

Background

United 241 incident

- When: November 1968
- Where: Departure from Detroit
- What: B727



Started rapid climb at 4700 ft maintaining 1G

At 6000 ft in 20-deg bank, aircraft encountered an abnormal meteorological condition

Bank increased to 40 degs and an abnormal climb rate

Captain applies forward pressure and nose-down trim

High rate of descent and difficulty recovering

-1.5G at 8700 ft and 4.7G at 1200 ft

- Why: Trim overcontrol in recovery

China Airlines 006 incident

- When: February 1985
- Where: 300 nmi NW of San Francisco, FL410
- What: 747 SP



Loss of No. 4 engine

Roll autopilot counters until it reaches limit...more roll

Almost 360 deg right roll, pitch down 69 deg

5.1g's reached during pull-up; exceeded Vmo

Recovered at 9,500 ft

Two serious injuries

- Why: Preoccupation with malfunction; failure to monitor instruments; likely spatial disorientation

Midwest Express 105

- When: September 1985
- Where: Milwaukee, Wisconsin
- What: DC-9

Day, VMC

Right engine failure on takeoff at 450 ft

Correct then incorrect pedal, followed by aft column

Continued climbing to 700 ft, rolled right near 90 degs

Accelerated stall

- Why: Improper response to engine failure, lack of crew coordination



China Eastern Airlines 583

- When: April 1993
- Where: 950 nmi south Shemya, Alaska
- What: MD-11



Night, VMC, FL330

Inadvertent deployment of leading-edge wing slats

Several violent pitch oscillations in ensuing recovery

Simultaneous shaker and slat overspeed chime

+2.1G to -1.2G

- Why: Light control forces and reduced pitch stability made overcontrol easy to do

China Airlines 140

- When: April 1994
- Where: Approach to Nagoya airport, Japan
- What: A300



At 1000 ft, GO lever inadvertently triggered
A/T disengaged. A/P trimmed stab nose up
PF tries to return to path countering with elevator
Captain takes control at 500 ft. Go around.
Surprised by mistrim, compounded by thrust
Pitch up to 52 degs. Stall until impact

Why: Lack of trim awareness, lack of mode awareness

Airborne Express N827AX



- When: December 1996
- Where: Narrows, Virginia
- What: DC-8

Night, in and out of clouds, 14,000 ft

Approach-to-stall tests.

Expecting shaker at 128 kts. Got early buffet at 151

Set full power, resulting in compressor surges in No. 2

Maintained 10-14 degs pitch

Airspeed continued to decrease to full stall

Eventually applied full rudder

- Why: Inappropriate inputs in response to stall

China Airlines 676

- When: February 1998
- Where: Chiang Kai Shek airport, Taiwan
- What: Airbus A300



Cleared for ILS/DEM in light rain and fog

1000 ft high at 1.2nm from threshold

A/P disconnected, crossed threshold at 1475 ft

Go around...pitched up rapidly to 35 degs

At 2330 ft, pitch was 42.7 deg...9 sec later, speed 43 kt

- Why: Unstable approach, inadequate CRM, for 12 secs the pitch-up from go-around thrust not countered, stall

Formosa Airlines B12255

- When: March 1998
- Where: 7 miles NW HSZ airport, Taiwan
- What: Saab 340B



Right main bus inop in preflight, but captain proceeds

Several systems unavailable

Torque split arises after attempt to equalize temps

Roll and yaw asymmetry from torque split

Potential disorientation and fatigue

- Why: Loss of situational awareness; failure to comply with MEL; likely fatigue

Thai Airways 261

- When: December 1998
- Where: Surat Thani Airport, Thailand
- What: Airbus A310



Two go-arounds in low visibility

On third attempt, runway not visible at MDA

Autopilot disconnected, and captain decides go around

Pitch increases to 40 degs, countered back to 32 degs

Counter inputs stop and pitch to 48 degs, airspeed 100

Stall

- Why: Stress and possible expectation that 3rd go-around would be like the first two. Similarity with China Air 140.

Korean Air Cargo 8509

- When: December 1999
- Where: Great Hallingbury, England
- What: 747-200



Night, scattered clouds 500 ft

Captain's ADI shows no bank while he increases it

Comparator alarm sounds. Flight Engineer says "bank"

Warnings canceled prior to impact at 90 deg bank

- Why: Poor CRM

Gulf Air 072

- When: August 2000
- Where: Persian Gulf, Bahrain
- What: A320

Dark night, VMC

On second go-around, captain command half the pitch req'd and did not maintain runway heading
With TOGA and low pitch, aircraft rapid accel
Flap overspeed warning; commanded flaps up
Captain deflected stick forward and got -15 deg pitch
Did not respond to multiple GPWS alerts

- Why: Likely spatial disorientation, incorrect go-around procedure, poor CRM



Icelandair 315 incident

- When: January 2002
- Where: Approach to Oslo airport
- What: B757



Day, IMC

Go around after unstable approach (near MCP alt)

After go-around transient, aircraft tries to level and
slow to MCP speed of 150 kts

Captain put in inputs to prevent stall

Pitch goes between +40/-49;

Load factor goes between 3.6 and -0.6g's

Aircraft had two more flights afterwards w/o inspection

- Why: Loss of situational awareness; mode switching challenges

Flash Airlines 604

- When: January 2004
- Where: Red Sea near Sharm el-Sheikh A/P
- What: 737-300

Night, VMC

Left turn to intercept VOR after takeoff

Aircraft banked right after heading select

Co-pilot warned that bank was increasing

Captain neutralizes wheel, then increases right bank

Banks 111 degs and 43 pitch down

- Airplane hits water at 24 degs right bank and 4G's
- Why: Findings inconclusive (disorientation? System failure?)



Pinnacle Airlines 3701

- When: October 2004
- Where: Jefferson City, Missouri
- What: CRJ-200



Night, VMC

Reposition flight; Climbed to FL410

Shaker and pusher activations; Dual engine flameout

Recovered from upset at FL340

Started performing double engine failure checklist

Did not obtain necessary speed for restart (300 kts)

Moved to APU-assisted start; unable due to core lock

- Why: Unprofessional behavior; lack of airspeed monitoring; improper response to stall; improper engine restart

Provincial Airlines C-GZKH incident



- When: May 2005
- Where: Climbout from St. John's, Newfoundland
- What: de Havilland DHC-8
Day, IMC
Inadvertently selected vertical speed mode (1190 fpm)
At 7000', engine anti-ice selected. Pneumatic not selected.
Through 8000', gradual speed decrease over 5 mins
Shaker activates at 14,800' and 104 kts
- Why: Inappropriate mode select; lack of monitoring of speed during climb out; lack of recognition of stall cues

West Caribbean Airways 708

- When: August 2005
- Where: Wreckage in Venezuela
- What: MD-82



Night, poor weather

Vertical speed mode climb to FL330...Mach EPR limited

Engine anti-ice cycled

Tried to cruise at FL 330, $M=0.75$. Again Mach EPR lim

Poor weather. Continuous speed drop.

Buffeting started. Descent requested.

Shaker activated in descent at FL320 and remained on

- Why: Lack of knowledge on operating limits, lack of speed monitoring, lack of proper response to stall

Armavia 967

- When: May 2006
- Where: Black Sea near Sochi, Russia
- What: A320

Night, IMC

Decided to divert, then decided to land

ATC instructed go-around after Wx dropped below mins

Thrust levels placed into climb; flaps and gear extended

“Speed, speed, speed” alert; Levers moved to TO/GA

Disengaged A/P, decrease pitch, banked right, used rudder

- Why: Likely spatial disorientation; poor CRM, improper go-around procedure; dual (and opposite) sidestick inputs



Adam Air 574

- When: January 2007
- Where: Makassar Strait off Indonesia
- What: 737-400
 - Day, IMC; stormy weather
 - FL350; slow right roll began “bank angle” alert
 - Bank angle reached 100 degs; pitch 60 degs down
 - Vertical speed of 54,000 ft/min recorded
 - Airplane had structural failure at 9000 ft
- Why: Preoccupation with troubleshooting INSS; inadvertent A/P disconnect; possible spatial disorientation



Kenya Airways 507

- When: May 2007
- Where: Doula Intl Airport, Cameroon
- What: 737-800



Night, IMC

After takeoff, captain gave command to engage A/P

Command not acknowledged; A/P not engaged

Several heading changes input into MCP, but no A/P

Captain engages A/P and increases bank angle

Bank reaches 115 degs and pitches down at 2900 ft

Pilots used opposite inputs during attempted recovery

Bank is 60 degs at impact

- Why: Lack of monitoring, spatial disorientation, lack of crew coordination

Thomsonfly G-THOF incident

- When: September 2007
- Where: Approach to Bournemouth Airport, U.K.
- What: 737-300



Night ILS approach

Uncommanded autothrottle disengagement

Autopilot trims stabilizer up to stay on path

Go around called after aircraft slows below speed

Pitch up to 44 degs, speed 82 kts

Full column forward ineffective, trim not applied

Thrust reduced to 86%. Recovered.

- Why: Unnoticed autothrottle disconnect, lack of trim awareness and application

Aeroflot 821

- When: September 2008
- Where: Perm, Russia
- What: 737-500

Night, rainy

Approach was not stabilized

Possible western versus eastern attitude display issue

Significantly below V_{ref} during approach

After base turn, aircraft roll 360 degs



- Why: Poor crew coordination, fatigue, spatial disorientation, captain alcohol consumption

XL Airways GXL888T

- When: November 2008
- Where: Off coast of Canet-Plage, France
- What: A320



Day, light rain

Water penetrated AoA sensors during a rinse

At FL320, AoA sensors 1 and 2 stopped moving (froze)

Later on approach, crew checked normal law protections

Stabilizer trimmed full nose up during decel

Drop to Direct Law likely unnoticed

Loss of control and crash into sea

- Why: System failure due to AoA vanes freezing. Lack of trim awareness. Lack of understanding in stall recognition

Empire Airlines 8284

- When: January 2009
- Where: Lubbock, Texas
- What: ATR-42

Night, IMC

Flap asymmetry (at F15, one side 0 and other 8-10 deg)

During troubleshooting, speed 160 to 125 kts in 26 sec

- Why: Continued approach after flap anomaly; lack of monitoring to maintain safe speed



Turkish Airlines 1951



- When: February 2009
- Where: Approach to Schiphol Airport, The Netherlands
- What: 737-800

Nonstandard ATC approach; then unstabilized approach

Left radio altimeter passed -8 feet to autothrottle

Autothrottle moved to 'retard flare' mode on approach

Autopilot increased AoA to stay on path during decel

Speed decay unnoticed until shaker activation at 460 ft

- Why: Unstable approach, lack of monitoring speed, pitch increase, and A/T mode. Stall recovery procedure improperly applied.



Colgan Air 3407



- When: February 2009
- Where: Clarence Center, New York
- What: DHC-8-400

Night VMC

Briefed Vref of 118 kts, but ref speeds switch “increase”

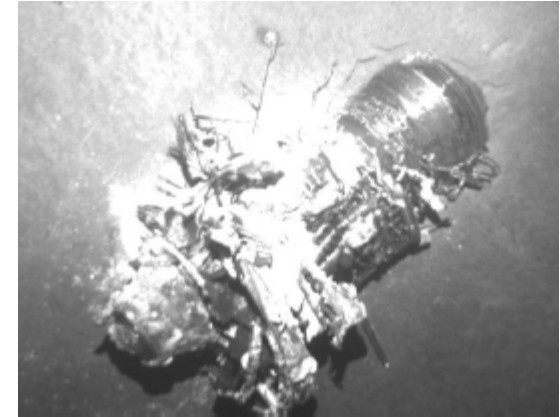
Shaker engaged at 131 kts, likely causing surprise

Captain pulled and resisted shaker

Tried to control roll during stall until impact

- Why: Lack of airspeed monitoring, unexpected stall warning activation, inappropriate response to stick shaker and pusher

Air France 447



- When: June 2009
- Where: International waters, Atlantic Ocean
- What: A330
 - Night IMC
 - Unreliable airspeed caused ALT 2B flight control law
 - Pilot inputs resulted in a stall
 - Stabilizer moved to nose-up limit and remained there
 - Tried to control roll during stall until impact
- Why: Unreliable airspeed procedure not applied, lack of stall recognition, recovery inputs disallowed return to safe flight

Afriqiyah Airways 771

- When: May 2010
- Where: Approach to Tripoli Intl Airport
- What: A330



Night, IMC

Continued below NDB MDA without ground visual ref
TAWS activated, then go-around

Go around pitch not maintained (nor FD commands)

Dual inputs, but not enough to cause warning

Captain took control and pushed down (F/O pulled)

- Why: Spatial disorientation, poor CRM, dual inputs, possible fatigue

Air Algerie 5017

- When: July 2014
- Where: 80 km SW of Gossi, Mali
- What: MD-83

Night

FL310, several heading changes to fly around cell

EPR erroneous on both engines (likely icing of sensors)

A/T then did not apply enough thrust

A/C slowed from 290 kts to 200 kts in 5.5 mins

A/P disengaged 20 sec after stall begins (AoA=25 deg)

Roll 140 degs, pitch down 80 degs

- Why: Crew did not activate engine anti-ice; lack of speed monitoring; lack of proper stall recovery inputs



Air Asia 8501

- When: December 2014
- Where: Karimata Strait, Indonesia
- What: A320



Dawn? (619 local) VMC

Repeated Rudder Travel Limit Unit failure at FL320

Alternate law entered after reset of FAC CBs

Sideslip from rudder causes roll and rise of FD

Pilot flying inputs results in stall

Continuous stall warning during last 3 mins

- Why: Potential ambiguous guidance on clearing failure, lack of upset training on how to recover from a full stall

Lion Air 610

- When: October 2018
- Where: Java Sea
- What: B737 MAX 8



7:30am local, VMC

AOA sensor miscalibration (undetected on installation)

Repeated activation of nose-down stabilizer trim

from Maneuvering Characteristics Augmentation
System

Unexpected FO trim actions

Pilot flying inputs results in stall

- Why: Inadequate maintenance actions, potentially questionable assumptions in MCAS logic, unexpected pilot actions

Commercial Air Safety Team Study

	<i>Lack of External Visual References</i>	<i>Flight Crew Impairment</i>	<i>Training</i>	<i>Airplane Maintenance</i>	<i>Safety Culture</i>	<i>Invalid Source Data</i>	<i>Distraction</i>	<i>Systems Knowledge</i>	<i>Crew Resource Management</i>	<i>Automation Confusion / Awareness</i>	<i>Ineffective Alerting</i>	<i>Inappropriate Control Actions</i>	<i>Total</i>
Formosa Airlines Saab 340	x	x			x		x	x	x		x		7
Korean Air 747-200F	x			x		x	x		x		x		6
Flash Airlines 737-300	x		x		x		x		x	x	x	x	8
Adam Air 737-400	x		x	x			x	x	x	x	x	x	9
Kenya Airways 737-800	x		x				x		x	x	x	x	7
Aeroflot-Nord 737-500	x	x	x	x	x		x	x	x	x	x	x	11
Gulf Air A320	x		x				x		x		x	x	6
Icelandair 757-200 (Oslo)	x						x		x	x	x	x	6
Armavia A320	x	x			x		x		x	x	x	x	8
Icelandair 757-200 (Baltimore)	x				x	x	x	x	x	x	x	x	9
Midwest Express 717	x				x	x	x		x		x	x	7
Colgan Air DHC-8-Q400	x	x	x		x		x	x	x	x	x	x	10
Provincial Airlines DHC-8	x		x				x			x	x	x	6
Thomsonfly 737-800	x		x	x	x		x			x	x		7
West Caribbean MD-82	x	x			x		x	x	x	x	x	x	9
XL Airways A320		x	x	x	x	x	x	x	x	x	x		10
Turkish Airlines 737-800	x			x	x	x	x		x	x	x		8
Empire Air ATR-42	x	x			x		x		x	x	x		7
Overall	17	7	9	6	12	5	18	7	16	14	18	12	

Upset Accidents and Incidents

Why?

Lack of
attention

Lack of
understanding

Lack of
proper response

Upset Accidents and Incidents

Why?

