NBAA|BACE
OCTOBER 16-18, 2018 · ORLANDO, FL

Real Stories of Loss of Control: When Upset Training Saved Lives

Tuesday, Oct. 16 | 2:30-3:30

Real Stories of Loss of Control: When Upset Training Saved Lives

Bill Oefelein

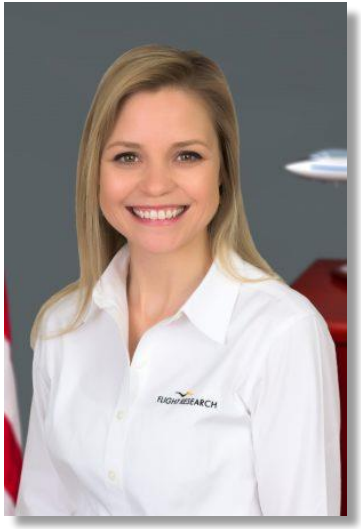
- Naval Aviator and Test Pilot
- US Naval Test Pilot School and National Test Pilot School Instructor
- NASA Astronaut
- Flight Research, Inc. Instructor Pilot

ISS014E09232

Flight Research, Inc.

Scott T. Glaser

Toni Mensching



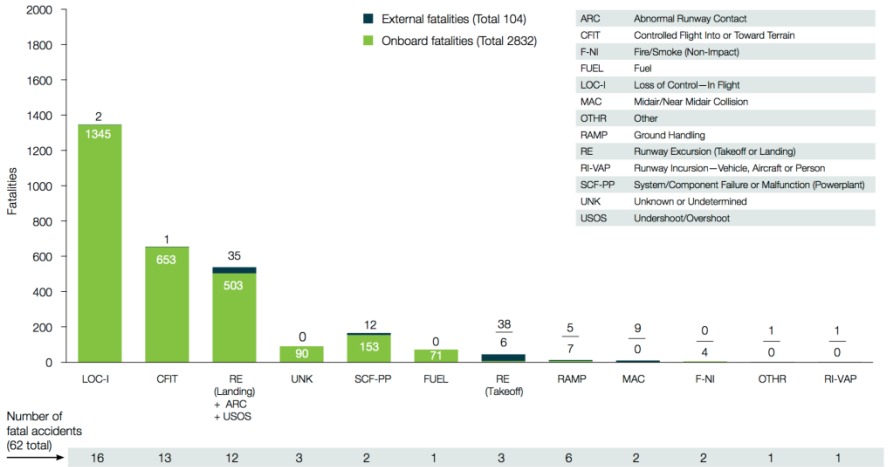
Upset/Loss of Control Defined

- An undesired airplane state characterized by unintentional divergences from parameters normally experienced during operations.
- May involve pitch and/or bank angle divergences as well as inappropriate airspeeds for the conditions.

Fatal LOC Accidents

Fatalities by CICTT Aviation Occurrence Categories

Fatal Accidents | Worldwide Commercial Jet Fleet | 2007 through 2016

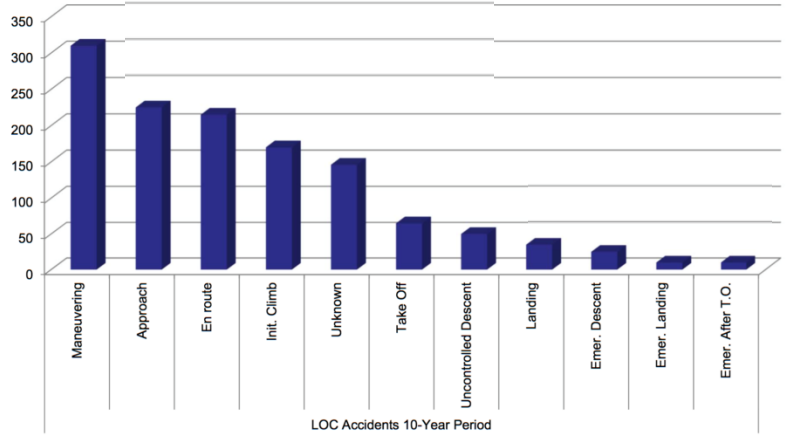


ARC	Abnormal Runway Contact
CFIT	Controlled Flight Into or Toward Terrain
F-NI	Fire/Smoke (Non-Impact)
FUEL	Fuel
LOC-I	Loss of Control—In Flight
MAC	Midair/Near Midair Collision
OTHR	Other
RAMP	Ground Handling
RE	Runway Excursion (Takeoff or Landing)
RI-VAP	Runway Incursion—Vehicle, Aircraft or Person
SCF-PP	System/Component Failure or Malfunction (Powerplant)
UNK	Unknown or Undetermined
USOS	Undershoot/Overshoot

Note: Principal categories as assigned by CAST.
For a complete description of CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories, go to www.intlaviationstandards.org.

22 | 2016 STATISTICAL SUMMARY, JULY 2017

Fatal LOC Accidents GA



Federal Aviation Administration

155

Contributing Factors to Loss of Control

- An airplane upset is not a common occurrence.
- There are a variety of reasons why upsets occur, including:
  - Environmentally-induced
    - Air Mass Related
    - Wake Turbulence
  - Systems-induced. Failures in:
    - Flight Instruments
    - Autopilots
    - Flight Control Systems
  - Pilot-induced
    - Scan Breakdown
    - Attitude and Power Adjustments
    - Inattention or Complacency
    - Distraction
    - Pilot Incapacitation
    - Vertigo or Spatial Disorientation
  - Misuse of Automation

LOC in General Aviation is high on the NTSB “Most Wanted List”

Recent LOC accident roundtable discussion hosted by NTSB suggested some training areas of focus:

- Inspire pilots to seek out enhanced training
- Pursue professionalism
- Train Stick and Rudder Skills and the associated aerodynamics

Upset Recognition and Recovery

Actions to recover from an upset would encompass three basic activities:

- Assess the energy (become situationally aware)
  - Recognize
  - Confirm
  - Automation
- Arrest the flight path divergence
  - Unload
  - Throttles
  - Ailerons
- Recover to a stabilized flight path
  - Pitch

These three activities must be part of every recovery from an upset.

Upset Recognition and Recovery Training

- Puts recognition and recovery actions into practice
- Can be part Simulator-based / part Aircraft-based
    - Simulators can provide the basic fundamentals for upset recovery
    - Physical and psychological effects and the airplane response during recovery can be significantly different from that experienced during simulator training.
    - Simulator limitations at the edges of the flight envelope can also cause fidelity issues
    - There is a balance

Upset Recognition and Recovery Training

- Training related to upset and/or stalls should emphasize awareness and avoidance.
- Pilots must be or become situationally aware before they are able to take appropriate actions.
- Train energy management/lift vector control/optimal performance
- Any Upset training can be valuable

Upset Recognition and Recovery Training: Recognized Benefits

- One of the questions we ask our students following URRT is:

  Do you feel that, after having taken the course, you are better prepared to deal with an in flight upset should one occur?

Across the board- the answers are positive-

Upset Recognition and Recovery Training: Recognized Benefits

- **Former Military Pilot/NASA Astronaut**

"I personally view this training to be invaluable. If you take your Citation desk model right now, hold it in a 10-degree nose low descent, and then roll it 180 degrees, you will be in an inverted upset situation that is not far-fetched. Picture yourself in the cockpit, seeing nothing but ground. The training teaches you how to address that and make the first move the correct move."

- **Private Pilot**

“The takeaway for me is the direct benefit of this training for safety in the way we fly, single pilot. No amount of simulator training can replicate the stress and confusion caused by encountering higher G loads and the other sensations that come from unusual attitudes. … I will go back for more. I urge all of you to consider this type of training."

- **Air Racer**

“For the three days I attended, each minute was spent talking, breathing and living airplanes; I have never learned so much in such a short period of time.”

Upset Recognition and Recovery Training: Recognized Benefits

- **Corporate Pilot:**

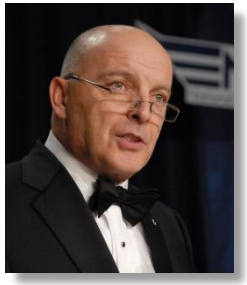
"You can't beat this kind of training; you just cannot do it in a simulator. You cannot simulate a high G load, getting the inverted feeling and simulate the queasiness, it just cannot be done. … This training gives you great confidence do it if you need to. Absolutely feel that I'm better qualified and know that if something happened I would be able to get out of that situation."

- **Government Pilot:**

"I come away knowing I'm a better pilot. That is phenomenal. Your initial reaction may not be the right reaction and there may be a better solution to come out of an upset condition. I now know that I can handle these upsets at a very high level. I feel like a much more proficient pilot. I recommend this training for all pilots from a small aircraft to a 747 pilots …"

Real Stories of Loss of Control: When Upset Training Saved Lives

Bob Agostino



Bombardier

Group Holdings

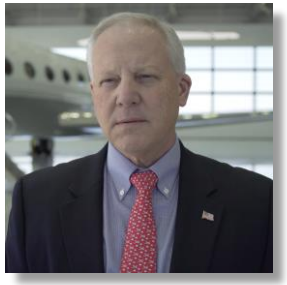
Test Pilot

Dave Hirschman

ATP; 2,000+ aerobatic dual

“Hijacked: The Heroes of Flight 705”

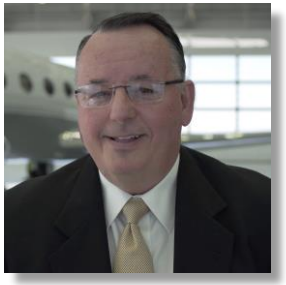
Joe Kline



G650 Captain

13,000+ flt hrs

Rod Lundy



G650 Captain

13,000+ flt hrs

Assistant Chief Pilot

Bill Flowers

G650 Captain

19,000+ flt hrs

Director of Standards

Bob Agostino

Upset Recovery Story

- Pilot
- Aircraft
- Location
- Outcome
- Possible Outcome without Upset Recovery Training

Rod Lundy, Joe Kline and Bill Flowers

- 3 Pilots
- All gulfstream flights
- Various locations
- All Positive Outcomes

David Hirschman

Upset Recovery Story

- Pilot
- Aircraft
- Location
- Outcome
- Possible Outcome without Upset Recovery Training

Upset Training: Aircraft and Simulators

Scott T. Glaser

- SVP Operations
- NBAA LOC-I Safety Committee
- Simulation Co-Patent
- Virgin Galactic
- NASA
- Lockheed Martin

Facts and Myths of Upset Recovery Training

MYTH: All training is good training

FACT: Training in small aircraft can cause a negative transfer of training

- Competition aerobatic aircraft have much different response.
- Can lead to improper response in heavier aircraft.
- Inertias and rates MUST be similar to the aircraft that you fly.

Facts and Myths of Upset Recovery Training

MYTH: URRT is just aerobatic training

FACT: URRT is specialized training focused on utilization of the entire flight envelope.

- URRT teaches
  - Capabilities of certificated aircraft
  - How to use those capabilities in adverse scenarios.
- Aerobatic maneuvers can be used to teach some concepts
- Aerobatics by themselves do not equate to URRT especially for large aircraft.

Facts and Myths of Upset Recovery Training

MYTH: Training in-aircraft is more dangerous than simulation

FACT: Accidents during training are more rare than actual accidents

- There is only one fatal URRT accident since modern inception.
- There was a sim fatality when an aircraft crashed into a simulation building.
- LOC-I is the #1 cause of fatalities…

Facts and Myths of Upset Recovery Training

MYTH: Providers require aerobatic maneuvers in business jets

FACT: Responsible providers DO NOT have students performing aerobatic maneuvers in business jets.

- Business jets are used for stalls, automation and elevated but non-aerobatic upsets.
- All maneuvers are WITHIN THE NORMAL FLIGHT ENVELOPE
- All attitude maneuvering is kept to capable but still type representative aircraft.

Facts and Myths of Upset Recovery Training

MYTH: I'll get air sick!!!

FACT: You will NOT get air sick if training is executed effectively.

- URRT is training. If you don't feel good you're not learning.
- Professional organizations mitigate Motion Sensitivity and halt training before it becomes active.

Training In-aircraft vs. Simulation

Pros – In Aircraft

- Real G-forces
- Real Emotions
- Reality – No Reset Button
- Real Aircraft Handling Qualities and Inertias

Training In-aircraft vs. Simulation

Sim Pros

- Your Systems
- Low Level – Ground doesn’t hurt

Upset Training: Money Well Spent

Toni Mensching

- Flight Research Marketing Director
- US Airways First Officer
- AOPA Government Affairs
- FedEx Pilot Recruitment
- Clay Lacy Corporate Flight Operations

Business Justification

Handout

- Aircraft upsets at high altitude are more frequent due to RVSM and GPS
- Speak to high net worth passengers/owners who value premium pilot training.
  - Bean counters are not in the back of the aircraft during flights.
- List of ICAO, EASA, FAA recommendations and requirements in your handout.
- Companies which understand risk are already doing it based on accident data
  - GEICO, ALLSTATE, OHIO NATIONAL etc.
- Insurance premium discounts are available

National Business Aviation Association 1200 G Street NW, Suite 1100 Washington, DC 20005 (202) 783-9000 www.nbaa.org

BACK UP MATERIAL

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GENERAL AVIATION ACCIDENTS

8.1 U.S. General Aviation Accidents, Fatal Accidents, and Fatalities (2000–2017)

Year	Accidents		Accidents		Fatalities		Flight Hours	Rate	
	All	Excluded	Fatal	Excluded	Total	Aboard		All	Fatal
2000	1,837	7	345	7	596	585	27,838,000	6.57	1.21
2001	1,727	3	325	1	562	558	25,431,000	6.78	1.27
2002	1,716	7	345	6	581	575	25,545,000	6.69	1.33
2003	1,741	4	352	3	633	630	25,998,000	6.68	1.34
2004	1,619	3	314	0	559	559	24,888,000	6.49	1.26
2005	1,671	2	331	1	563	558	[illegible]	[illegible]	1.38
20[illegible]	1,5[illegible]	2	[illegible]8	1	[illegible]6	[illegible]54	23,963,[illegible]00	[illegible]6.35	1.2[illegible]
20[illegible]	1,6[illegible]	2	[illegible]8	2	4[illegible]	[illegible]	23,819,[illegible]00	[illegible]6.94	1[illegible]
[illegible]08	1,568	2	27[illegible]	0	496	487	22,805,[illegible]	6.87	[illegible]21
2009	1,480	4	275	1	479	470	20,862,000	7.08	1.32
2010	1,441	3	271	2	458	455	21,688,000	6.63	1.24
2011	1,471	3	270	1	458	447	21,488,000	6.84	1.24
2012	1,472	1	273	1	438	438	20,881,000	7.05	1.30
2013	1,224	3	222	3	391	386	19,492,000	6.26	1.12
2014	1,224	0	256	0	423	413	19,617,000	6.24	1.31
2015	1,210	7	230	4	378	375	20,576,000	5.85	1.10
2016	1,266	2	213	2	386	379	21,333,747	5.93	0.99
2017P	1,223	n/a	198	n/a	n/a	n/a	n/a	n/a	n/a

P = Preliminary

Source: NTSB, FAA, and GAMA

General Aviation as defined by NTSB includes operations under Part 91, Part 91K, Part 125, Part 133, and Part 137 for the purpose of accident statistics.
Excluded "Accidents" and "Fatalities" are suicide/sabotage and stolen/unauthorized events, which are not included in rates.

BACK UP MATERIAL

BOEING COMMERCIAL AVIATION

Accident Rates by Airplane Type

Hull Loss Accidents | Worldwide Commercial Jet Fleet | 1959 through 2016

Sorted by year of introduction	Hull losses	Hull losses w/fatalities	Hull loss accident rate / Hull loss with fatalities accident rate
*No longer in service	99	53	4.61 / 8.60
707/720	153	74	4.28 / 8.84
DC-8	75	51	4.00 / 5.89
727	95	56	0.73 / 1.24
DC-9	92	49	0.78 / 1.47
BAC 1-11	26	12	1.38 / 2.99
737-100/-200	102	52	0.89 / 1.75
F-28	43	22	2.35 / [illegible]
747-100/-200/-300/SP	37	19	1.46 / [illegible]
DC-10/MD-10	28	12	1.29 / [illegible]
L-1011	4	3	[illegible]
A300	17	4	2.5[illegible]
MD-80/-90	31	15	0.32 / [illegible]
767	10	2	[illegible]
757	5	5	0.20 / 0.20
BAe 146,RJ-70/-85/-100	16	8	0.70 / 1.41
A310	12	9	1.85 / 2.47
737-300/-400/-500	50	19	0.25 / 0.66
A300-600	7	4	0.63 / 1.10
A320/321/319/318	25	12	0.11 / 0.23
F-100/F-70	13	4	0.36 / 1.16
747-400	7	4	0.49 / 0.86
MD-11	10	5	1.84 / 3.69
A340	2	0	0 / 0.61
A330	4	2	0.21 / 0.42
777	4	2	0.20 / 0.39
737-600/-700-/800-900	15	7	0.09 / 0.19
717	0	0	0 / 0
CRJ-700/-900/-1000	0	0	0 / 0
EMB-170/-175/-190	4	1	0.07 / 0.27
**A380	0	0	0 / 0
**787	0	0	0 / 0
**747-8	0	0	0 / 0
**A350	0	0	0 / 0
**C-Series	0	0	0 / 0
**A320/321/319 NEO	0	0	0 / 0
Total	986	506	0.68 / 1.33

Hull loss accident rate—total bar
Hull loss with fatalities accident rate

0 1 2 3 4 5 6 7 8 9 10
Hull loss accident rate (per million departures)

* The Comet, CV880/990, Caravelle, Concorde, Mercure, Trident, and VC-10 are no longer in commercial service.
** These types have accumulated fewer than 1 million departures.

Fatalities by CICTT Aviation Occurrence Categories

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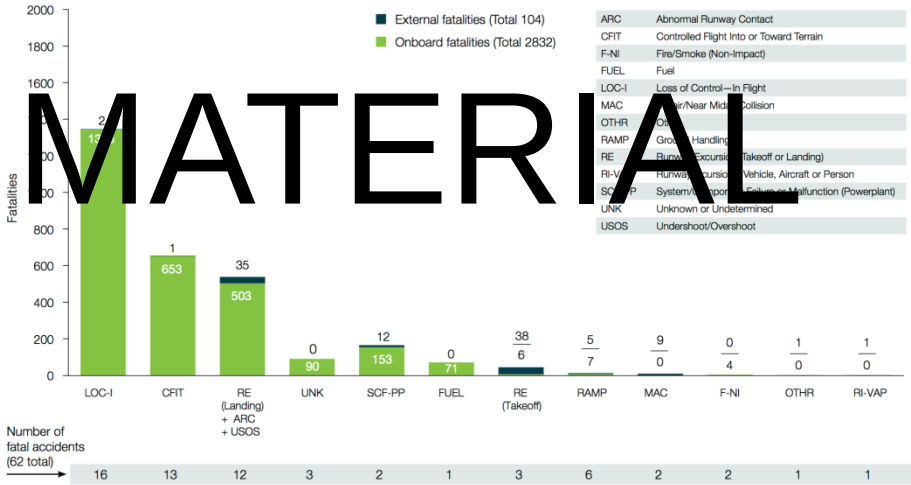

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RAMP	Gro[illegible] Handling
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