AFI Flight Operations Safety Awareness Seminar (FOSAS)

Loss Of Control in Flight (LOC-I)
Controlled Flight Into Terrain (CFIT)

ICAO/Airbus
Nairobi, 19-21 Sep. 2017
Loss Of Control In Flight (LOC-I)

Around 28%

The single biggest cause of fatal accidents over the last 20 years

Flight Envelope Protection (4th gen Aircraft) has reduced LOC-I accident rates by 75% compared to 3rd gen
Context

Breakdown per Accident Category (since 1997)

+ Loss Of Control In Flight (LOC-I)
+ Controlled Flight Into Terrain (CFIT)

Around 22% of fatal accidents
The introduction of Glass Cockpits, FMS & TAWS Systems (3rd and 4th gen Aircraft) has reduced CFIT accident rates by 85%
Agenda
Loss Of Control In flight
Controlled Flight Into Terrain
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Loss Of Control In Flight (LOC-I)

LOC-I definition and statistics

ICAO LOC-I:
- “Loss of control in flight is an extreme manifestation of a deviation from intended flight path.”

For non protected Airbus (A300/310)
- 7 accidents due to LOC-I for 34 million FH
  (1 for 5 million FH)

For Airbus FBW (revenue flights only)
- 2 accidents due to LOC-I (in alternate law) for 200 million FH
Loss Of Control In Flight (LOC-I)

Is it a Loss Of Control In Flight?

NO

• The pilot stayed ahead of his aircraft (positive Situational Awareness)

• The pilot is specifically trained for it

• The pilot remained in the adequate control loop
Loss Of Control In Flight (LOC-I)

Threats and Error in LOC-I

Threats

- Weather,
- Air Traffic Control,
- Systems malfunctions,
- Crew,
- Stress,
- Fatigue,
- Loss of situational awareness (SA),
- Disregard of procedures,

Any conditions increasing the complexity of the operation:

Errors

A Threat not properly managed, can decrease safety margins and can lead to errors:

- Intentional non-compliance errors,
- Procedural errors,
- Communications errors,
- Proficiency errors (piloting skills),
- Operational decision errors,

From Threat and Error Management (TEM) concept
Loss Of Control In Flight (LOC-I)

Lines of defense

Aircraft on the intended trajectory
Undesired Aircraft State (UAS)
Pilot out of the control loop

Weather
Systems malfunction
Loss of Situation Awareness
Proficiency issues

Adherence to procedures
Good flying practice

Recognize and Avoid
Recovery actions

Back to Safe Operation

First Line
Loss Of Control In Flight (LOC-I)

First Line of defense: Adherence to procedures and Good flying practice

- Weather
  - Knowledge and analysis of the weather forecast
  - Make optimum use of the weather radar
  - Avoidance of adverse weather with specific regard to aircraft and system performance
  - Climbing will reduce the flight envelope margins (Rec MAX)
  - Reducing speed will increase the risk of LOC-I

- Systems malfunction

- Loss of Situation Awareness

- Proficiency issues

Aircraft on the intended trajectory

Adherence to procedures
Good flying practice

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

First Line of defense: Adherence to procedures and Good flying practice

- Aircraft on the intended trajectory
- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Adherence to procedures
Good flying practice

Loss of Situational Awareness
- Knowledge of the intended flight path and expected energy level
- Constant review of progress along the intended 3D track by continuous monitoring of flight parameters, especially when parameters are changing
- Awareness of the aircraft configuration
- Being sensitive to the risk of being at too low a speed
- Stay “ahead of the aircraft” (anticipation)
- Be ready to “impose” a decision on ATC

("Unable, .... request heading 230 ....")

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

First Line of defense: Adherence to procedures and Good flying practice

- Aircraft on the intended trajectory
- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Proficiency issues
- Be able to fly basics (Pitch, roll without AP/FD and/or without ATHR. This requires knowledge of basic pitch and thrust targets)
- Be prepared to trade height for speed (potentially loose height to gain speed)
- Know the aircraft characteristics (Rec Max, VMO/MMO, GD/VLS, VFE, …)
- Continuously consider possible “escape” strategies,

To be trained in Simulator

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Lines of defense

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Pilot out of the control loop

Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Second Line

- Recognize and Avoid
- Recovery actions

Back to Safe Operation

ACCIDENT
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid

- **Aircraft on the intended trajectory**
- **Undesired Aircraft State (UAS)**
- **Weather**
- **Systems malfunction**
- **Loss of Situation Awareness**
- **Proficiency issues**

**System malfunction**
- Be aware of the potential for distraction
- Priority must always be given to maintaining a safe trajectory and energy level
- One pilot must always be flying the aircraft (Golden Rule No 1)
- Make and communicate consistent decisions

**Recognize and Avoid**

- **Back to Safe Operation**
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Loss of Situational Awareness
- Recognize a developing divergence from intended flight path and/or energy level
- Know what an Undesired Aircraft State is
- Be prepared to impose avoidance decisions on ATC ("….Descending to FL250….")

To be trained in Simulator

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)

Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Proficiency issues
- Maintain the aircraft in the normal flight envelope, e.g. by trading height for speed, AoA coming first,
- Be able to fly the aircraft out of the Undesired Aircraft State (pitch, roll, thrust)
- Fly the prepared “escape” strategy,
  → To be trained in Simulator

Second Line

- Recognize and Avoid

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Lines of defense

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Pilot out of the control loop
- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Third Line

- Adherence to procedures
- Good flying practice
- Recovery actions

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Third line of defense: Back in the loop and Recovery actions

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Pilot out of the control loop
- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Pilot out of the control loop example

Recovery actions

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Third line of defense: Back in the loop and Recovery actions

- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Aircraft on the intended trajectory
Undesired Aircraft State (UAS)
Pilot out of the control loop

Loss of Situational Awareness

- Be able to **recognize that the crew is out of the correct flying loop**. Develop the key mindset
  - For PF: think about **releasing the controls**
  - For PM: **use the right words** to bring back PF into the loop
- Step back and analyse (attitude and energy) to **fly (Golden Rule No 1)**
- Be trained to recognize stall condition
- Communicate the individual awareness levels and the intention (“... Stall, I have control....”) or (“…. I have lost it, you have control.....”)

Back to Safe Operation

Recovery actions
Loss Of Control In Flight (LOC-I)

Third line of defense: Back in the loop and Recovery actions

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Pilot out of the control loop

- Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Stall Warning and Buffeting example

Back to Safe Operation

Recovery actions
Loss Of Control In Flight (LOC-I)

Third line of defense: Back in the loop and Recovery actions

- Aircraft on the intended trajectory
- Undesired Aircraft State (UAS)
- Pilot out of the control loop

Weather
- Systems malfunction
- Loss of Situation Awareness
- Proficiency issues

Proficiency issues
- Be capable of recovering the aircraft to a safe state
- **Ease the back pressure** / push the stick (or yoke)
  - If Stall warning triggered or buffeting:
    - Release back pressure on stick or yoke
  - If Stall warning or buffeting remains:
    - Push the stick or the yoke forward in order to stop it.

Third Line

Recovery actions

Back to Safe Operation
Loss Of Control In Flight (LOC-I)

Summary

Avoid:
+ By always staying ahead of the aircraft (anticipation)

Recover:
+ Develop mindset to bring the crew back in the loop
Agenda
Loss Of Control In flight
Controlled Flight Into Terrain
Controlled Flight Into Terrain (CFIT)

CFIT definition and statistics

ICAO CFIT:
- “In flight collision or near collision with terrain, water, or obstacle without indication of loss of control.”

33% of fatal accidents (2009-2013)

85% occurred during approach & landing
Controlled Flight Into Terrain (CFIT)

Case study 1

Extract from NTSB report Ref NTSB/AAR-14/02

+ “On August, 14, 2013, at about 0447 central daylight time (CDT), United Parcel Service flight 1354, an Airbus A300-600, N155UP, crashed short of runway 18 while on approach to Birmingham-Shuttlesworth International Airport (KBHM), Birmingham, Alabama.“

+ “The two flight crew members were fatally injured and the airplane was destroyed."

+ “The cargo flight was operating under 14 Code of Federal Regulation Part 121 supplemental and originated from Louisville International Airport, Louisville, Kentucky.”
Controlled Flight Into Terrain (CFIT)

Case study 1: Event description

Non Precision Approach
+ ”Profile” approach initially briefed
+ F-PLN not properly sequenced
+ Changed to V/S after FAF
Controlled Flight Into Terrain (CFIT)

Case study 1: Event description

TAWS caution “SINK RATE” (262ft AGL, 1015ft QNH)
+ Rate of descent reduced
+ 2 seconds after “There it is”

TAWS caution “TOO LOW TERRAIN”
+ Then trees impact

“UPS 1354 heavy is 11 miles from BASKIN maintain 2500 till established on localizer. Cleared LOC 18 approach.”
Controlled Flight Into Terrain (CFIT)

Case study 1: Summary

- F-PLN not properly sequenced
- Changes to an approach after the completion of the approach briefing not rebriefed
- Stabilization criteria not respected
- Automated “MINIMUM” alert not activated
- No reaction to TAWS alert
- GPS not connected to TAWS
- TAWS software not updated (earlier triggering)
In April 2014, A320 performed a PAR (Precision Approach Radar)

After a level off at 1000ft with autopilot engaged, the descent was initiated at about 5NM from runway

At about 350ft and 3NM from runway, the EGPWS caution “TOO LOW TERRAIN” triggered, immediately followed by the EGPWS warning “TERRAIN TERRAIN PULL-UP”

A Go Around was initiated by setting TOGA with autopilot engaged
Case study 2: Summary

+ Immediate reaction to TAWS
+ However, only a go around was performed, autopilot ON, whereas a pull up manoeuver is required

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“PULL UP” - “TERRAIN TERRAIN PULL UP” - “OBSTACLE OBSTACLE PULL UP”

Simultaneously:
AP .......................................................... OFF
PITCH .............................................. PULL UP

Pull to full backstick and maintain in that position.

THRUST LEVERS ......................................................... TOGA
SPEED BRAKES lever .............................................. CHECK RETRACTED
BANK .......................................................... WINGS LEVEL or ADJUST

Aircraft achieve the best climb performance when the wings are as level as possible.
If the “TERRAIN TERRAIN PULL UP” or “OBSTACLE OBSTACLE PULL UP” aural alert
triggers, a turning manoeuver can be initiated if the flight crew concludes that turning is
the safest action. The PULL UP maneouver must be performed before the turn towards the safe
direction, as climbing increases the terrain clearance.
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Controlled Flight Into Terrain (CFIT)

Summary

Avoid:
+ Rebrief if necessary
+ Implement FWC altitude and minima auto callouts
+ Use GPS position and update TAWS software

Recover:
+ Adhere to memory items