 heated wing airplane (2 fatalities)
- 11 boot-equipped airplanes (6 different models - 228 fatalities)

In view of these numbers, the Committee questions the continued certification of pneumatic boots on transport airplanes?

6. CONCLUSIONS

The Committee is quite concerned about the deterioration in the basic flying skills of pilots today. The industry must take a long, hard look at the trends with pilot training emphasizing "management skills" and the de-emphasis of "basic flying skills." As we have seen, every now and then, the pilot has to set aside his management skills and revert to basic "fly the airplane."

The Committee feels that many pilots today do not maintain their hand flying skills from lack of practice. We feel that the industry must provide a means for pilots to maintain proficiency.

7. RECOMMENDATIONS

The S-7 Committee recommends the following:

To training organizations:

- Ensure that piloting skills are trained and maintained to include the full spectrum of automation including manual flight, use of raw data, flight directors, autopilot, FMS, etc.
- Ensure that upset recovery training includes a proper blend of classroom, ground-based simulation, and flight training.
- Ensure that training conducted in simulators does not exceed envelopes defined by valid flight test or wind tunnel data.
- Ensure that training conducted in ground-based simulators includes adequate briefing for trainees on differences between airplane motion cues and simulator motion cues.
- Ensure that instructors for upset recovery training have received upset recovery training in flight
- Final validation of training effectiveness must be conducted in flight.²⁰

To the Industry as a whole:

- Ensure that flight operations, standard operating procedures, and company policies allow pilots to maintain their basic flying skills.

²⁰ This should be interpreted as validating the effectiveness of the training curriculum following its development and does not necessarily apply to each pilot trained.

- Adopt an industry standard that pilots must be proficient throughout the full automation spectrum and that pilots must be able to maintain this proficiency.
- Continue the development of simulators with sufficient data to cover the high AoA regime with adequate motion cues.
- Develop and evaluate displays to graphically present angle-of-attack information in high AoA situations as an aid to stall and upset recovery.
- Develop displays to cue the pilot to developing SDO scenarios and to provide guidance to recover the airplane to controlled flight.
- Develop and install retrofit and forward-fit envelope protection as a mitigation technique.

To regulatory agencies:

- Expand the air carrier training Advisory Circular (16) to the entire aviation community, including general aviation and primary flight training.
- Consider amending the takeoff warning systems requirement (§25.703) to require a means of preventing takeoff with an improper configuration, similar to §25.670(a) for flight control gust locks.
- Consider amending the ice protection requirements (§25.1419) to require prevention on ice accretion on critical airfoils instead of allowing accretion followed by removal.
- Ensure that incident reporting programs are in place to provide verifiable incident data for prediction of accident trends.

To accident investigative agencies:

- Ensure that pilot experience (including second pilot data) is documented during the accident investigation. A return to the NTSB *Preliminary Report Aviation* form would help.
- Ensure that incident reporting programs are in place to provide verifiable serious incident data for prediction of accident trends.

8. NOTES

8.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications nor in documents that contain editorial changes only.

PREPARED BY SAE COMMITTEE S-7. FLIGHT DECK AND
HANDLING QUALITIES STANDARDS FOR TRANSPORT AIRCRAFT

APPENDIX A – LIST OF MISHAPS

No	Date	Aircraft	Ident	Loc'n	Phase	Fat	Dam	Result	Occurrence	Category
1	07-May-81	BAC-111	AUT 901	SABE	Approach	31	D	Uncontrolled Descent to Gro	Turbulence	AtmDist
2	26-Jun-81	HS-748	DAN 240		Descent	3	D	Uncontrolled Descent to Gro	Flight Control Integrity Lost	FCS
3	09-Jul-81	Howrd-500	KFA KFN	CYYZ	Initial climb	3	D	Uncontrolled Descent to Gro	Stall	Stall
4	20-Jul-81	F-27	SOM 40		Climb	50	D	In-flight Breakup	Turbulence	AtmDist
5	22-Aug-81	B-737	FEA 103		Climb	110	D	In-flight Breakup	Flight Control Integrity Lost	FCS
6	06-Oct-81	FO-28	NLM 431		Climb	17	D	In-flight Breakup	Turbulence	AtmDist
7	13-Jan-82	B-737	FLZ 90	KDCA	Initial climb	74	D	Uncontrolled Descent to Gro	Stall	Stall
8	28-Jun-82	Yak-42	AFL 8641		Cruise	132	D	Uncontrolled Descent to Gro	Flight Control Disconnected	FCS
9	06-Jul-82	IL-62M	AFL 411	UUEE	Initial climb	90	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
10	09-Jul-82	B-727	PAA 759	KMSY	Initial climb	145	D	Uncontrolled Descent to Gro	Wind Shear	AtmDist
11	09-Dec-82	F-27A	ANS 304	SCSE	Approach	46	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
12	11-Jan-83	DC-8	UAL 2885	KDTW	Initial climb	3	D	Spiral Dive Into Ground	Attempted TO W/Mis-set Trim	Crew Inv
13	15-Feb-83	DHC-6	SPA 868	KSUN	Final approach - no	0	D	Uncontrolled Descent to Gro	Flight Control Disconnected	FCS
14	29-Apr-83	SE-210	SAN 832	SEGU	Approach	8	D	Collision W/Terrain	Stall	Stall
15	08-Jun-83	L-188C	RAA 68R	PACD	Cruise	0	S	Diversion	Jammed Flight Controls	FCS
16	24-Nov-83	L-1011	ACA 965	KCHS	Climb	0	N	Cabin Injuries	Turbulence	AtmDist
17	21-Jul-84	DHC-6	SPI 3SP	TAV	Landing flare	1	D	Collision W/Obstacle	Flight Control Disconnected	FCS
18	06-Dec-84	E-110	PBA 1039	KJAX	Initial climb	13	D	Uncontrolled Descent to Gro	Flight Control Integrity Lost	FCS
19	23-Dec-84	Tu-154	AFL 338	UNKL	Climb	110	D	Engine Shutdown Command	Improper Engine Failure Recover	Other
20	09-Jan-85	L-188A	TPI 57Q	KMKC	Missed approach	3	D	Uncontrolled Descent to Gro	Stall	Stall
21	19-Jan-85	IL-18D	CUB 899		Cruise	38	D	Uncontrolled Descent to Gro	Undetermined	Undet
22	21-Jan-85	L-188C	GAL 203	KRNO	Initial climb	70	D	Uncontrolled Descent to Gro	Stall	Stall
23	05-Feb-85	DC-9	ABX 6AX	KPHL	Initial climb	0	D	Collision W/Terrain	Attempted TO W/Contaminated	Icing
24	19-Feb-85	B-747SP	CAL 6	KSFO	Cruise	0	S	Upset	Autopilot	FCS
25	23-Jun-85	E-110P	TAB GJN	SIZX	Approach	17	D	Uncontrolled Descent to Gro	Stall	Stall
26	10-Jul-85	Tu-154B	AFL 7425		Cruise	200	D	Uncontrolled Descent to Gro	Stall	Stall
27	02-Aug-85	L-1011	DAL 191	KDFW	Landing	134	D	Collision W/Terrain	Wind Shear	AtmDist
28	12-Aug-85	B-747SR	JAL 123		Cruise	520	D	Uncontrolled Descent to Gro	Flight Control Integrity Lost	FCS
29	06-Sep-85	DC-9	MEP 105	KMKE	Initial climb	31	D	Uncontrolled Descent to Gro	Stall	Stall
30	10-Oct-85	IAI-1124	QH 474	YSSY	Cruise	2	D	Spiral Dive Into Ground	Loss Of All Attitude Displays	Other
31	12-Dec-85	DC-8	ARW 0JW	CYQX	Initial climb	256	D	Collision W/Terrain	Attempted TO W/Contaminated	Icing
32	31-Jan-86	SC-360	EIN 328	EGNX	Approach	0	D	Collision W/Terrain	Contaminated Airfoil	Icing
33	02-Mar-86	An-24B	AFL 423	UWKB	Approach	38	D	Uncontrolled Descent to Gro	Stall	Stall
34	07-Apr-86	DC-10	SAB SLB		Descent	0	M	Upset	Wake Turbulence	AtmDist
35	16-Jan-87	Yak-40	AFL 505	UTTT	Initial climb	9	D	Collision W/Terrain	Wake Turbulence	AtmDist
36	04-Mar-87	CASA-212	NWA 2268	KDTW	VFR pattern	9	D	Uncontrolled Descent to Gro	Use Of Reverse/Beta In Flight	Crew Inv
37	16-Aug-87	MD-80	NWA 255	KDTW	Takeoff	154	D	Collision W/Obstacle	Attempted TO W/Incorrect Config	Crew Inv
38	31-Aug-87	B-737	TIA 365	VTSP	Approach	83	D	Collision W/Terrain	Stall	Stall
39	15-Oct-87	ATR-42	ATI TRH		Climb	37	D	Uncontrolled Descent to Gro	Contaminated Airfoil	Icing
40	15-Nov-87	DC-9	COA 1713	KDEN	Initial climb	28	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing
41	23-Nov-87	BE-1900C	RYA 103	PAHO	Final approach - no	18	D	Uncontrolled Descent to Gro	Load - C/G Out Of Range	Other
42	29-Jan-88	V-950F	ITS 1004	LFPO	Initial climb	0	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
43	08-Feb-88	SA-227	NFD 108		Approach	21	D	In-flight Breakup	Loss Of All Attitude Displays	Other
44	31-Aug-88	B-727	DAL 1141	KDFW	Initial climb	14	D	Crash After Takeoff	Attempted TO W/Incorrect Config	Crew Inv
45	18-Nov-88	SA-226	LIT 440	LFBK	Initial climb	4	D	Collision W/Terrain	Flight Control Hardover	FCS
46	06-Feb-89	V-950F	RAM 3132	LFML	Initial climb	3	D	Uncontrolled Descent to Gro	Flight Control Disconnected	FCS
47	10-Mar-89	FO-28	ONT 1363	CYHD	Initial climb	24	D	Collision W/Obstacle	Attempted TO W/Contaminated	Icing
48	26-Apr-89	SE-210	KRE 25X	SKBQ	Initial climb	5	D	Collision W/Obstacle	Stall	Stall
49	08-May-89	BE-99	SE-IZO	ESMO	Approach	16	D	Uncontrolled Descent to Gro	Load - C/G Out Of Range	Other
50	19-Jul-89	DC-10	UAL 232	KSUX	Cruise	111	D	Uncontrolled Descent to Gro	Flight Controls Hydraulic Failure	Hydraulic
51	03-Sep-89	IL-62M	CUB 9646	MUHA	Initial climb	126	D	Collision W/Obstacle	Wind Shear	AtmDist
52	08-Sep-89	CV-580	PAR 394		Cruise	55	D	In-flight Breakup	Structural Failure - Flutter	Other
53	26-Sep-89	SA-227	SKI 70	CYXT	Missed approach	7	D	Collision W/Obstacle	Spatial Disorientation	SDO
54	26-Dec-89	JS-3101	NPA 415	KPSC	Final approach - pr	6	D	Uncontrolled Descent to Gro	Icing Stall	Stall
55	12-Apr-90	DHC-6	WIP 839	ENVY	Initial climb	5	D	In-flight Breakup	Turbulence	AtmDist
56	21-Nov-90	DHC-8	BKP 125	VTSM	Missed approach	38	D	Spiral Dive Into Ground	Spatial Disorientation	SDO

No	Date	Aircraft	Ident	Loc'n	Phase	Fat	Dam	Result	Occurrence	Category
57	30-Jan-91	JS-3101	USA 7PC	KBKW	Approach	0	D	Uncontrolled Descent to Gro	Tailplane Stall	Icing
58	11-Feb-91	A-310	IFL OAC	UUEE	Missed approach	0	N	Upset	Attempt To Override Autopilot	Crew Inv
59	17-Feb-91	DC-9	RYN 590	KCLE	Initial climb	2	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing
60	03-Mar-91	B-737	UAL 585	KCOS	Approach	25	D	Uncontrolled Descent to Gro	Flight Control Hardover	FCS
61	05-Apr-91	E-120RT	ASO 2311	KNEA	Approach	23	D	Uncontrolled Descent to Gro	Asymmetric Thrust/Drag	Propulsio
62	26-May-91	B-767	LDA 4		Climb	223	D	In-flight Breakup	Thrust Reverse-Unwanted	Propulsio
63	10-Jul-91	BE-C99	LEX 508	KBHM	Approach	13	D	Uncontrolled Descent to Gro	Turbulence	AtmDist
64	11-Sep-91	E-120	BTA 2574		Cruise	14	D	In-flight Breakup	Structural Failure	Other
65	18-Sep-91	CV-580	TEK ICA		Cruise	2	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
66	11-Nov-91	E-110	NES SCU	SBRF	Initial climb	15	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
67	12-Dec-91	B-747	EIA 5EV		Cruise	0	U	Upset	Spatial Disorientation	SDO
68	29-Dec-91	B-747	CAL 358		Climb	5	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
69	15-Feb-92	DC-8	ATI 805	KTOL	Approach	4	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
70	22-Mar-92	An-30	AFL 002		Cruise	27	D	Loss-of-Control	Pilot Induced Oscillation (PIO)	FCS
71	22-Mar-92	FO-28	USA 405	KLGA	Initial climb	27	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing
72	06-Jun-92	B-737	CMP 201		Cruise	47	D	In-flight Breakup	Turbulence	AtmDist
73	31-Jul-92	Yak-42D	CTH 7552	ZSNJ	Initial climb	108	D	Uncontrolled Descent to Gro	Undetermined	Undet
74	04-Oct-92	B-747	ELY 1862	EHAM	Climb	4	D	Uncontrolled Descent to Gro	Flight Control System	FCS
75	24-Nov-92	B-737	CSN 3943	ZGKL	Approach	141	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
76	02-Jan-93	SF-340A	REX 2PX	KHIB	Landing	0	D	Hard Landing	Icing Stall	Stall
77	05-Mar-93	FO-100	PMK 301	LWSK	Initial climb	83	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing
78	31-Mar-93	B-747	JAL 46E	PANC	Climb	0	S	Upset	Asymmetric Thrust/Drag	Propulsio
79	06-Apr-93	MD-11	CES 583	PASY	Cruise	2	M	Cabin Fatalities	Pilot Induced Oscillation (PIO)	FCS
80	07-Apr-93	B-757	CDZ OOA	KHOU	Cruise	0	U	Upset	Turbulence	AtmDist
81	29-Apr-93	E-120RT	C2X 2733		Climb	0	S	Forced Landing	Autopilot-Induced Stall	Stall
82	27-Jul-93	MD-80	DAL 822	KCHS	Landing flare	0	M	Collision W/Terrain	Stall	Stall
83	18-Aug-93	DC-8	CKS 808	MUG	Circling approach	0	D	Uncontrolled Descent to Gro	Stall	Stall
84	07-Jan-94	JS-4101	ACA 291	KCMH	Final approach - pr	5	D	Uncontrolled Descent to Gro	Stall	Stall
85	24-Feb-94	An-12BP	AFL 118	UBBN	Approach	13	D	Uncontrolled Descent to Gro	Tailplane Stall	Icing
86	23-Mar-94	A-310	AFL 593		Cruise	75	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
87	04-Apr-94	SF-340B	KLC 433	EHAM	Go-around	3	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
88	26-Apr-94	A-300	CAL 140	RJNA	Approach	264	D	Uncontrolled Descent to Gro	Attempt To Override Autopilot	Crew Inv
89	06-Jun-94	Tu-154M	CNW 2303	ZLXY	Climb	160	D	Uncontrolled Descent to Gro	Flight Control System	FCS
90	29-Jun-94	MD-11	AAL 901		Cruise	0	M	Upset	Inadvertent Control Input	Crew Inv
91	02-Jul-94	DC-9	USA 1016	KRDU	Missed approach	37	D	Uncontrolled Descent to Gro	Wind Shear	AtmDist
92	08-Sep-94	B-737	USA 427	KPIT	Descent	132	D	Uncontrolled Descent to Gro	Flight Control Hardover	FCS
93	17-Sep-94	DHC-6	PCO DMR		Initial climb	3	D	Uncontrolled Descent to Gro	Flight Control Disconnected	FCS
94	24-Sep-94	A-310	ROT 381	LFPO	Final approach - pr	0	N	Upset	Attempt To Override Autopilot	Crew Inv
95	31-Oct-94	ATR-72	SIM 4184	KORD	holding (IFR)	68	D	Uncontrolled Descent to Gro	Contaminated Airfoil	Icing
96	11-Dec-94	B-737	MRK 308		Climb	0	N	Upset	Autopilot	FCS
97	13-Dec-94	JS-3201	NVE 3379	KRDU	Approach	15	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
98	31-Mar-95	A-310	ROT 371		Climb	60	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
99	05-Dec-95	Tu-134B	AHY 703	UBBN	Initial climb	52	D	Uncontrolled Descent to Gro	Uncommanded Bank	FCS
100	13-Dec-95	An-24	BAT 166	LIPX	Initial climb	49	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing
101	07-Jan-96	DC-9	VJA 558	KBNA	Landing	0	S	Hard Landing	Uncommanded Spoiler Extension	FCS
102	06-Feb-96	B-757	ALW 301	MDPP	Climb	189	D	Uncontrolled Descent to Gro	Instrument Failure	Other
103	12-Feb-96	GAF-N24A	N-224E	MTPP	Initial climb	10	D	Uncontrolled Descent to Gro	Undetermined	Undet
104	21-Jun-96	A-340	DLH 436	KDFW	Climb	0	U	Cabin Injuries	Unexpected Control Gains	FCS
105	02-Oct-96	B-757	PLI 603		Climb	70	D	Collision W/Terrain	Spatial Disorientation	SDO
106	31-Oct-96	FO-100	TAM 402	SBSP	Initial climb	96	D	Collision W/Obstacle	Asymmetric Thrust/Drag	Propulsio
107	07-Nov-96	B-727	ADK 86		Approach	144	D	Uncontrolled Descent to Gro	Aggressive Maneuver	Crew Inv
108	09-Jan-97	E-120RT	COM 3272	KDTW	Descent	29	D	Uncontrolled Descent to Gro	Icing Stall	Stall
109	12-May-97	A-300B4	AAL 903	KPBI	Level off from desc	0	M	Upset	Stall	Stall
110	08-Jun-97	MD-11	JAL 706	RJNA	Descent	0	M	Upset	Attempt To Override Autopilot	Crew Inv
111	07-Aug-97	DC-8	FBF 101	KMIA	Initial climb	4	D	Uncontrolled Descent to Gro	Load - C/G Out Of Range	Other
112	16-Feb-98	A-300	CAL 676	RCTP	Approach	196	D	Uncontrolled Descent to Gro	Stall	Stall

No	Date	Aircraft	Ident	Loc'n	Phase	Fat	Dam	Result	Occurrence	Category
113	21-May-98	DC-10	COA 75	KLAX	Climb	0	M	Uncommanded Pitch	Autopilot	FCS
114	11-Dec-98	A-310	TIA 261	VSSB	Approach	101	D	Uncontrolled Descent to Gro	Somatogravic Illusion	SDO
115	15-Jan-99	DC-9	MEP 150		Descent	0	N	Cabin Injuries	Wake Turbulence	AtmDist
116	15-Apr-99	MD-11F	KAL 6316	ZSSS	Climb	3	D	Uncontrolled Descent to Gro	Spatial Disorientation	SDO
117	31-Aug-99	B-737	LPR 3142	SABE	Initial climb	63	D	Uncontrolled Descent to Gro	Attempted TO W/Incorrect Config	Crew Inv
118	02-Sep-99	B-737	UAL 2036		Cruise	0	M	Cabin Injuries	Wake Turbulence	AtmDist
119	09-Nov-99	DC-9	TEJ 725	MMPN	Climb	18	D	Collision W/Terrain	Spatial Disorientation	SDO
120	22-Dec-99	B-747	KAL 8509	EGSS	Climb	4	D	Uncontrolled Descent to Gro	Spatial Disorientation	SDO
121	10-Jan-00	SF-340B	CRX 498	LSZH	Initial climb	10	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
122	30-Jan-00	A-310	KQA 431	DIAP	Initial climb	169	D	Collision W/Terrain	Stall	Stall
123	31-Jan-00	MD-80	ASA 261		Cruise	88	D	Uncontrolled Descent to Gro	Jammed Flight Controls	FCS
124	27-Feb-00	B-747	BAW 179		Descent	0	N	Upset	Uncommanded Pitch	FCS
125	17-Jul-00	B-737	LLR 7412	VEPT	Approach	55	D	Uncontrolled Descent to Gro	Stall	Stall
126	19-Jul-00	G-159	AWV 9807		Cruise	2	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
127	23-Aug-00	A-320	GFA 72	OBBI	Missed approach	143	D	Collision W/Terrain	Somatogravic Illusion	SDO
128	02-Oct-00	A-340	THY JDN		Cruise	0	N	Altitude Deviation	Flight Controls Mode Change	FCS
129	26-Oct-00	CL-600	COM 8CA		Cruise	0	N	Upset	Wake Turbulence	AtmDist
130	15-Nov-00	An-24	API FCG	FNLU	Initial climb	57	D	Collision W/Terrain	Loss-of-Control (Vmc)	Crew Inv
131	27-Dec-00	E-135LR	EGF 230	KORD	Initial climb	0	N	Upset	Jammed Flight Controls	FCS
132	25-Jan-01	DC-3C	RUC 225	SVCB	Approach	24	D	Uncontrolled Descent to Gro	Unknown	Other
133	07-Feb-01	A-320	IBE 1456	LEBB	Landing	0	D	Hard Landing	Unexpected Control Gains	FCS
134	17-Mar-01	A-320	NWA 985	KDTW	Initial climb	0	S	Collision W/Terrain	Pilot Induced Oscillation (PIO)	FCS
135	19-Mar-01	E-120	COM 5054	KPBA	Descent	0	S	Upset	Icing Stall	Stall
136	24-Mar-01	DHC-6	ISB 1501	TFFJ	Final approach - no	19	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
137	04-Jul-01	Tu-154M	VLK 352		Approach	145	D	Uncontrolled Descent to Gro	Autopilot-Induced Stall	Stall
138	18-Sep-01	Let-410	TG-CFE	MGGT	Initial climb	8	D	Uncontrolled Descent to Gro	Stall	Stall
139	16-Oct-01	E-145LR	ASH 5733	KROA	Landing	0	S	Hard Landing	Stall	Stall
140	12-Nov-01	A-300	AAL 587	KJFK	Climb	260	D	In-flight Breakup	Wake Turbulence	AtmDist
141	22-Jan-02	B-757	ICE 315	ENGM	Go-around	0	N	Upset	Somatogravic Illusion	SDO
142	04-May-02	BAC-111	EXW 4226	KNKN	Cruise	71	D	Uncontrolled Descent to Gro	Stall	Stall
143	25-May-02	B-747	CAL 611		Cruise	225	D	Uncontrolled Descent to Gro	Structural Failure - Fatigue	Other
144	04-Jun-02	MD-80	NKS 970		Cruise	0	N	Upset	Autopilot-Induced Stall	Stall
145	14-Jun-02	A-330	ACA 875	EDDF	Approach	0	N	Uncommanded Pitch	Flight Control Logic	FCS
146	28-Jun-02	SF-340B	HZL 185	YBTH	Approach	0	N	Upset	Icing Stall	Stall
147	09-Oct-02	B-747	NWA 85	PANC	Cruise	0	M	Uncommanded Bank	Flight Control Hardover	FCS
148	20-Oct-02	B-757	ICE 662	KBWI	Climb	0	N	Upset	Spatial Disorientation	SDO
149	03-Dec-02	A-300	Unknown	EDDM	Climb	0	N	Design Airspeed Exceeded (	Controls (Trim)	FCS
151	07-Dec-02	A-320	ACA 1130	CYYZ	Final approach - pr	0	N	Go Around	Pilot Induced Oscillation (PIO)	FCS
150	07-Dec-02	A-320	ACA 457	CYYZ	Final approach - pr	0	N	Hard Landing	Pilot Induced Oscillation (PIO)	FCS
152	21-Dec-02	ATR-72	TNA 791		Descent	2	D	Uncontrolled Descent to Gro	Icing Stall	Stall
153	27-Dec-02	Let-410	9X-RRB	FMCV	Missed approach	1	D	Uncontrolled Descent to Gro	Spatial Disorientation	SDO
154	08-Jan-03	BE-1900D	AMW 548	KCLT	Initial climb	21	D	Uncontrolled Descent to Gro	Flight Control Integrity Lost	FCS
155	10-Feb-03	An-28	ENI 827	EETN	Initial climb	2	D	Collision W/Obstacle	Attempted TO W/Contaminated	Icing
156	06-Mar-03	B-737	DAH 6289	DAAT	Initial climb	102	D	Uncontrolled Descent to Gro	Stall	Stall
157	23-Apr-03	BE-99A	ABS DYF	CYPA	Approach	0	D	Uncontrolled Descent to Gro	Flight Control Actuator	FCS
158	08-Jul-03	B-737	SUD 139	HSSP	Missed approach	116	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
159	24-Aug-03	Let-410	HH-PRV	MTCH	Circling approach	21	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
160	03-Oct-03	CV-580F	AFN 642		Descent	2	D	In-flight Breakup	Icing Stall	Stall
161	26-Oct-03	FH-227B	CTZ 760		Cruise	5	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
162	03-Jan-04	B-737	FLS 604	HESH	Climb	148	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
163	10-Feb-04	FO-50	IRK 7170	OMSI	Final approach - no	43	D	Uncontrolled Descent to Gro	Undetermined	Undet
164	04-Mar-04	Il-76MD	AZV ZVA	UBBB	Initial climb	3	D	Uncontrolled Descent to Gro	Attempted TO W/Incorrect Config	Crew Inv
165	18-Jun-04	SF-340	REX KEQ	YMLL	Descent	0	U	Upset	Stall	Stall
166	05-Oct-04	An-12	SRW SAF		Cruise	4	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
167	14-Oct-04	B-747	MKA 1602	CYHZ	Initial climb	7	D	Collision W/Terrain	Stall	Stall
168	21-Nov-04	CL-600	CES 5210	ZBOW	Initial climb	53	D	Uncontrolled Descent to Gro	Attempted TO W/Contaminated	Icing

No	Date	Aircraft	Ident	Loc'n	Phase	Fat	Dam	Result	Occurrence	Category
169	27-May-05	DHC-8	C-GZKH	CYYT	Climb	0	N	Upset	Icing Stall	Stall
170	01-Aug-05	B-777	MAS 124	YPPH	Climb	0	N	Upset	Uncommanded Pitch	FCS
171	16-Aug-05	MD-80	WCW 708		Cruise	160	D	Uncontrolled Descent to Gro	Autopilot-Induced Stall	Stall
172	05-Sep-05	B-737	BRB 907		Cruise	0	U	Upset	Uncommanded Bank	FCS
173	30-Sep-05	B-737	DLH BEA	EDDF	Approach	0	N	Landed Without Further Inci	Wake Turbulence	AtmDist
174	22-Oct-05	B-737	BVU 210		Climb	117	D	Collision W/Terrain	Undetermined	Undet
175	19-Dec-05	G-73T	CHK 101	KMPB	Initial climb	20	D	Uncontrolled Descent to Gro	Structural Failure - Fatigue	Other
176	23-Dec-05	An-140	AHY 217		Cruise	23	D	Uncontrolled Descent to Gro	Loss Of All Attitude Displays	Other
177	02-Jan-06	SF-340B	SIM 3008		Climb	0	N	Upset	Icing Stall	Stall
178	03-May-06	A-320	RNV 967	URSS	Missed approach	113	D	Uncontrolled Descent to Gro	Spatial Disorientation	SDO
179	10-Jul-06	F-27	PIA 688	OPMT	Initial climb	45	D	Collision W/Terrain	Stall	Stall
180	13-Aug-06	L-387	DAH 2208		Cruise	3	D	Uncontrolled Descent to Gro	Undetermined	Undet
181	22-Aug-06	Tu-154M	PLK 612		Cruise	170	D	Uncontrolled Descent to Gro	Turbulence	AtmDist
182	29-Oct-06	B-737	ADK 53	DNAA	Initial climb	96	D	Uncontrolled Descent to Gro	Wind Shear	AtmDist
183	01-Jan-07	B-737	DHI 574		Cruise	102	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
184	25-Jan-07	FO-100	RAE 7775	LFBP	Initial climb	0	S	Collision W/Obstacle	Attempted TO W/Contaminated	Icing
185	05-May-07	B-737	KQA 507	FKKD	Initial climb	114	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
186	29-Jul-07	An-12BP	VAS 9655	UDD	Initial climb	7	D	Uncontrolled Descent to Gro	Loss-of-Control (Vmc)	Crew Inv
187	09-Aug-07	DHC-6	TAH 1121	NTTM	Initial climb	20	D	Uncontrolled Descent to Gro	Flight Control Integrity Lost	FCS
188	23-Sep-07	B-737	TOM HOF	EGHH	Final approach - pr	0	N	Uncommanded Pitch	Stall	Stall
189	16-Dec-07	CL-600	AWI 3758	KPVD	Landing	0	S	Hard Landing	Stall	Stall
190	10-Jan-08	A-320	ACA 190	KOMK	Climb	0	M	Upset	Wake Turbulence	AtmDist
191	14-Feb-08	CL-600	BRU 1834	UDYZ	Initial climb	0	D	Collision W/Terrain	Attempted TO W/Contaminated	Icing
192	20-Aug-08	MD-80	JKK 5022	LEMD	Initial climb	154	D	Collision W/Terrain	Attempted TO W/Incorrect Config	Crew Inv
193	14-Sep-08	B-737	AFL BKO	USPP	Approach	88	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
194	07-Oct-08	A-330	QFA 72	YPLM	Cruise	0	M	Upset	Flight Control Logic	FCS
195	27-Jan-09	ATR-42	CFS 8284	KLLB	Final approach - pr	0	S	Uncontrolled Descent to Gro	Stall	Stall
196	28-Jan-09	B-757	AEU TRZ	DGAA	Cruise	0	N	Landed Without Further Inci	Instrument Failure	Other
197	12-Feb-09	DHC-8	CJC 3407	KBUF	Approach	49	D	Uncontrolled Descent to Gro	Stall	Stall
198	25-Feb-09	B-737	THY 1951	EHAM	Approach	9	D	Collision W/Terrain	Stall	Stall
199	01-Jun-09	A-330	AFR 447	TASIL	Cruise	228	D	Uncontrolled Descent to Gro	Spatial Disorientation	SDO
200	21-Oct-09	B-707	SUD 2241	OMSJ	Initial climb	6	D	Uncontrolled Descent to Gro	Failure To Maintain Control	Crew Inv
201	28-Nov-09	MD-11F	SMJ 324	ZSPD	Initial climb	3	D	Uncontrolled Descent to Gro	Undetermined	Undet
202	25-Jan-10	B-737	ETH 409	OLBA	Climb	90	D	Spiral Dive Into Ground	Spatial Disorientation	SDO
203	12-May-10	A-330	AAW 771	HLLT	Approach	103	D	Collision W/Terrain	Somatogravic Illusion	SDO

Summary

Mishaps		Injuries			
Incidents:	23	Number of Fatalities:	Occupants:	9072	55.5% of occupants
Serious Incidents:	2		Ground:	214	
Non-fatal Accidents:	33		Total:	9286	
Fatal Accidents:	145	Serious Injuries:	Occupants:	610	3.7% of occupants
Total:	203		Ground:	20	
			Total:	630	
Hull Loss Accidents:	153	Minor/No Injuries	Occupants:	6663	40.8% of occupants

Primary Cause of Upsets	Cause	No	Fat
	Aerodynamic Stall:	43	1592
	Flight Controls:	40	1320
	Pilot Involvement:	32	1495
	Spatial Disorientation:	23	1387
	Atmospheric Disturbances:	22	1140
	Airframe Ice:	17	642
	Propulsion system:	4	342
	Hydraulic System:	1	111
	Other:	14	721
	Undetermined:	7	322
	Total:	203	9072

Factors in Upsets	Factor	No	Fat
	Stalls:	60	2550
	Flight Controls:	54	2361
	Pilot Involved:	66	2989
	Spatial Disorientation:	34	1894
	Improper Recovery:	42	2481
	Atmospheric Disturbance:	26	1140
	Inappropriate TO attempt:	18	915
	Airframe Ice:	30	681

Totals don't match, many mishaps have multiple factors.

Pilot Flying Experience

	PF	P1	P2	P3
Total Hours:	9082	11309	5339	8219
Hours in Type:	2148	2477	1226	3196

APPENDIX B – DETAILS OF MISHAPS

Date: 07-May-81	Callsign: AUT 901	No: 1
Operator: AUT	Fltno: 901	Operation: SCHED DOM PAX
Aircraft: BAC-111	Reg: LV-LOX	S/N: 212
Location: 15 Km ESE Newbery Airport	Code: SABA	Fat: 31 Ser: 0 M/N 0 G Fat: 0 T Fat: 31
Phase: Approach	Result: Uncontrolled Descen	Altitude: 2000
Occurrence: Turbulence	Issues: Failure To Maintain Control	Crew Decisions
Accident Group: Atmospheric Disturbance	Atmospheric Disturbance	

Description: Flight AU901 departed Tucumán at 09:11 for a flight to Buenos Aires. The flight was uneventful and at 10:35 the Tower controller cleared the flight to descend to 750 metres to the San Fernando VOR and cleared the flight for a direct approach to runway 13 from the VOR. At 10:40 the flight reported over the OP VOR and was cleared to land. The wind had shifted from 6 knots at 60 degrees to 12 knots at 030 degrees. Visibility was reducing. At 10:42 the crew reported the runway in sight and obtained the current weather information, which included heavy rainfall, wind 360 degrees at 10 knots. The pilots lost sight of the runway and decided to abort the approach. The One-Eleven continued South to the Quilmes (ILM) NDB. The Tower controller cleared the flight to hold over the ILM beacon at 900 metres. Because of Cumulonimbus clouds over the NDB, the crew requested a holding pattern over the Río de la Plata at 600 metres. At 10:52 they were cleared for another straight in approach to runway 31. Shortly afterwards the pilots lost control of the plane, which crashed into the river. Just 55-65% of the wreckage was recovered; both FDR and CVR were not found after 42 days of searching.

Probable Cause: "Loss of control of the aircraft and impact with the water by an error of appreciation by the pilot in assessing the meteorological conditions on crossing through a zone of influence of an extremely violent cumulonimbus."

Pilot Data: PF P1 P2
PF: Flt Hrs:
 in Type:

Agency: JAAC **File:** **Accident Report No:**

Date: 26-Jun-81			Callsign: DAN 240				No: 2								
Operator	DAN	Fltno: 240	Operation:	SCHED	DOM CAR	From: EGKK To: EGNX	Oper Region: Western Europe								
Aircraft:	HS-748		Reg:	G-ASPL		S/N: 1560	Engines:	RR533-2	MTOW	46500	Mfrs Region:	Western Europe			
Location: Nailstone, UK			Code:	Fat: 3		Ser: 0	M/N	0	G Fat:	0	T Fat:	3	Dam	D	
Phase:		Descent		Result:	Uncontrolled Descen				Altitude:		Day/Night: U			Vis/Instr: U	
Occurrence:		Flight Control Integrity Lost			Issues:		Structural Overload Failure				Door Opened In-Flight				
Accident Group:		Flt Control System													

Description:	While descending, the right-hand rear door detached, struck the horizontal tail plane and became lodged on the leading edge. Control was lost, and the aircraft entered a steep dive. During the dive, the wings and tail plane failed due to overstressing.
Source:	

Probable Cause: "The accident was caused by the baggage door becoming lodged on, the leading edge of the right tailplane after it had opened and detached in flight. This produced changes in the aerodynamic characteristics of the aircraft which rendered it uncontrollable resulting in overstressing of the wings and tailplane leading to an in-flight structural failure.

A contributory factor was the mis-rigged state of the door operating mechanism which allowed the top and the bottom pairs of claw catches to lose synchronisation. The failure of the door warning arrangements to give adequate warning of door safety was a further contributory factor."

Pilot Data:		PF	P1	P2
PF: P	Flt Hrs:	8418	8418	5611
	in Type:	1393	1393	1711

Agency: AAIB File:

Accident Report No: AAIB-AAR-5/1983

Report on the accident to Bae HS-748, G-ASPL at Nailstone,
Leicestershire on 28 June 1983

Date: 09-Jul-81		Callsign: KFA KFN				No: 3	
Operator: KFA	FltNo:	Operation: NSCHD	DOM CAR	From: CYYZ	To:	Oper Region: North America	
Aircraft: Howrd-500	Reg: C-GKFN	S/N: 500-107	Engines: R-2800	MTOW: 34000	Mfrs Region:	North America	
Location: Toronto (YYZ)		Code: CYYZ	Fat: 3	Ser: 0	M/N: 0	G Fat: 0	T Fat: 3
Phase: Initial climb		Result: Uncontrolled Descen	Altitude:		Day/Night: U		
Occurrence: Stall		Issues: Load - C/G Out Of Range		Uncommanded Pitch			
Accident Group: Stall							

Description:	The aircraft suddenly pitched nose-up on takeoff, stalled and crashed. Presumably the aft centre of gravity limit was exceeded because the aircraft had been loaded with many parcels of various sizes and weights.
Source: ASN	This was probably aggravated by the fact that the CofG moves further aft when the landing gear is retracted on this type of aircraft.

Probable Cause:

Pilot Data:		PF	P1	P2
PF:	Flt Hrs:			
	in Type:			

Agency: TSB File: Accident Report No:

Date: 20-Jul-81	Callsign: SOM 40	No: 4
Operator: SOM	Fltno: 40	Operation: SCHED DOM PAX
From: HCMM	To: HCMH	Oper Region: Africa
Aircraft: F-27	Reg: 6O-SAY	S/N: 10557
Engines:	MTOW: 41910	Mfrs Region: Western Europe
Location: Near Balad, Somalia	Code:	Fat: 50 Ser: 0 M/N 0 G Fat: 0 T Fat: 50
Phase: Climb	Result: In-flight Breakup	Altitude:
Occurrence: Turbulence	Issues: Structural Overload Failure	Day/Night: U Vis/Instr: I
Accident Group: Atmospheric Disturbance		

Description:	The F-27 entered an area of heavy rain in clouds with severe turbulence, eight minutes after take-off. The aircraft entered a spiral dive after encountering strong vertical gusts. Loads during the dive increased to 5.76 G. These loads exceeded the design stress limits, causing part of the right wing to separate.
Source: ASN	

Probable Cause:

Pilot Data:		PF	P1	P2
PF:	Flt Hrs:			
	in Type:			

Agency: File: Accident Report No:

Date:	22-Aug-81	Callsign:	FEA 103	No:	5						
Operator	FEA	Fltno:	103	Operation:	SCHED DOM PAX	From:	RCSS	To:	RCKH	Oper Region:	Asia (Except ME)
Aircraft:	B-737	Reg:	B-2603	S/N:	19939	Engines:	JT8D-7A	MTOW		Mfrs Region:	North America
Location:	Near Miao-Li, Taiwan	Code:		Fat:	E+0:Ser: 0	M/N	0	G Fat:	0	T Fat:	E+0: Dam D
Phase:	Climb	Result:	In-flight Breakup	Altitude:		Day/Night:	D	Vis/Instr:	U		
Occurrence:	Flight Control Integrity Lost	Issues:	Structural Failure	Flight Control System							
Accident Group:	Flt Control System	Explosive Decompression	Corrosion								

Description: FEAT's Boeing 737 B-2603 was used extensively on domestic flights within Taiwan since being acquired from United Airlines in April 1976.

Source: asn On August 5, 1981 the aircraft lost cabin pressure during a flight from Taipei (TSA) to Kaohsiung (KHH). On August 22 the 737 took off from Taipei on a flight to Makung (MZG). Ten minutes after take-off from there was a loss of cabin pressure. The flight crew returned to Taipei, where repair work was carried out. Later that day the aircraft entered service again as Flight 103 to Kaohsiung. Fourteen minutes after take-off the aircraft suffered an explosive decompression and disintegrated.

Probable Cause: PROBABLE CAUSE: "Extensive corrosion damage in the lower fuselage structures, and at a number of locations there were corrosion penetrated through pits, holes and cracks due to intergranular corrosion and skin thinning exfoliation corrosion, and in addition, the possible existence of undetected cracks because of the great number of pressurization cycles of the aircraft (a total of 33,313 landings), interaction of these defects and the damage had so deteriorated that rapid fracture occurred at a certain flight altitude and pressure differential resulting rapid decompression and sudden break of passenger compartment floor beams and connecting frames, cutting control cables and electrical wiring. And eventually loss of power, loss of control, midair disintegration."

Pilot Data: PF P1 P2

PF: Flt Hrs:
in Type:

Agency: File: Accident Report No:

Date: 06-Oct-81 Callsign: NLM 431 No: 6

Operator NLM Fltno: 431 Operation: SCHED DOM PAX From: EHRD To: EHEH Oper Region: South America
Aircraft: FO-28 Reg: PH-CHI S/N: 11141 Engines: MTOW 77842 Mfrs Region: Western Europe
Location: Near Moerdijk, Netherlands Code: Fat: 17 Ser: 0 M/N 0 G Fat: 0 T Fat: 17 Dam D
Phase: Climb Result: In-flight Breakup Altitude: 3000 Day/Night: D Vis/Instr: I
Occurrence: Turbulence Issues: Structural Overload (Gust) Atmospheric Disturbance
Accident Group: Atmospheric Disturbance

Description: During the weather briefing (44 minutes before take-off) the crew was warned for an area with thunderstorms with 3/8 cumulonimbus at 1200 feet, wind 210°/15-25 knots and 5km visibility. At 17:04 the F-28 took off from Rotterdam for a flight to Hamburg via Eindhoven. At 17:09 the crew noted heavy rainfall in thunderstorms on the weather avoidance radar and received clearance to avoid this area. At 17:12 the aircraft entered a tornado, which resulted in loads increasing to +6.8 G and -3.2 G. The right wing separated and the aircraft crashed out of control out of 3000 feet.

Probable Cause:

Pilot Data: PF P1 P2
PF: Flt Hrs:
in Type:

Agency: File: Accident Report No:

Date: 28-Jun-82	Callsign: AFL 8641				No: 8
Operator: AFL	Fltno: 8641	Operation: SCHED	DOM PAX	From: ULLI	To: KIEV
Oper Region: Eastern Europe					
Aircraft: Yak-42	Reg: CCCP42	S/N: 110401	Engines: D-36	MTOW: 132000	Mfrs Region: Eastern Europe
Location: Mozyr, Belarus		Code:	Fat: E+0;Ser: 0	M/N: 0	G Fat: 0
T Fat: E+0:		Dam: D			
Phase: Cruise	Result: Uncontrolled Descen	Altitude: FL 300	Day/Night: D		
Vis/Instr: U					
Occurrence: Flight Control Disconnected	Issues: Controls (Trim)	Structural Fatigue			
Accident Group: Flt Control System		Flight Control System			

Description:	The aircraft lost control and crashed from an altitude of FL300 following the failure of the horizontal stabilizer
Source: ASN	jackscREW due to fatigue.

Probable Cause:

Pilot Data:		PF	P1	P2
PF:	Flt Hrs:			
	in Type:			

Agency: File: Accident Report No:

Date: 06-Jul-82	Callsign: AFL 411	No: 9
Operator: AFL	Fltno: 411	Operation: SCHED INT PAX
From: UUEE	To: GOOY	Oper Region: Eastern Europe
Aircraft: Il-62M	Reg: CCCP86	S/N: 403753
Engines: D-30KU	MTOW: 363000	Mfrs Region: Eastern Europe
Location: Moscow (SVO)	Code: UUEE	Fat: 90
Ser: 0	M/N: 0	G Fat: 0
T Fat: 90	Dam: D	
Phase: Initial climb	Result: Uncontrolled Descen	Altitude:
Day/Night: U	Vis/Instr: U	
Occurrence: Loss-of-Control (Vmc)	Issues: Multiple Engine Failures	Failure To Maintain Control
Accident Group: Crew Involvement	Asymmetric Thrust/Drag	False Warning

Description:	An Ilyushin 62M passenger jet, registered СССР-86513, was destroyed in an accident near the village of Mendeleevo, Russia. All 82 passengers and eight crew members were killed.
Source: ASN	Aeroflot flight SU411 took off from Moscow-Sheremetyevo Airport (SVO) at 00:33 on a flight to Dakar (DKR), Senegal and Freetown (FNA), Sierra Leone. Eight seconds after raising the landing gear the fire alarm for engine nr. 1 went off. The crew shut down the engine in accordance with the Flight Manual and used the three stages of fire suppression systems. After 30 seconds another alarm went off about a fire in engine nr. 2. This engine was also shut down. At that time the speed was 320 km/h, height about 160 m, landing gear was retracted, and flaps were in takeoff position (30 °). The crew had initiated a right hand turn, which was recommended in case of a failure of the left hand engines. The crew were not able to maintain altitude. The speed decreased, increasing the angle of attack and slip. The airplane stalled at a height of 75 m and came down in a 70 ° left bank and a pitch angle of -20 °. The plane crashed in swampy woods. Investigation revealed that both fire alarms were false. Hot air from a ruptured pipe of the air conditioning system had blown on the temperature sensors.

Probable Cause:

Pilot Data:	PF	P1	P2
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PF: Flt Hrs:
 in Type:

Agency: File: Accident Report No:

Date: 09-Jul-82 Callsign: PAA 759 No: 10

Operator PAA Fltno: 759 Operation: SCHED DOM PAX From: KMSY To: KLAS Oper Region: North America
 Aircraft: B-727 Reg: N-4737 S/N: 19457 Engines: JT8D-7B MTOW 172000 Mfrs Region: North America
 Location: New Orleans Code: KMSY Fat: E+0:Ser: 0 M/N 0 G Fat: 8 T Fat: E+0: Dam D
 Phase: Initial climb Result: Uncontrolled Descen Altitude: 150 AG Day/Night: D Vis/Instr: V
 Occurrence: Wind Shear Issues: Loss-of-Control Initial Climb
 Accident Group: Atmospheric Disturbance Atmospheric Disturbance

Description: Pan Am Flight 759 was a scheduled flight from Miami (MIA) to Las Vegas (LAS), with an en route stop at New Orleans (MSY). At 15:58:48 Boeing 727 "Clipper Defiance" taxied from its gate at the New Orleans International Airport. Before leaving the gate, the flightcrew had received ATIS message Foxtrot which read in part "...time one eight five five Zulu, weather, two thousand five hundred scattered, two five thousand thin broken, visibility six miles in haze, temperature niner zero, wind two four zero at two, winds are calm altimeter three zero zero one..."

Source: ASN The flightcrew requested runway 10 for the takeoff and ground control cleared the flight to taxi to runway 10. At 15:59:03, the first officer requested a wind check. Winds were 040 degrees at 8 knots. At 16:02:34, while Flight 759 was taxiing to runway 10, the crew heard a transmission from ground control, advising another airplane of low level wind shear alerts in the northeast quadrants of the airport. At 16:03:33, the first officer requested another wind check. Ground control replied, "Wind now zero seven zero degrees at one seven... peak gusts two three, and we have low level wind shear alerts all quadrants, appears to be a frontal passing overhead right now, we're right in the middle of everything." The captain then advised the first officer to "...let your airspeed build up on takeoff..." and said that they would turn off the air conditioning packs for the takeoff, which would enable them to increase the EPR's on engines Nos. 1 and 3 to 1.92.

The flightcrew completed the takeoff and departure briefings and turned onto the active runway for takeoff. At 16:06:22, Flight 759 informed the tower that it was ready for takeoff. The local controller cleared the flight for takeoff, and the first officer acknowledged the clearance. About 16:07:57, the Boeing 727 began its takeoff. According to witnesses, the airplane lifted off about 7,000 feet down runway 10, climbed in a wings-level attitude, reached an altitude of about 100 feet to 150 feet above the ground (AGL), and then began to descend towards trees. The airplane crashed into a residential area and was destroyed during the impact, explosion, and subsequent ground fire. Eight persons on the ground were killed.

Probable Cause: "The airplane's encounter during the lift-off and initial climb phase of flight with a micro-burst induced windshear which imposed a downdraft and a decreasing headwind, the effects of which the pilot would have had difficulty recognizing and reacting to in time for the airplane's descent to be arrested before its impact with trees. Contributing to the accident was the limited capability of current ground based low level windshear detection technology to provide definitive guidance for controllers and pilots for use in avoiding low level wind shear encounter

Pilot Data: PF P1 P2 FE
 PF: CP Flt Hrs: 6127 11727 6127 19904
 in Type: 3914 10595 3914 10508

Agency: NTSB File: DCA92AA028

Accident Report No: NTSB-AAR-83-02

Pan American World Airways, Inc., Clipper 759, Boeing 727-235, N4737, New Orleans International Airport, Kenner, Louisiana, July 9, 1982

Date: 09-Dec-82		Callsign: ANS 304				No: 11	
Operator	ANS	Fltno: 304	Operation: SCHED	DOM PAX	From: SCTI	To: SCSE	Oper Region: South America
Aircraft: F-27A	Reg: CC-CJE	S/N: 63	Engines:		MTOW: 41910	Mfrs Region: Western Europe	
Location: La Serena (LSC)		Code: SCSE	Fat: 46	Ser: 0	M/N: 0	G Fat: 0	T Fat: 46
Phase: Approach		Result: Uncontrolled Descen	Altitude:			Day/Night: D	Vis/Instr: U
Occurrence: Loss-of-Control (Vmc)		Issues: Engine Failure				Improper Engine Failure Rec	
Accident Group: Crew Involvement							

Description:	After a 1h20 minutes flight from Santiago, the F-27 approached La Serena runway 11. suddenly the aircraft
Source: ASN	banked left and started a steep descent, crashing into the ground in a nose-up attitude, 2000m short of the runway. The aircraft burst into flames immediately.

Probable Cause:

PROBABLE CAUSE: "Inadequate flight planning by the pilot-in-command in co-ordinating the adoption of measures and applying procedures to successfully remedy a stall condition caused by total loss of power in the left engine when the aircraft was flying at low altitude on final approach to land, in landing configuration" (Directorate General of Civil Aviation, Chile)

Pilot Data:	PF	P1	P2
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PF: Flt Hrs:
in Type:

Agency: DGAC File: Accident Report No:

Date: 11-Jan-83		Callsign: UAL 288				No: 12	
Operator	UAL	Fltno: 2885	Operation: SCHED	DOM CAR	From: KDTW	To: KSJC	Oper Region: North America
Aircraft:	DC-8	Reg: N-8053U	S/N: 46010/4	Engines: JT3D-3B	MTOW		Mfrs Region: North America
Location:	Detroit, MI (DTW)		Code: KDTW	Fat: 3	Ser: 0	M/N 0	G Fat: 0 T Fat: 3 Dam D
Phase:	Initial climb		Result: Spiral Dive Into Grou	Altitude: 1000		Day/Night: N Vis/Instr: V	
Occurrence:	Attempted TO W/Mis-set Trim			Issues: Spatial Disorientation		Controls (Trim)	
Accident Group:	Crew Involvement			Unqualified Person At Contro		Supervisory Error	
				Mis-trim			

Description:	United Flight 2885 departed Cleveland at 01:15 for a cargo flight to Los Angeles via Detroit. The DC-8 arrived at Detroit at 01:52. Cargo for Detroit was unloaded, the airplane was refueled, and cargo for Los Angeles was loaded. The engines were started, and then the crew called for taxi instructions at 02:45:58. During the taxi, the flightcrew accomplished the before takeoff checklist. The second officer called "trim" and the first officer responded "set". The flightcrew however, inadvertently overlooked setting the stabilizer trim for takeoff, and the setting of 7.5 units ANU was the previous landing trim setting. At 02:49:16, the captain, the first officer, and the second officer discussed the idea of the first officer switching seats with the second officer. They then switched seats about 02:49:40. United 2885 called for clearance onto runway 21R at 02:49:58 and was cleared for takeoff at 02:50:03. The throttles were advanced for takeoff at 02:51:05 and power stabilized 7 seconds later. Speed callouts "eighty knots" and "Vee One" were called by the captain and the airplane broke ground about 02:51:41. The airplane continued to climb with wings level to about 1,000 feet. The airplane then rolled to the right in a gradual right turn until it was in a wings vertical position (right wing down, left wing up) and crashed into a freshly plowed farm field.
Source: ASN	

Probable Cause: The flight crew's failure to follow procedural checklist requirements and to detect and correct a mistrimmed stabiliser before the aircraft became uncontrollable. Contributing to the accident was the captain allowing the second officer, who was not qualified to act as a pilot, to occupy the seat of the first officer and to conduct the take-off.

Pilot Data:		PF	P1	P2	SO
PF: SO	Flt Hrs:	8827	16102	9360	8827
	in Type:	4468	2711	6493	4468

Agency: NTSB File: DCA83AA014

Accident Report No: NTSB-AAR-83-07

Aircraft Accident Report: Loss Of Control On Takeoff, United Airlines Flight 2885, N8053U, McDonnell Douglas DC-8-54F, Detroit, Michigan, January 11, 1983

Date: 15-Feb-83	Callsign: SPA 868				No: 13			
Operator SPA	Fltno: 868	Operation: SCHED	DOM PAX	From: KBOI	To: KSUN	Oper Region:	North America	
Aircraft: DHC-6	Reg: N-361V	S/N: 361	Engines: PT6A-27	MTOW: 12500	Mfrs Region:	North America		
Location: 1 S Haley-Sun Valley Arpt (	Code: KSUN	Fat: 0	Ser: 0	M/N 8	G Fat: 0	T Fat: 0	Dam D	
Phase:	Final approach - no	Result:	Uncontrolled Descen	Altitude: 800 AG	Day/Night: D	Vis/Instr: V		
Occurrence:	Flight Control Disconnected		Issues:	Maintenance Error				
Accident Group:	Flt Control System							

Description:	The Twin Otter, operating on a flight for Transwestern, approached Hailey runway 31 at an altitude of 800 feet when the captain reduced power. Suddenly, the aircraft nosed over and descended steeply. The pilot tried to control the descent by adding power. The plane crash-landed on a highway, veered off and struck a 4 feet high snow bank.
Source:	ASN

Probable Cause: "The in-flight loss of elevator control following separation of the control rod from the torque tube at a connection where the company's maintenance department had used a non-standard, unsecured bolt, which the company's inspection department had failed to detect. Contributing to the accident was the company's failure to maintain the separation of maintenance and inspection functions required by the maintenance program approved by the Federal Aviation Administration, and the failure of the FAA to detect the company's deviation from approved maintenance procedures during surveillance inspection."

Pilot Data:		PF	P1	P2
PF: P	Flt Hrs:	12000	12000	275
	in Type:	1000	1000	100

Agency: NTSB File: DCA83AA017

Accident Report No: NTSB/AAR-84-03
Sierra Pacific Airlines, DeHavilland DHC-6-300, N361V, Hailey,
Idaho, February 15, 1983

Date: 29-Apr-83		Callsign: SAN 832				No: 14	
Operator	SAN	Fltno: 832	Operation: SCHED	DOM PAX	From: SEGU	To: SEQU	Oper Region: South America
Aircraft:	SE-210	Reg: HC-BAT	S/N: 125	Engines: RRAVON533	MTOW: 123200	Mfrs Region:	Western Europe
Location:	Guayapul-Simon Bolivar Arp	Code: SEGU	Fat: 8	Ser: 0	M/N 92	G Fat: 0	T Fat: 8
Phase:	Approach	Result:	Collision W/Terrain	Altitude:		Day/Night: U	Vis/Instr: U
Occurrence:	Stall	Issues:	Multiple Engine Failures		Failure To Maintain Control		
Accident Group:	Stall						

Description:	Captain German Cruz carried out a test flight April 28 following engine overhaul on HC-BAT. After landing he reported that the aircraft did not respond well. The next afternoon HC-BAT was prepared for a domestic flight to Quito. The log book reported the engines had been rechecked and found to be OK. Captain Cruz, also at the controls of flight 832 took off from runway 21. Immediately after rotation one of the engines failed. The captain elected to return to the airport and during the procedure turn the 2nd engine slowly lost power. The Caravalle stalled and crash landed heavily in muddy ground. The aircraft broke in three.
Source: ASN	

Probable Cause:

Pilot Data:	PF	P1	P2
PF: P	Flt Hrs:		
	in Type:		

Agency: File: Accident Report No:

Date: 08-Jun-83		Callsign: RAA 68R				No: 15	
Operator	RAA	FltNo:	Operation: SCHED	DOM PAX	From: PACD	To: KSEA	Oper Region: North America
Aircraft:	L-188C	Reg: N-1968R	S/N: 2007	Engines: 501-D13	MTOW: 115757	Mfrs Region:	North America
Location:	Cold Bay, AK (CDB)	Code: PACD	Fat: 0	Ser: 0	M/N 15	G Fat: 0	T Fat: 0
Phase:	Cruise	Result:	Diversion	Altitude:	FL250	Day/Night:	D
Occurrence:	Jammed Flight Controls	Issues:	Propeller Failure	Partial Loss-of-Control			
Accident Group:	Flt Control System	Depressurization	Depressurization	Partial Loss-of-Control			

Description:	During a cruise climb, the aircrew noted an unusual vibration; however, attempts to isolate the vibration were unsuccessful. While climbing from FL190 to FL250, the flight engineer went aft to observe the engines & props, but noted nothing unusual. A flight attendant went forward to advise the captain that nothing was observed, when the vibration increased in intensity. As she left the cockpit, she peered out the right window and saw the nr.4 prop separate and strike the aircraft. This caused major damage to the lower fuselage and resulted in decompression of the cabin. The flight controls became jammed and the engines would not respond to throttle movement. The autopilot was used for minimal control and the flight crew were able to divert to Anchorage, AK. They were able to climb and descend by retracting and extending the landing gear with the nr.2 eng shut down. The aircraft was landed safely and the engines were shut down to decelerate. The exact cause of the prop separation was not determined since it fell in the ocean during the occurrence.
Source: NTSB	

Probable Cause: PROBABLE CAUSE: "Propeller system/accessories..undetermined."

Pilot Data:	PF	P1	P2
PF:	Flt Hrs:	13874	
	in Type:	5711	

Agency: NTSB File: DCA83AA029 Accident Report No:

Date: 24-Nov-83		Callsign: ACA 965				No: 16	
Operator	ACA	Fltno: 965	Operation: SCHED INT	PAX	From:	To:	Oper Region: North America
Aircraft:	L-1011	Reg: C-FTNJ	S/N: 193E1-6	Engines: RB-211-22B	MTOW: 468000	Mfrs Region:	North America
Location:		Code: KCHS	Fat: 0	Ser: 4	M/N E+0:	G Fat: 0	T Fat: 0
Phase:	Climb	Result:	Cabin Injuries	Altitude:	FL370	Day/Night:	N
Occurrence:	Turbulence	Issues:					
Accident Group:	Atmospheric Disturbance						

Description:	DURING FLT AT FL350, THE FLTCREW NOTED SOME THUNDERSTORMS IN THE VICINITY OF THEIR ROUTE OF FLT & ADVISED THE ATC CONTROLLER THAT THEY MIGHT HAVE TO DETOUR. AFTER TURNING & CLIMBING TO FL370, THEY NOTED 'MODERATE CHOP TO LIGHT TURBULENCE' & SAW A FLASH OF LIGHTNING TO THE NORTH. THE FLTCREW TURNED ON THE SEATBELT SIGN & ANNOUNCED IN FRENCH & ENGLISH FOR OCCUPANTS TO REMAIN SEATED & FASTEN THEIR SEATBELTS. WHILE FLYING IN 'UPPER CLOUD' ABOUT 20 MI DOWNWIND FROM A LINE OF THUNDERSTORMS, THE ACFT ENCOUNTERED SEVERE TURBULENCE. SOME OCCUPANTS WHO WERE NOT PROPERLY RESTRAINED WERE INJURED & SOME WERE HIT BY LOOSE OBJECTS. SERVICE CARTS AS WELL AS OTHER OBJECTS WERE THROWN ABOUT.
Source:	NTSB

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident to be: WEATHER CONDITION..TURBULENCE,CLEAR AIR

Contributing Factors

WEATHER CONDITION..THUNDERSTORM

Pilot Data:		PF	P1	P2	SO
PF: CP	Flt Hrs:	12480	22900	12480	4470
	in Type:	5081	2733	5081	3400

Agency: NTSB File: DCA84AA008.

Accident Report No: NTSB-AAR-84-13

Turbulence Injuries, Air Canada Flight 965, Lockheed L-1011, C-FTNJ, Near Charleston, South Carolina, November 24, 1983

Date: 21-Jul-84		Callsign: SPI 3SP				No: 17	
Operator	SPI	Fltno:	Operation: SCHED	DOM PAX	From: NSTU	To: HI36	Oper Region: North America
Aircraft:	DHC-6	Reg: N-43SP	S/N: 669	Engines: PT6A-27	MTOW	12500	Mfrs Region: North America
Location:	Tau Airport, Am Samoa (HI3		Code: TAV	Fat: 1	Ser: 5	M/N 8	G Fat: 0 T Fat: 1 Dam D
Phase:	Landing flare	Result:	Collision W/Obstacle		Altitude: 300 AG	Day/Night: D	Vis/Instr: V
Occurrence:	Flight Control Disconnected		Issues:	Flight Control System		Maintenance Error	
Accident Group:	Flt Control System		Corrosion				

Description:	While turning from base leg onto final approach the flight controls suddenly collapsed forward and the nose of the aircraft pitched up. The pilot tried to maintain control by using throttle and flap control. The Twin Otter then collided with the terminal building and a vehicle. It appeared that the elevator control cable was rusted and broken at Station 376 and the cable pulley in the area was also damaged. The cable hadn't been inspected for 725.9 hours, while inspection is required every 700 hours. The corrosion process was speeded up by the fact that the aircraft was operated in a high humidity and marine salt environment. The aircraft had also carried large amounts of salt pork and corned beef in the aft cargo compartment, directly above the corroded cable area.
Source: ASN	

Probable Cause: The National Transportation Safety Board determines the probable cause(s) of this accident to be:
FLT CONTROL SYST,ELEVATOR CONTROL..CORRODED

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
FLT CONTROL SYST,ELEVATOR CONTROL..FAILURE,TOTAL

Pilot Data:	PF	P1	P2
PF:	Flt Hrs:	5094	
	in Type:	1020	

Agency: NTSB File: LAX84FA415 Accident Report No:

Date: 06-Dec-84		Callsign: PBA 103				No: 18	
Operator	PBA	Fltno: 1039	Operation: SCHED	DOM PAX	From: KJAX	To: KTPA	Oper Region: North America
Aircraft:	E-110	Reg: N-96PB	S/N: 110365	Engines: PT6A-34	MTOW		Mfrs Region: South America
Location:	1.5 M NW Jacksonville (JAX)		Code: KJAX	Fat: 13	Ser: 0	M/N 0	G Fat: 0 T Fat: 13
Phase:	Initial climb		Result: Uncontrolled Descen	Altitude: 600	AG	Day/Night: T	Vis/Instr: V
Occurrence:	Flight Control Integrity Lost			Issues: Overstress			
Accident Group:	Flt Control System						

Description:	At 18:12, flight 1039 was cleared for takeoff from runway 31. At 18:13, while over the departure end of the runway and climbing through 600 feet, the crew acknowledged a frequency change. Thirty seconds later, the airplane was seen in a steep descent near the extended centerline of the runway.
Source: ASN	The Banderante struck the ground 7,800 feet beyond the departure end of runway 31 and 85 feet to the right of the extended runway centerline in an inverted nose down attitude, after which it caught fire and burned. Before ground impact, the horizontal stabilizer, including bulkhead No. 36, had separated from the fuselage. Both elevators and elevator tips, the tail cone assembly, and the aft portion of the ventral fin also had separated in flight.

Probable Cause: "A malfunction of either the elevator control system or elevator trim system, which resulted in an airplane pitch control problem. The reaction of the flight crew to correct the pitch control problem overstressed the left elevator control rod, which resulted in asymmetrical elevator deflection and overstress failure of the horizontal stabilizer attachment structure. The Safety Board was not able to determine the precise problem with the pitch control system."

Pilot Data:		PF	P1	P2
PF: CP	Flt Hrs:	3000	10000	3000
	in Type:	500	400	500

Agency: NTSB File: DCA85AA004

Accident Report No: NTSB-AAR-86-04
Provincetown-Boston Airlines Flight 1039, Embraer Bandeirante
EMP-110P1, N96pb, Jacksonville, Florida, December 6, 1984

Date: 23-Dec-84		Callsign: AFL 338				No: 19	
Operator	AFL	Fltno:	Operation:	SCHED DOM PAX	From: UNKL	To: UIII	Oper Region: Eastern Europe
Aircraft:	Tu-154	Reg: CCCP85	S/N: 79A-338	Engines: NK-2U	MTOW	228800	Mfrs Region: Eastern Europe
Location:	Krasnoyarsk,Russia,USSR (	Code: UNKL	Fat: E+0;Ser: 1	M/N 0	G Fat: 0	T Fat: E+0;	Dam D
Phase:	Climb	Result:	Engine Shutdown Co	Altitude: 6700		Day/Night: D	Vis/Instr: U
Occurrence:	Improper Engine Failure Reco		Issues:	Hydraulic Failure	Engine Fire		
Accident Group:	Other		Shut Down Wrong Engine				

Description:	Two minutes after takeoff, at an altitude of 2040 m, the no. 3 engine suffered an uncontained failure. The no. 3 engine caught fire, but the flight engineer shut down engine no. 2. Some ten seconds later the engineer noticed the error and began attempts to restart engine no. 2. Meanwhile the crew was returning to the airport for an emergency landing. The no. 3 engine was then shut down and extinguishing bottles were fired. This was insufficient to put out the fire.
Source: ASN	Then the no. 2 engine suddenly spooled up to takeoff power. The engine power levers did not have any effect and the crew shut down the engine but the fuel valve was not closed. Meanwhile, the fire of the engine number 3 spread into the cavity of the pylon and the rear compartment where the APU was located. The fire continued to spread to engine no. 2. With one engine working the airplane passed the Outer Marker at an altitude of 175 m and a speed of 420 km/h. Because of fire damage to the electrical system, the Voltage dropped. The hydraulics failed and the airplane could no longer be controlled. It rolled right and descended at a rate of 10 m/sec. The airplane struck the ground in a 50 degree right bank, four minutes and 30 seconds after the start of the emergency.

Probable Cause: The reason for failure of engine no. 3 was a fatigue failure of the first stage low pressure compressor disk because of a metallurgical and manufacturing defect.

Pilot Data:	PF	P1	P2
PF:	Flt Hrs:		
	in Type:		

Agency: File: Accident Report No:

Date: 09-Jan-85 Callsign: TPI 57Q No: 20

Operator: TPI Fltno: Operation: NSCHD DOM CAR From: KDTW To: KMKC Oper Region: North America
Aircraft: L-188A Reg: N-357Q S/N: 1044 Engines: 501-D13 MTOW: 115757 Mfrs Region: North America
Location: Kansas City, MO (MKC) Code: KMKC Fat: 3 Ser: 0 M/N: 0 G Fat: 0 T Fat: 3 Dam: D
Phase: Missed approach Result: Uncontrolled Descent Altitude: 3100 Day/Night: D Vis/Instr: V
Occurrence: Stall Issues: Airspeed Awareness Approach Technique
Accident Group: Stall Supervisory Error Crew Resource Management

Description: After being vectored for a VOR runway 03 approach, a clearance was given to circle and land on runway 36 instead. Because the aircraft was high on the approach, a missed approach was initiated. After circling left, the aircraft became accidentally lined up with the nearby Fairfax Airport. The captain then took over control from the 1st officer, initiated a missed approach and climbed steeply to 3100 feet. At 3100 feet the Electra stalled and entered a steep descent and crashed into a public water treatment plant.

Probable Cause: PROBABLE CAUSE: "Airspeed..not maintained..pilot in command
Stall..inadvertent..pilot in command
CONTRIBUTING FACTORS:
Weather condition..low ceiling
Weather condition..fog
Light condition..dawn
IFR procedure..improper..copilot/second pilot
Supervision..inadequate..pilot in command
Became lost/disoriented..inadvertent..copilot/second pilot
Became lost/disoriented..inadvertent..pilot in command"

Pilot Data: PF P1 P2
PF: P Flt Hrs: 14500 14500
 in Type: 5000 5000

Agency: NTSB File: DCA85AA009 Accident Report No: NTSB-PB85-910410

Date: 19-Jan-85 Callsign: CUB 899 No: 21

Operator: CUB Fltno: Operation: SCHED INT PAX From: HUHA To: MNM Oper Region: North America
Aircraft: Il-18D Reg: CUT899 S/N: 188011 Engines: MTOW 135640 Mfrs Region: Eastern Europe
Location: Near San Jose De Los Lajas Code: Fat: 38 Ser: 0 M/N 0 G Fat: 0 T Fat: 38 Dam D
Phase: Cruise Result: Uncontrolled Descen Altitude: Day/Night: D Vis/Instr: I
Occurrence: Undetermined Issues: Undetermined
Accident Group: Undetermined

Description: The Ilyushin turned right twice with 30° bank, then turned left with a vertical bank, lost control and crashed.
Source:

Probable Cause: PROBABLE CAUSE: "Possibly failure of the artificial horizon and obstruction of aileron control due to shifted cargo."

Pilot Data: PF P1 P2
PF: Flt Hrs:
in Type:

Agency: File: Accident Report No:

Date: 21-Jan-85 Callsign: GAL 203 No: 22

Operator: GAL Fltno: 203 Operation: NSCHD DOM PAX From: KRNO To: KMSP Oper Region: North America

Aircraft: L-188C Reg: N-5532 S/N: 1121 Engines: 501D13 MTOW: 115757 Mfrs Region: North America

Location: Reno, NV (RNO) Code: KRNO Fat: 70 Ser: 1 M/N: 0 G Fat: 0 T Fat: 70 Dam: D

Phase: Initial climb Result: Uncontrolled Descen Altitude: 250 AG Day/Night: N Vis/Instr: V

Occurrence: Stall Issues: Failure To Maintain Airspeed Door Opened In-Flight

Accident Group: Stall Distraction Crew Resource Management

Description: The ill-fated flight crew were scheduled to fly Lockheed Electra N5532 from Seattle (SEA) to Oakland (as Flight 201), from Oakland to Reno (RNO) as Flight 202, from Reno (RNO) to Minneapolis (MSP) as Flight 203 and finally returning to Seattle using flight number 204.

Source: ASN Scheduled departure time for Flight 201 had been 15:30, but had been delayed until about 20:00. The airplane departed Seattle at 20:19 on a ferry flight to Oakland, where it arrived at 22:25. Sixty-five passengers boarded the plane for the flight to Reno. At 00:21, while the airplane was being serviced, the crew requested an IFR clearance to Minneapolis. Following ground servicing the ground handler supervisor signalled to the crew that they could commence engine starting. However, after engines one and four were started, he noticed that the other ground handler was unable to disconnect the air start hose. It was stretched taut from the power cart to the airplane's air start access panel, located on the underside of the right wing leading edge, close to the fillet area. He gave the flightcrew an emergency stop signal, left his position, and disconnected the hose. None of the two ground crewmembers remembered closing the air start access door. At approximately 00:59 the first officer requested taxi instructions. Reno tower almost immediately thereafter cleared Galaxy 203 to taxi to runway 16R. The aircraft taxied to the runway and at 01:01:32 the first officer requested takeoff clearance. Four seconds later Galaxy 203 was given clearance to take off from runway 16R. While accelerating through V1 speed, a "thunking" type sound was heard, followed by another one just after V2. Heavy airframe vibration started after liftoff. The captain reacted to the airplane's vibration by reducing power significantly in all four engines, indicating that he believed the vibration was caused by the powerplants or propellers. The airplane reached an altitude of about 200-250 feet and started a right hand turn to return to the airport. The Electra then entered an aerodynamic stall buffet because of insufficient engine power to maintain flight. The Electra crashed into a field, bounced, slid into some mobile homes and burst into flames. Of the three persons who survived the initial impact, one died on January 29, while the second died on February 4. The sole survivor, a 17-year-old male, was thrown clear of the airplane onto the adjacent highway.

Probable Cause: "The captain's failure to control and the co-pilot's failure to monitor the flight path and airspeed of the aircraft. This breakdown in crew coordination followed the onset of unexpected vibration shortly after takeoff. Contributing to the accident was the failure of ground handlers to properly close an air start access door, which led to the vibration."

Pilot Data:		PF	P1	P2	FE
PF: P	Flt Hrs:	14500	14500	5000	262
	in Type:	5600	5600	172	262

Agency: NTSB File: DCA85AA010

Accident Report No: NTSB-AAR-86-01

Aircraft Accident Report: Galaxy Airlines, Lockheed L-188C, N5532, Reno, Nevada, January 21, 1985