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Loss Of Control in Flight

Presented by Capt. ZHAO Weibo





93MILITARY

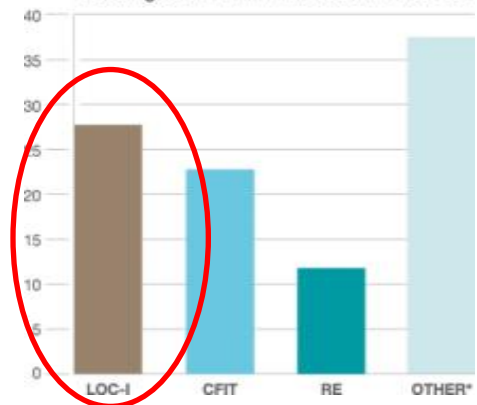
- **WAS IT A LOSS OF CONTROL IN FLIGHT?**
- **No:**
 - **The pilot stayed ahead of his aircraft (positive Situational Awareness)**
 - **The pilot is specifically trained for it**
 - **The pilot remained in an adequate control loop**

LOC-I – Table of content

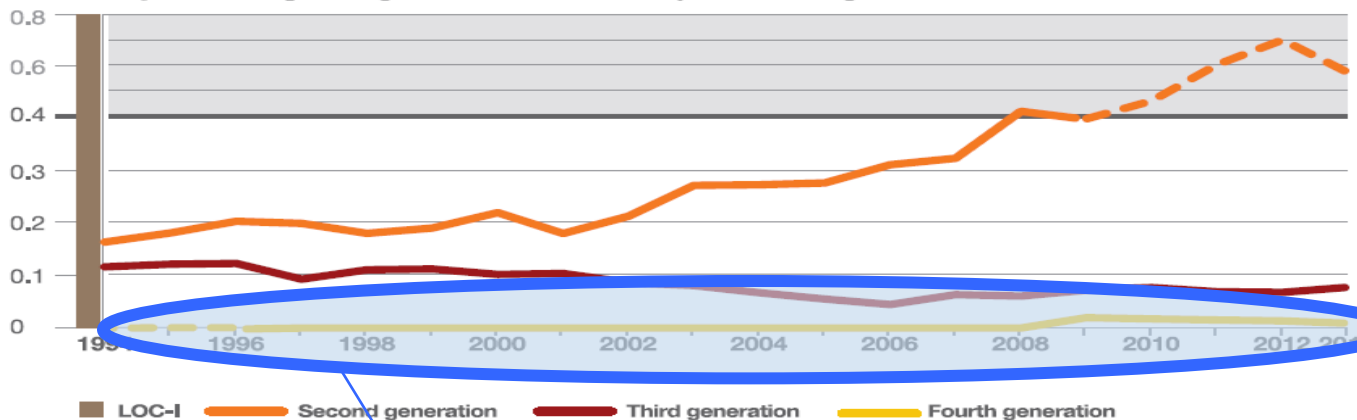
- LOC-I definition and statistics
- Threat and Errors in LOC-I
- 1st line of defence: Adherence to procedures and flying practice
- 2nd line of defence: Recognise and Avoid
- 3rd line of defence: Back in the loop and Recovery actions
- Summary

LOC-I definition and statistics

Percentage of total number of accidents since 1994



10 year moving average LOC-I accident rate per million flights



LOC-I type of accident for the 4th generation of aircraft.
(Fly-by-wire & Flight Envelope Protection)

LOC-I definition and statistics (cont'd)

- ICAO LOC-I:

“Loss of control in flight is an extreme manifestation of a deviation from intended flight path”

- For non protected aircraft: A300 / 310 / 300-600
 - ✓ 7 accidents due to LOC-I for 34 million FH (1 for 5 million FH)
- For AIRBUS FBW envelope protected aircraft (revenue flights only):
 - ✓ 2 accidents due to LOC-I (in alternate law) for 200 million FH

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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:

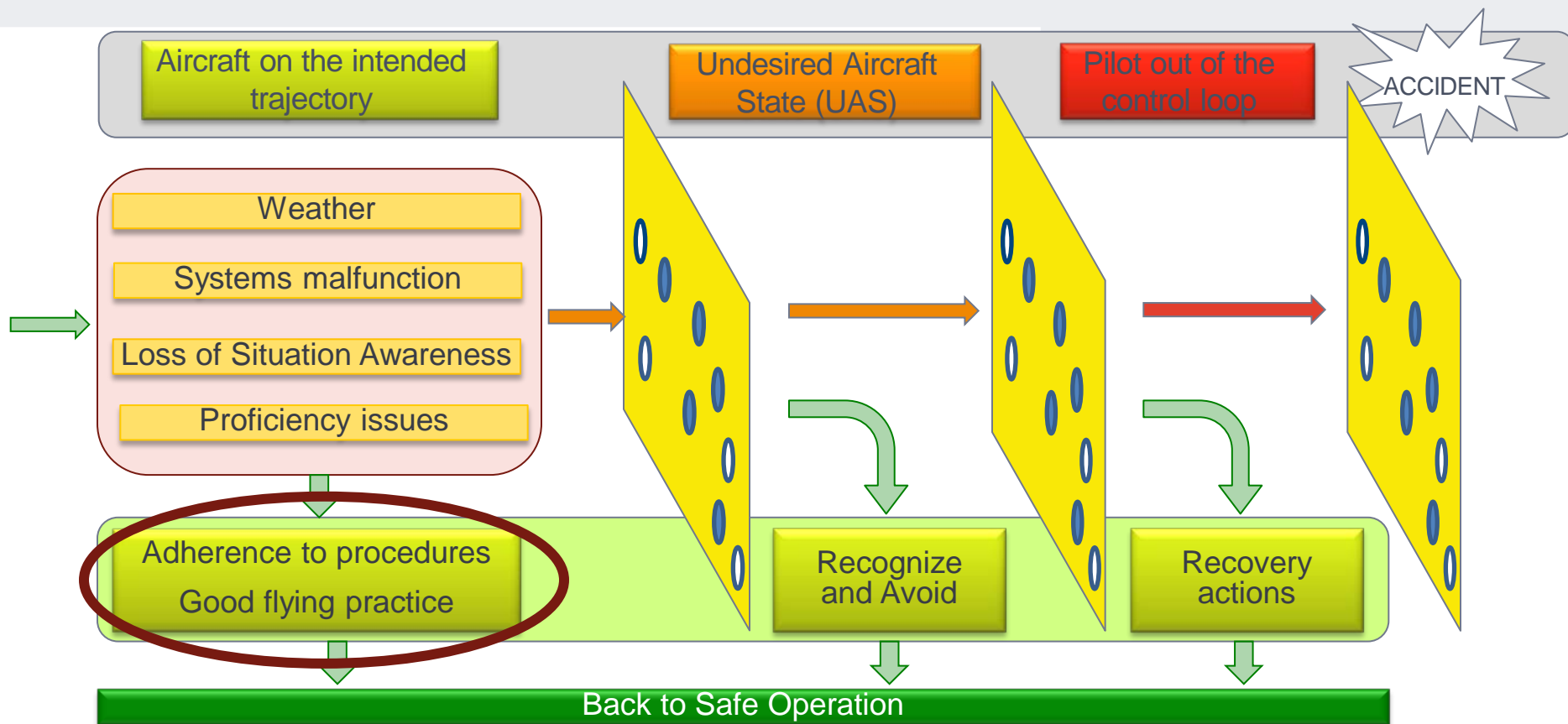
- Intentional non-compliance errors,
- Procedural errors,
- Communications errors,
- Proficiency errors (piloting skills),
- Operational decision errors,

From Threat and Error Management (TEM) concept

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1st line of defence: Adherence to procedures and flying practice



1st line of defence: Adherence to procedures and flying practice (cont'd)

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

1st line of defence: Adherence to procedures and flying practice (cont'd)

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”*)

1st line of defence: Adherence to procedures and flying practice (cont'd)

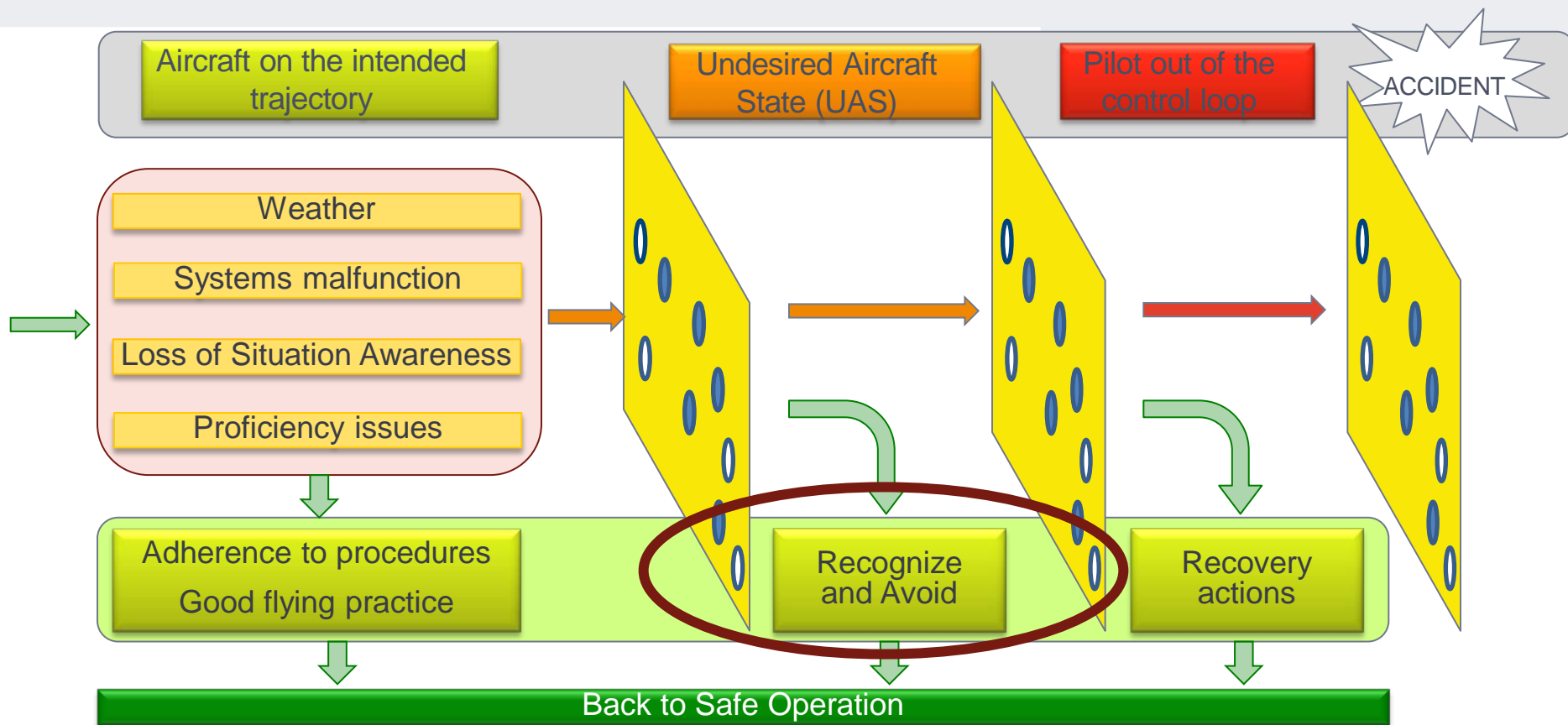
- Proficiency issues

- Be able to fly basics (Pitch, roll without AP/ FD and/or without ATHR. This requires knowledge of basic pitch and power targets)
- Be prepared to trade height for speed (potentially lose 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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2nd line of defence: Recognise and Avoid



2nd line of defence: Recognise and Avoid (cont'd)

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

2nd line of defence: Recognise and Avoid (cont'd)

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

2nd line of defence: Recognise and Avoid (cont'd)

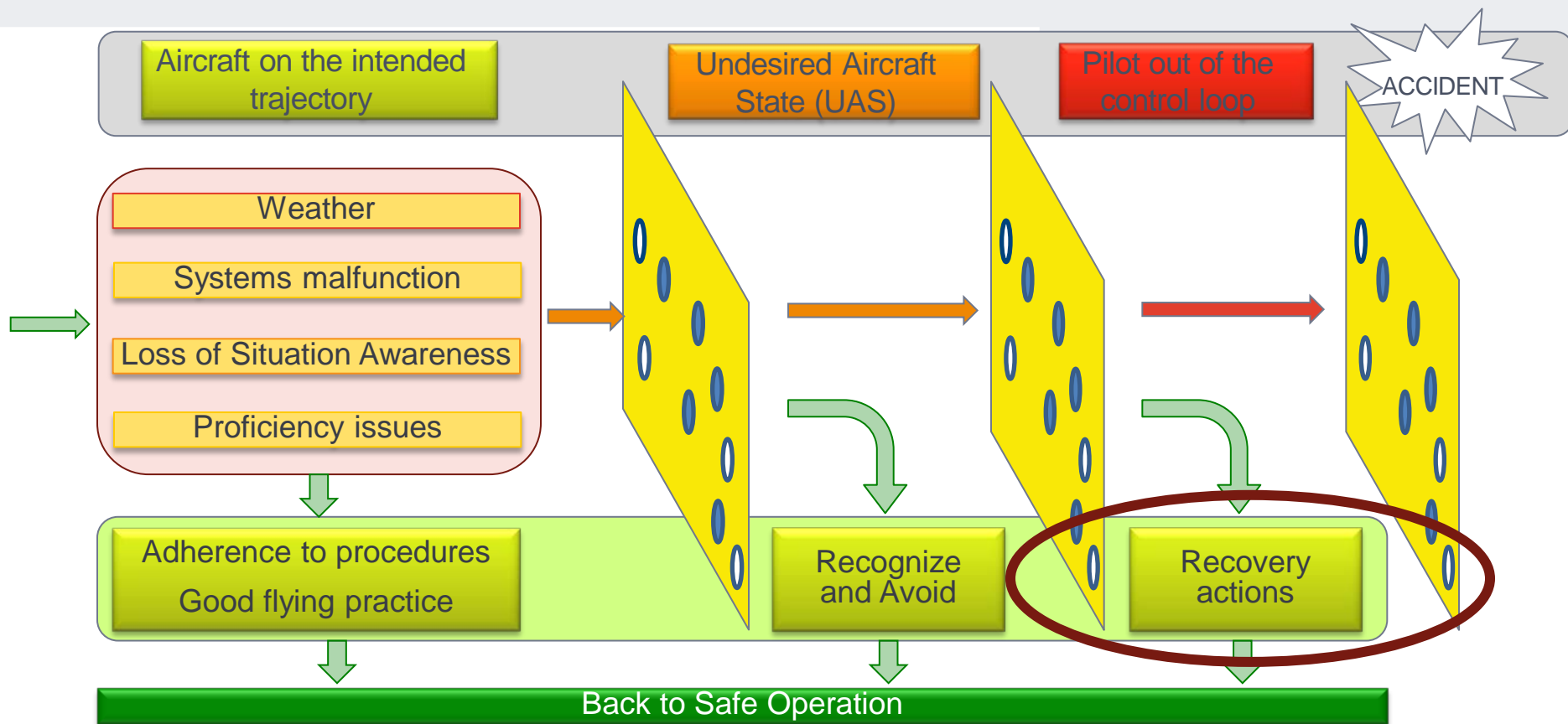
Proficiency issues

- 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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3rd line of defence: Back in the loop and Recovery actions



Loss of Control - One answer per airline please

Question - Does your airline carry out upset recovery training?

Answer -

- 1 - Yes
- 2 - No
- 3 - Don't know

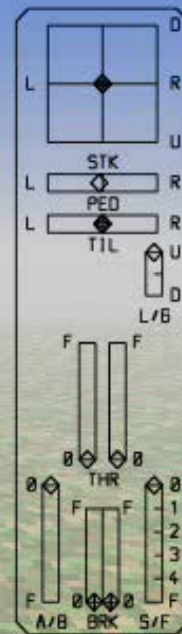
3rd line of defence: Back in the loop and Recovery actions (cont'd)

Pilot out of the control loop example



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)



3rd line of defence: Back in the loop and Recovery actions (cont'd)

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 (“... We are stalled, I have control....”) or (“.... I have lost it, you have control....”)

3rd line of defence: Back in the loop and Recovery actions (cont'd)

Stall Warning and Buffeting example



3rd line of defence: Back in the loop and Recovery actions (cont'd)

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.

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Summary

Avoid:

By always staying ahead of the aircraft
(anticipation)

Recover:

Develop mindset to bring the crew back in the loop