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

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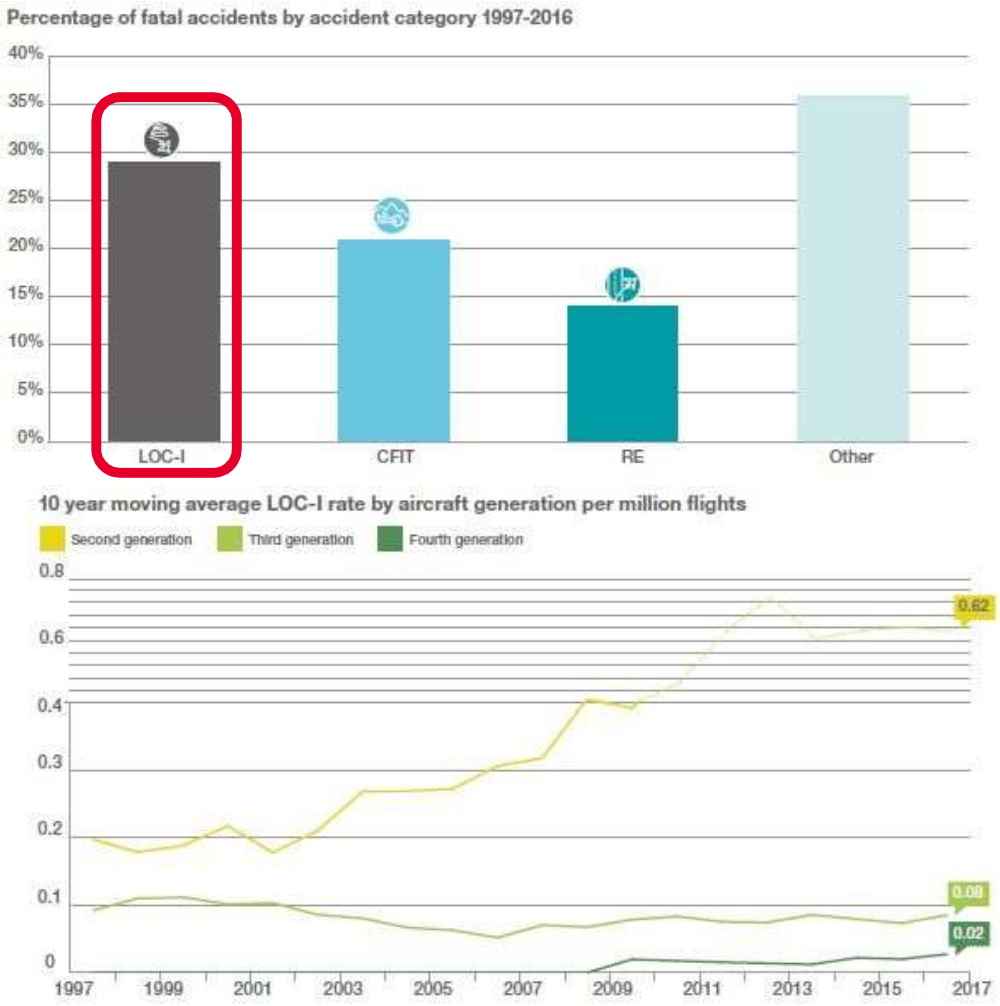
Context



Breakdown per Accident Category (since 1997)

+ **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

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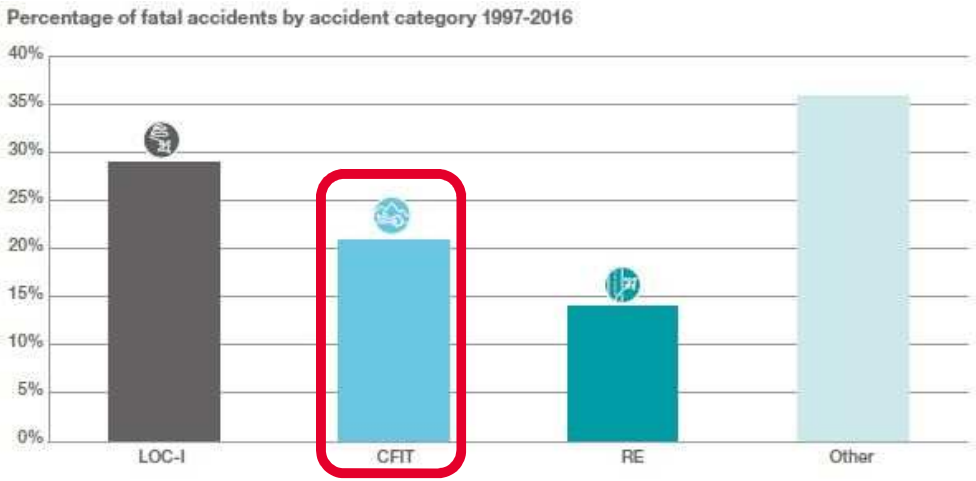
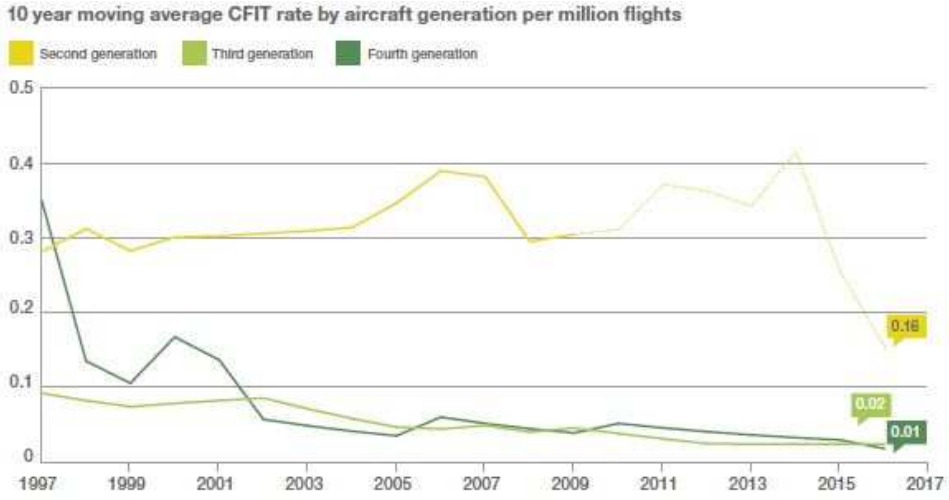
Context





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%

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Agenda

Loss Of Control In flight
Controlled Flight Into Terrain

LOC–I

CFIT

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Loss Of Control In flight
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LOC–I

CFIT

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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

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93MILITARY

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

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Loss Of Control In Flight (LOC-I)

Threats and Error in LOC-I

Threats

Any conditions increasing the complexity of the operation:

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

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

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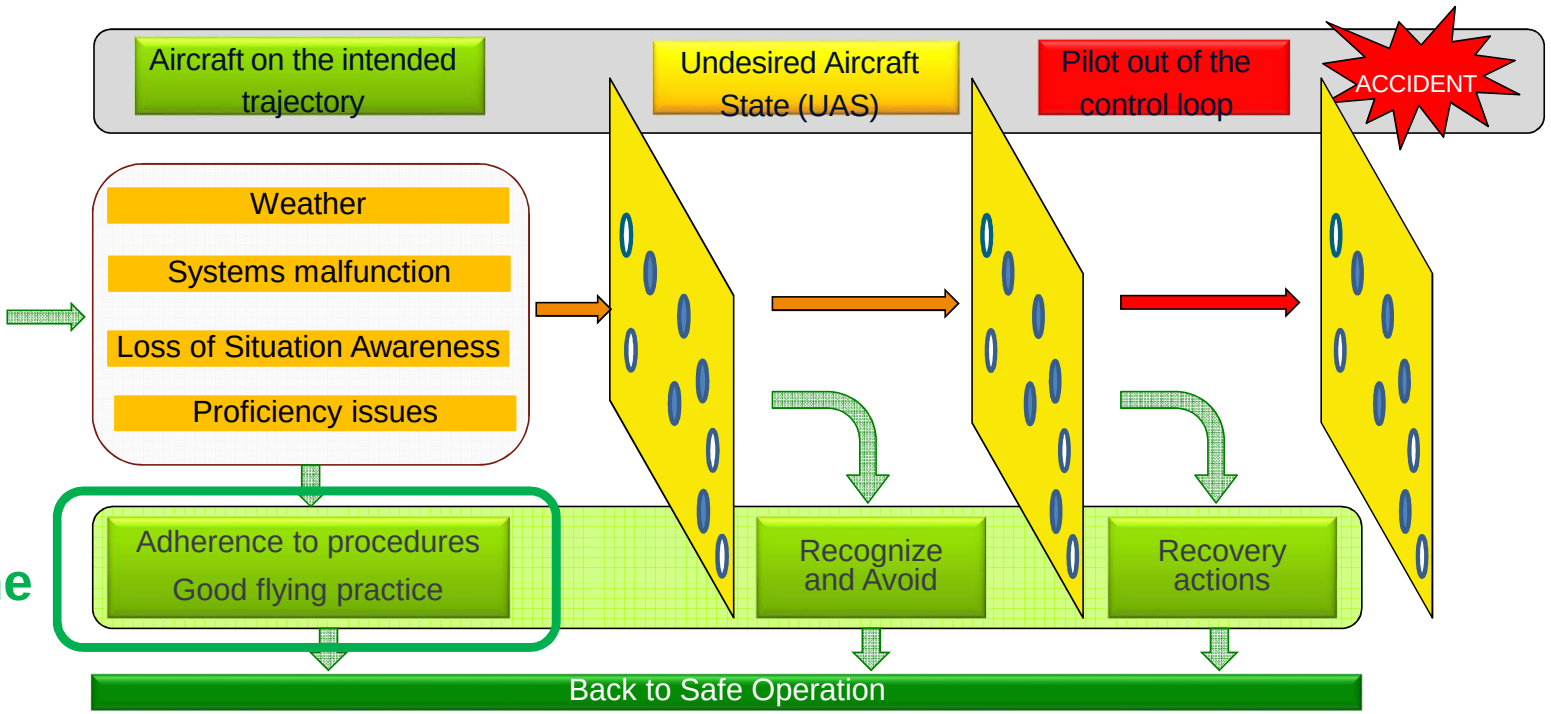
Loss Of Control In Flight (LOC-I)

Lines of defense



First Line

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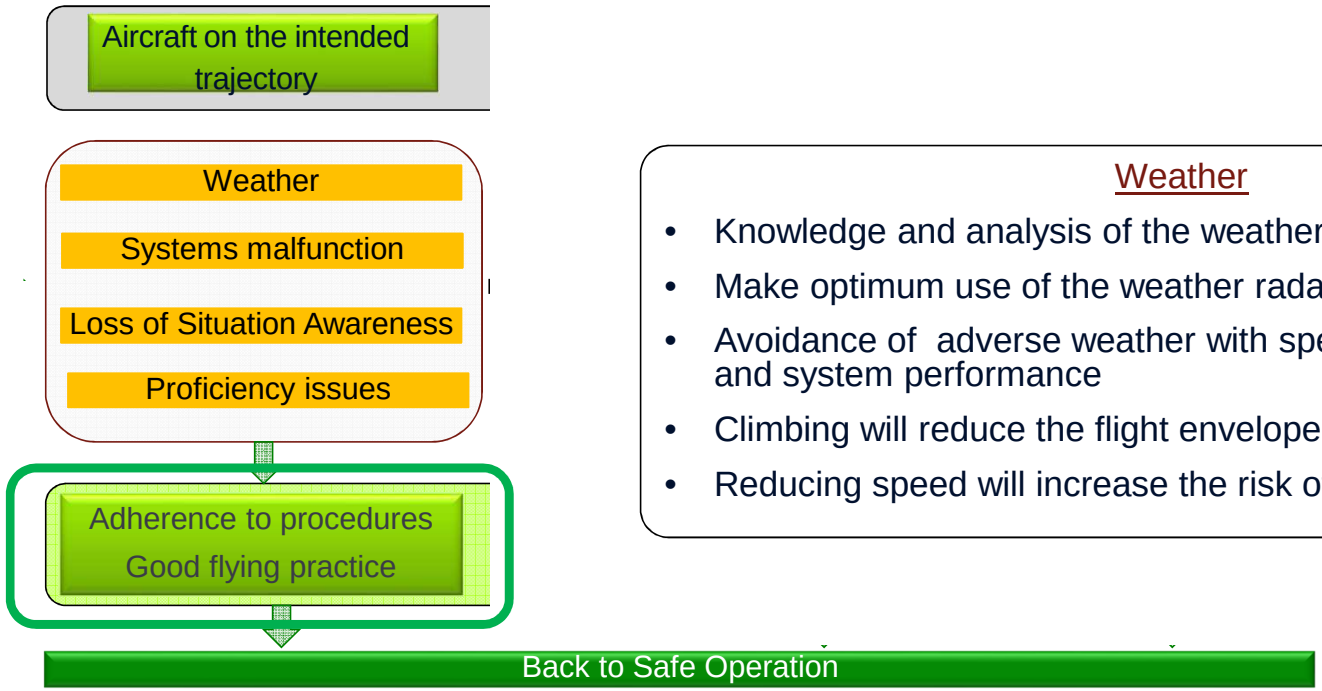
Loss Of Control In Flight (LOC-I)

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



First Line

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

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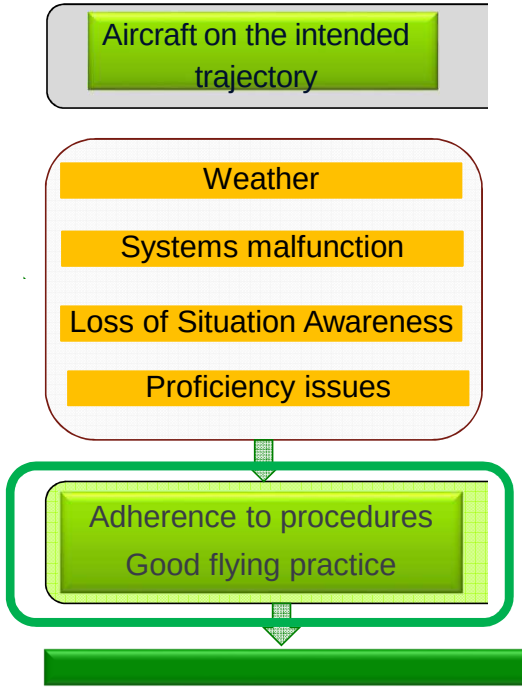
Loss Of Control In Flight (LOC-I)

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



First Line

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 ….”)

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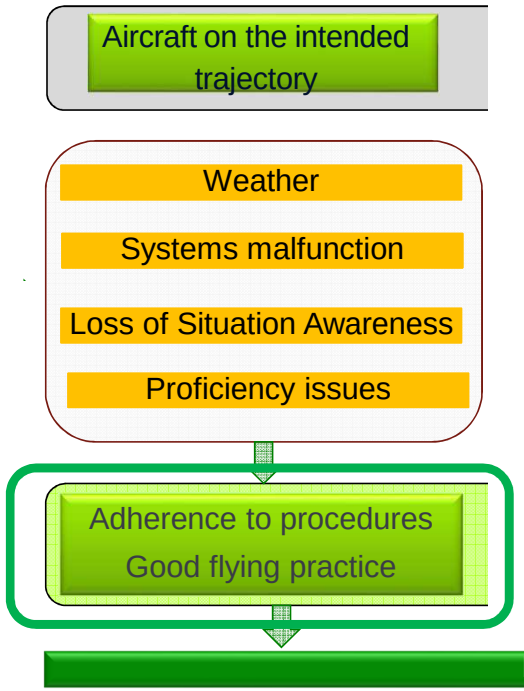
Loss Of Control In Flight (LOC-I)

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



First Line

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

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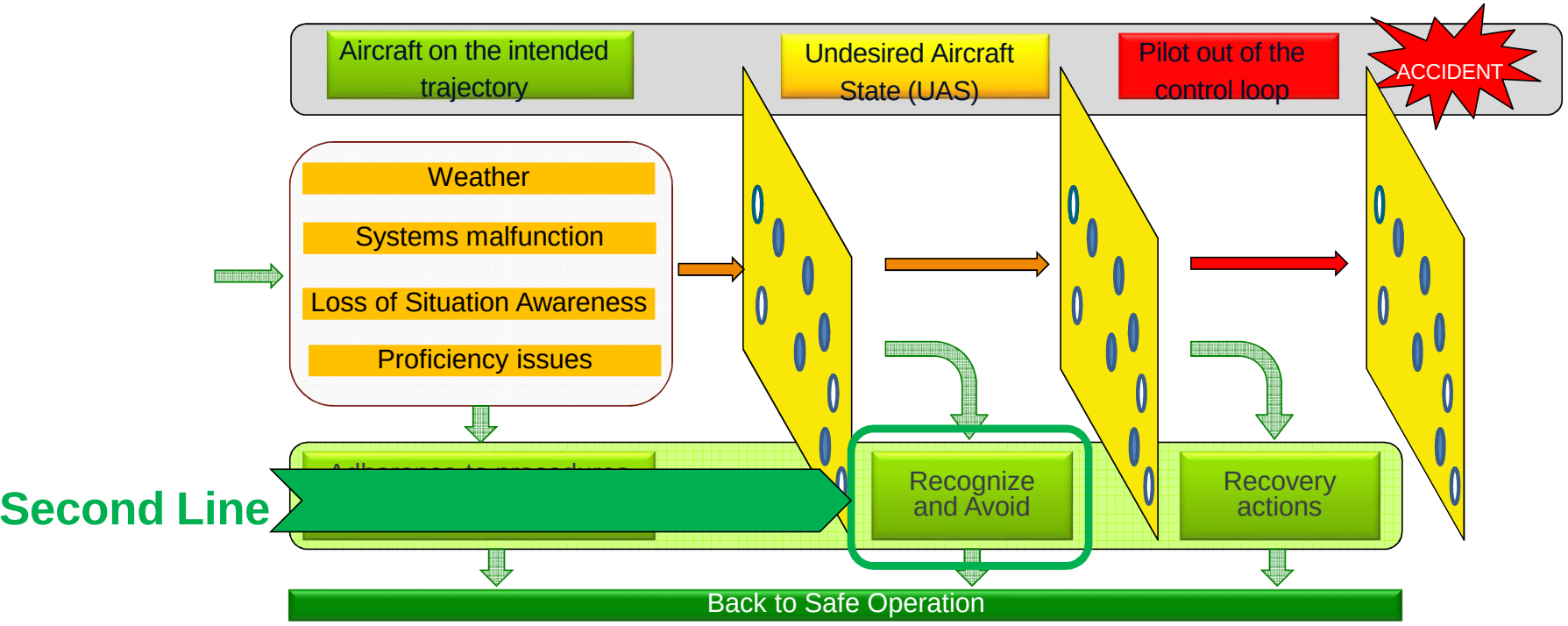
Loss Of Control In Flight (LOC-I)

Lines of defense



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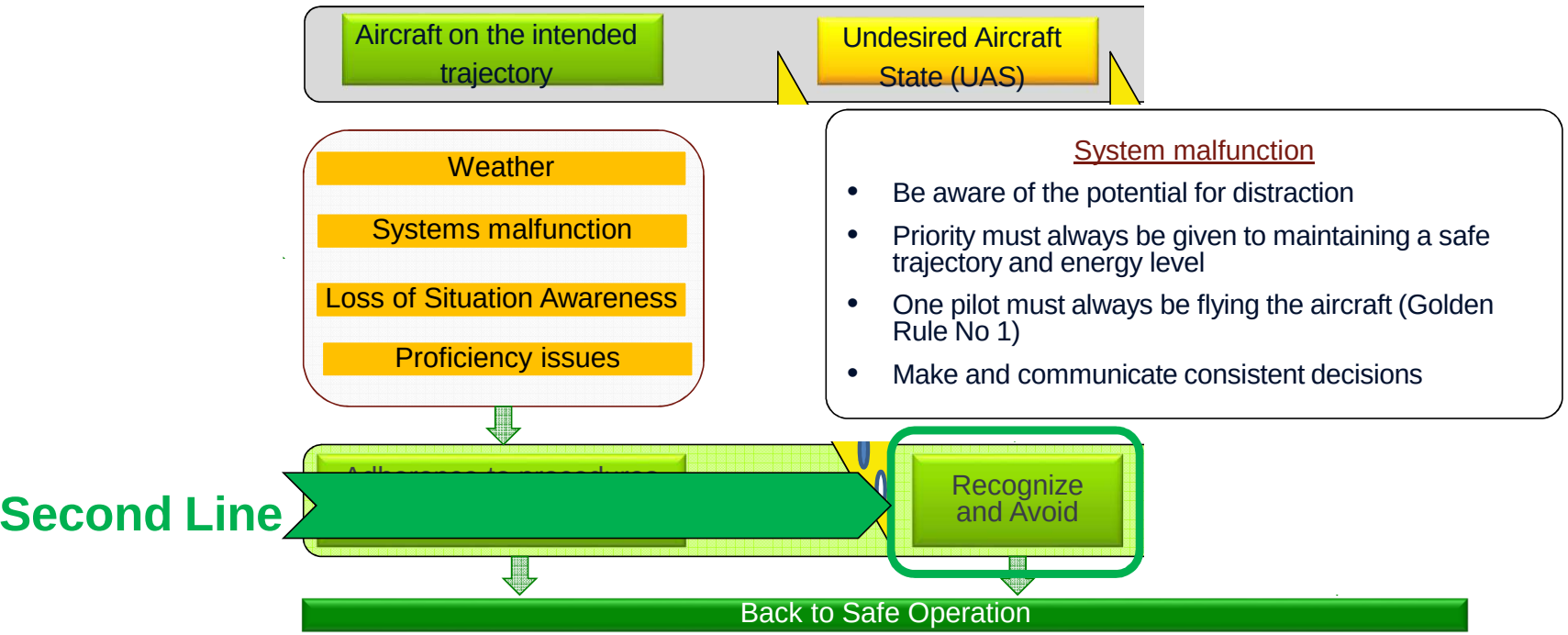
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid



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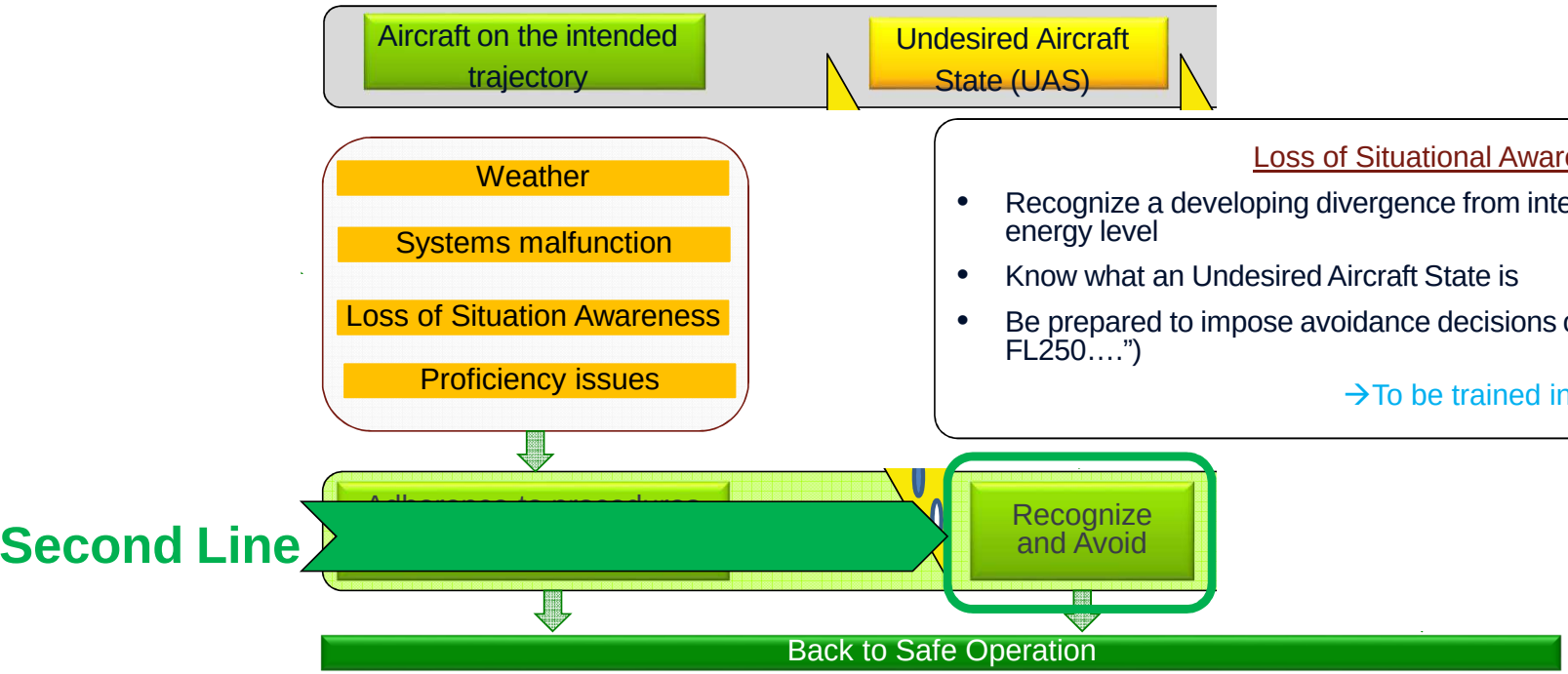
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid



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

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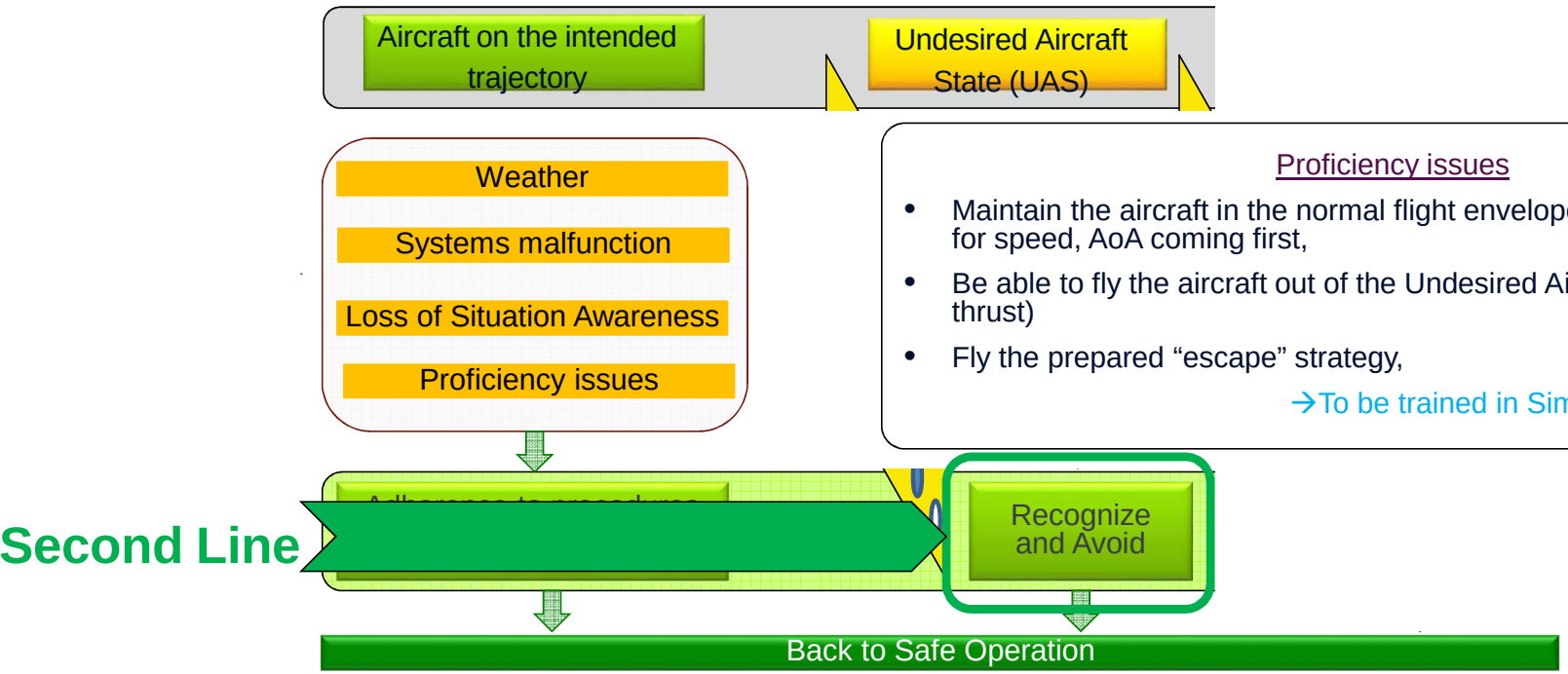
Loss Of Control In Flight (LOC-I)

Second line of defense: Recognize and Avoid



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

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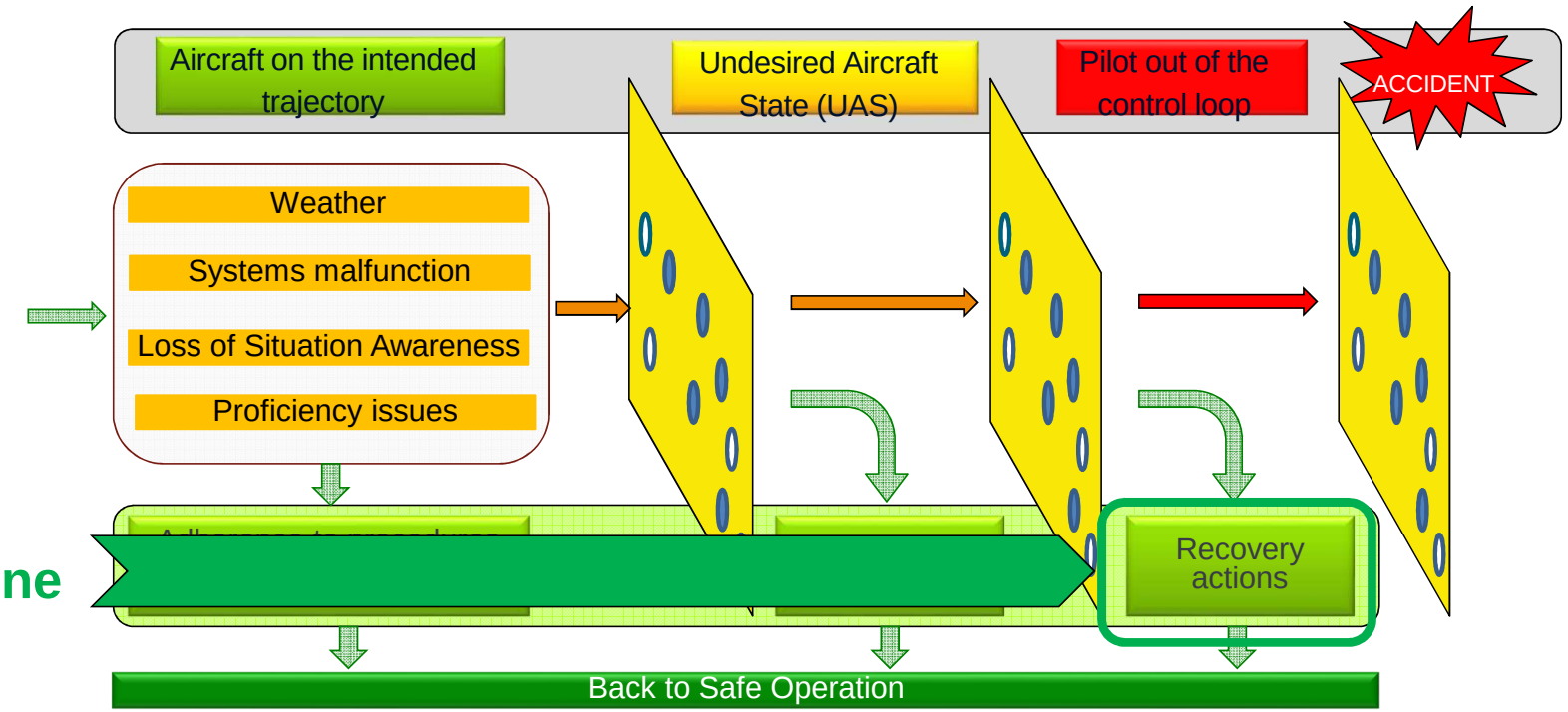
Loss Of Control In Flight (LOC-I)

Lines of defense



Third Line

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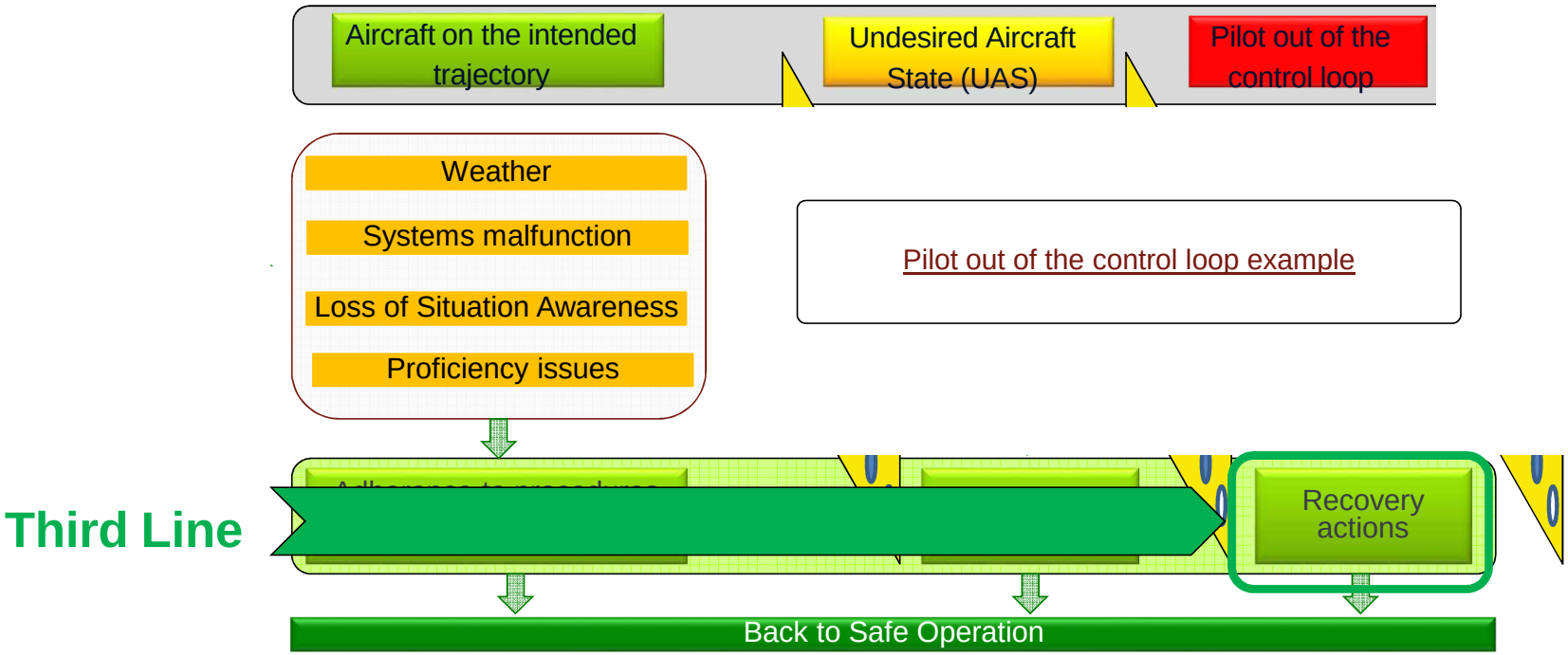
Loss Of Control In Flight (LOC-I)

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



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ALT = 36528 FT
IAS = 251.8 KTS
V/S = 437 FT/MIN
PHI = -0.1 DEG
THE = 3.0 DEG
PSI = 77.2 DEG
ALF = 2.4 DEG
BET = 0.0 DEG
GAM = 0.6 DEG
Vortex with pilot effect (in blue)
CAMERA
NUM IND
GRA IND
C/S AMP
OPTIONS
MODEL
AVI
?
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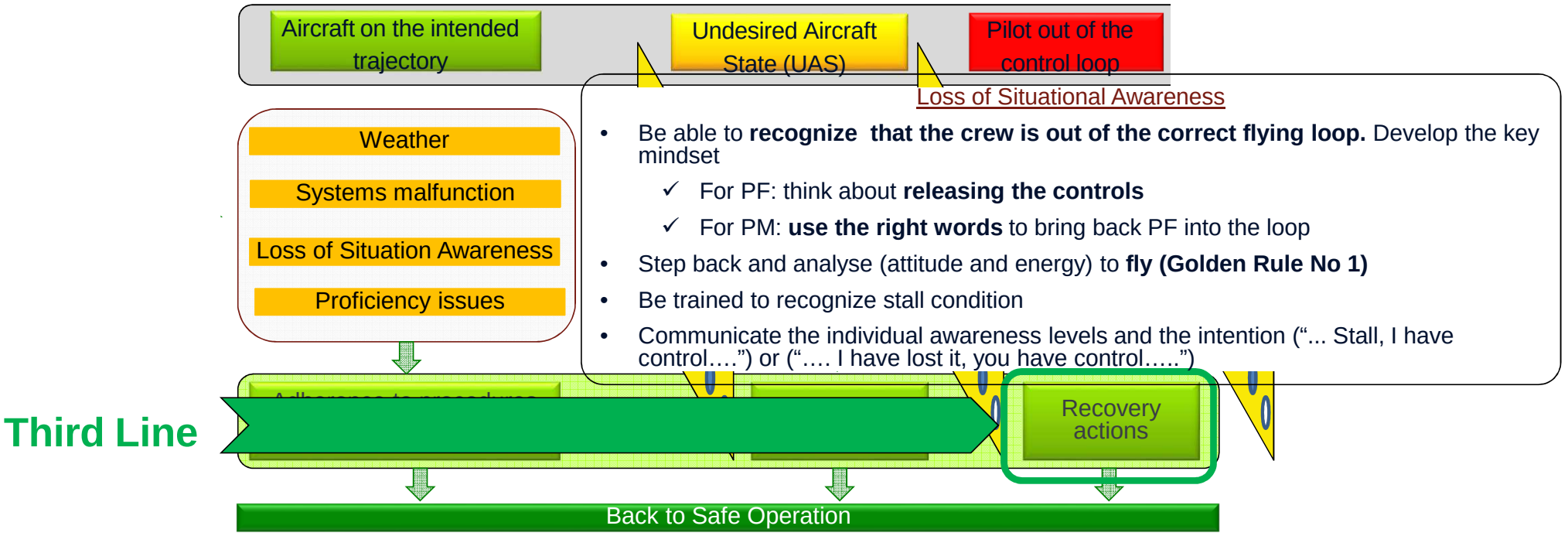
Loss Of Control In Flight (LOC-I)

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



Third Line

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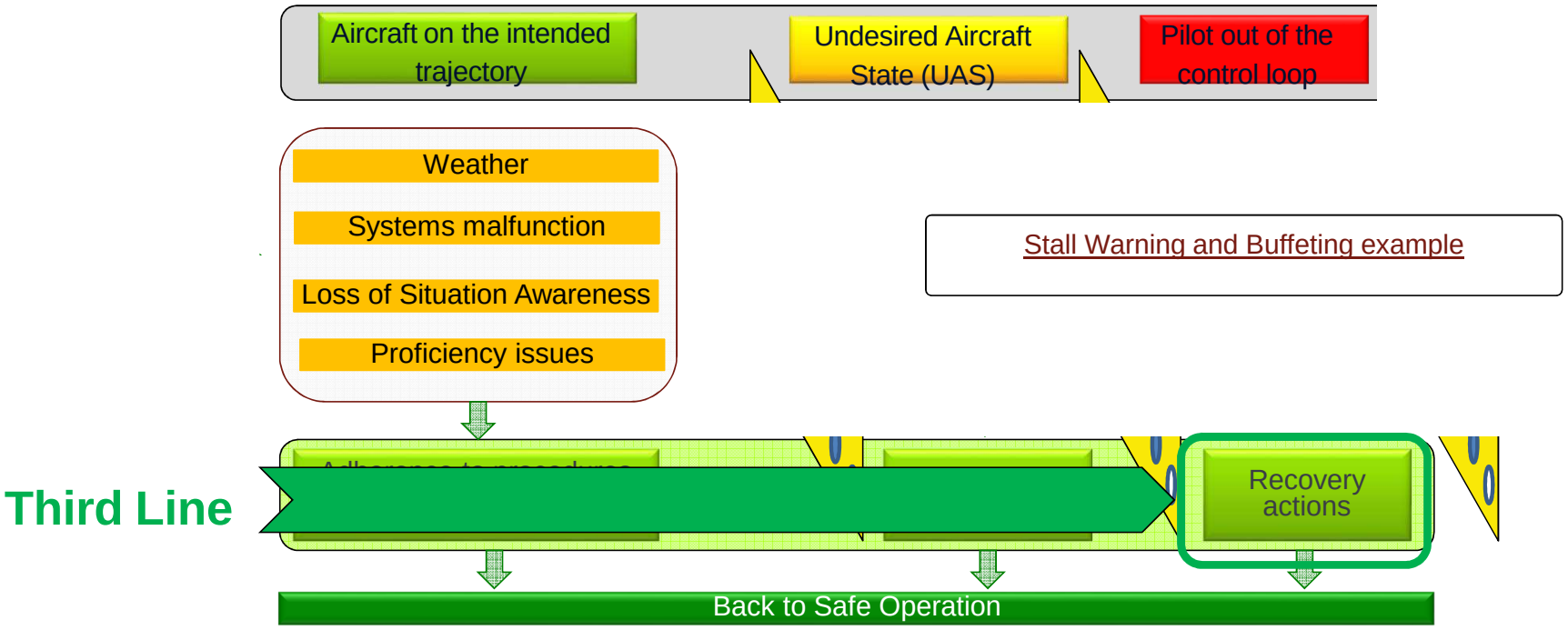
Loss Of Control In Flight (LOC-I)

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



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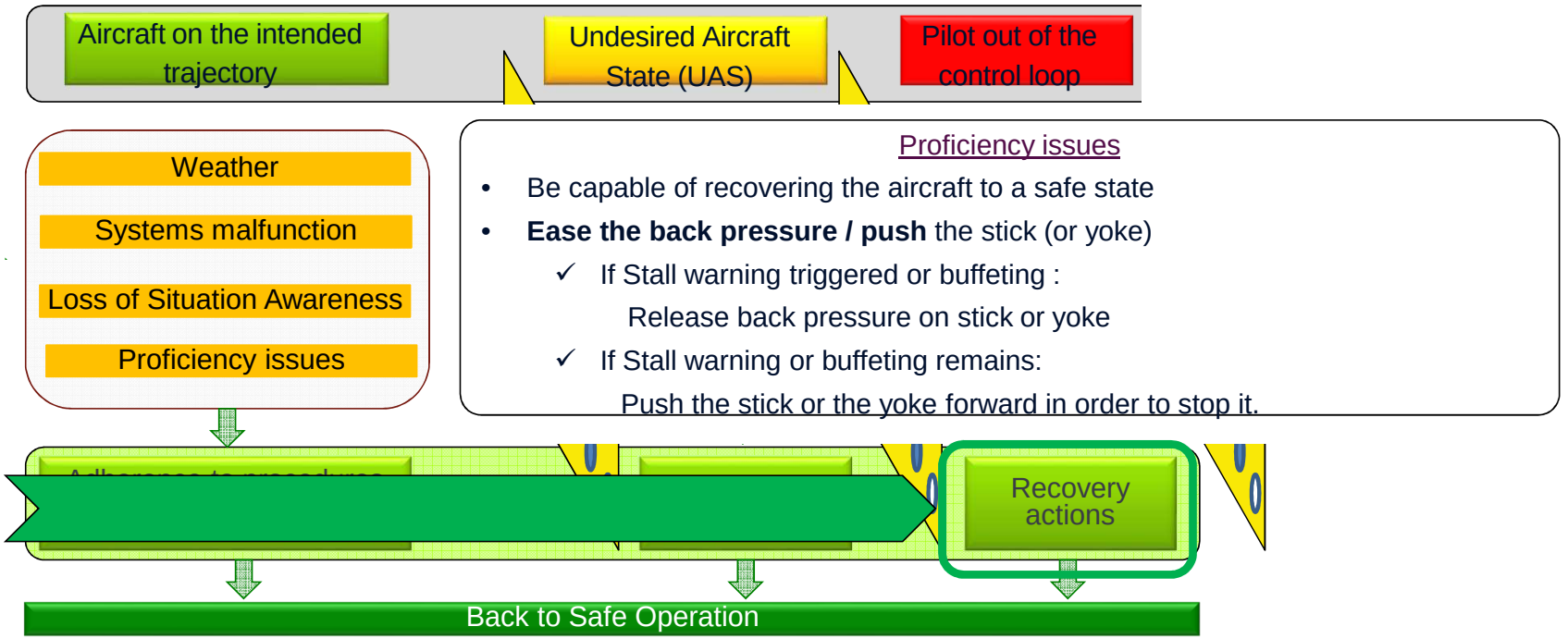
Std
NAV
ARC
PLAN
ENG
ADF
OFF
VOR

Loss Of Control In Flight (LOC-I)

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



Third Line

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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

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Agenda

Loss Of Control In flight
Controlled Flight Into Terrain

LOC-I

CFIT

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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

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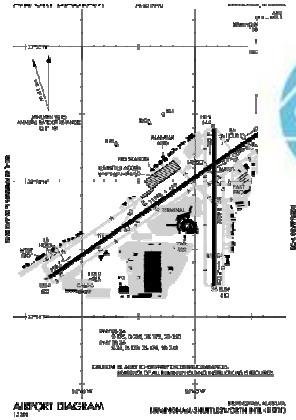
Controlled Flight Into Terrain (CFIT)



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.*"

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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

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Controlled Flight Into Terrain (CFIT)

Case study 1: Event description

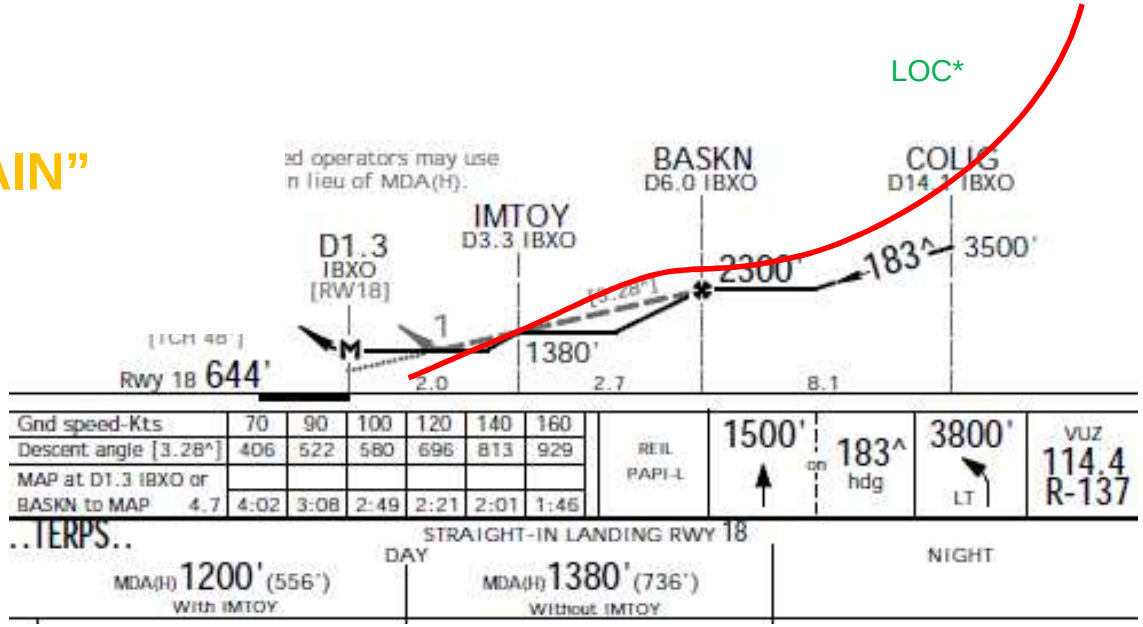
"UPS 1354 heavy is 11 miles from BASKIN maintain 2500 till established on localizer. Cleared LOC 18 approach."

TAWS caution "SINK RATE" (262ftAGL, 1015ft QNH)

+ Rate of descent reduced
+ 2 seconds after *"There it is"*

TAWS caution "TOO LOW TERRAIN"

+ Then trees impact



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runway 18 threshold
aft fuselage
engines and forward fuselage
rising terrain
ground contact
tree strikes

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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)

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Controlled Flight Into Terrain (CFIT)

Case study 2

+ 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

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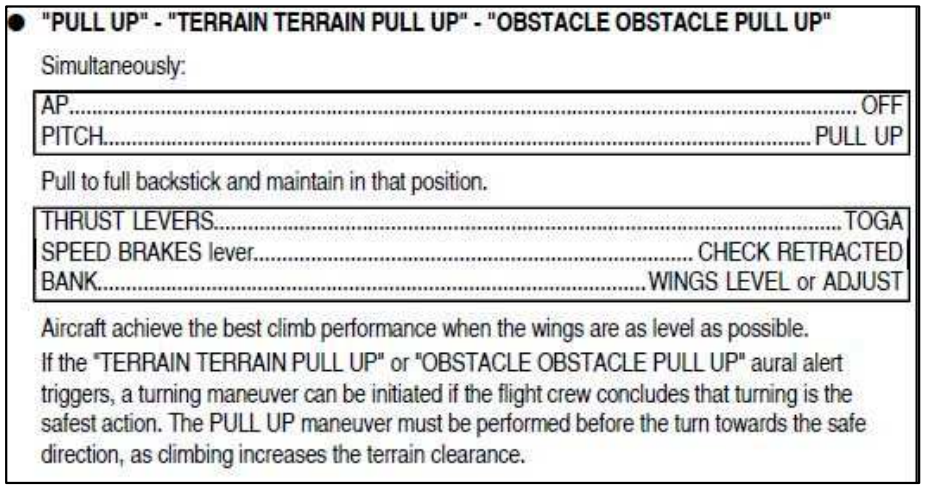
Controlled Flight Into Terrain (CFIT)

Case study 2: Summary

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



● **"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 maneuver can be initiated if the flight crew concludes that turning is the safest action. The PULL UP maneuver 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

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