



Technology to support Competency based training programs

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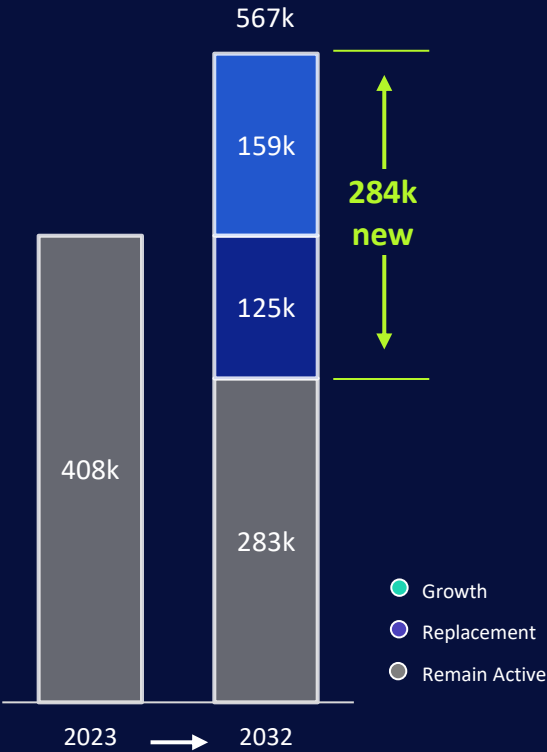
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CAE

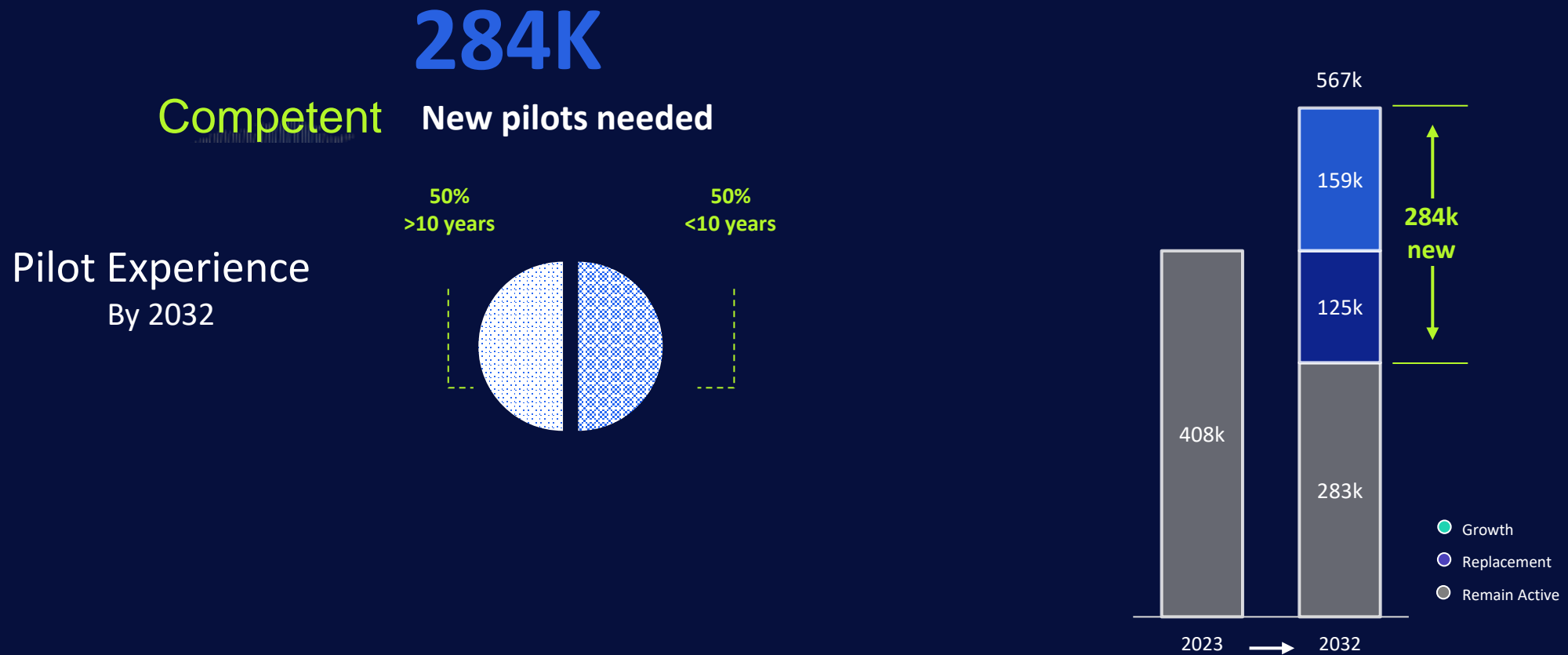
Agenda

1. A training response to the pilot demand forecast.
2. Supporting technology.
3. The collection and analysis of accurate training data.

Civil Aviation Talent Forecast



Civil Aviation Talent Forecast



“Meet the numbers” and manage the risk of a reduction in overall “relevant” experience.

“Meet the numbers” and manage the risk of a reduction in overall “relevant” experience.

An aligned training method

Competency Based Training and Assessment (CBTA) provides the assurance that competence demonstrated in the context of training can reliably predict successful performance on the job in the operational context.

What does the move to CBTA mean for the training system?

Program characteristics	Consequences for the training system
<ul style="list-style-type: none">• Training required to perform the job on day 1.• Focus on <u>all</u> competencies required to do the job in operations. i.e. extend focus to leadership/teamwork, situation awareness, communication, decision making etc.• Success is measured by the ability to demonstrate behaviours required for safety, in complex immersive scenarios.• Equal Focus on Process (behaviour) and Outcome (exceedances).• Focus is on preparing for both the known and the unforeseen.• Focus is on Threat and Error Management.• Focus is on preparing to deal with Startle ,Surprise, and developing Resilience• Training and Operational data analysis, are mandatory.	

People and Technology consequences

What does the move to CBTA mean for the training system?

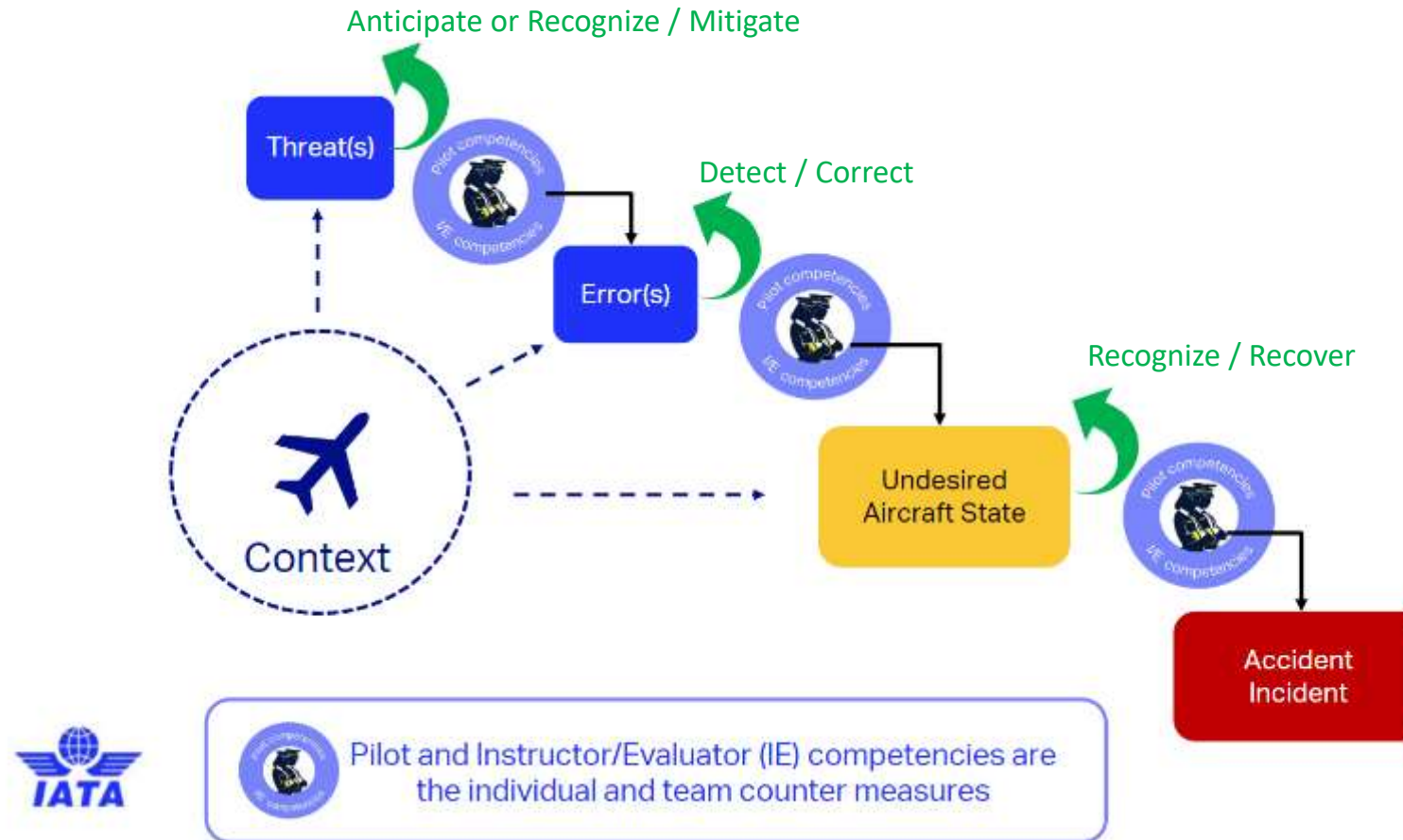
Program characteristics	Consequences for the training system
<ul style="list-style-type: none"> • Training required to perform the job on day 1. 	<ol style="list-style-type: none"> 1. Instructor training/monitoring to evaluate ALL competencies. 2. Reduce Instructor workload- to allow focus on crew behaviours. <ul style="list-style-type: none"> • Automatic Lesson Plans. • Telemetry to capture error, exceedances. • Biometrics to supplement instructor observations. 3. Ability to accurately simulate the “Job” environment. <ul style="list-style-type: none"> • Simulation of “Subtle” and/or “Highly Improbable” scenarios. • AI to simulate real time ATC. 4. Establish a data collection and analysis infrastructure.
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People and Technology consequences

Technology to support Competency Based Training Programs

Supporting Technology

Effective threat and error management = competent pilots



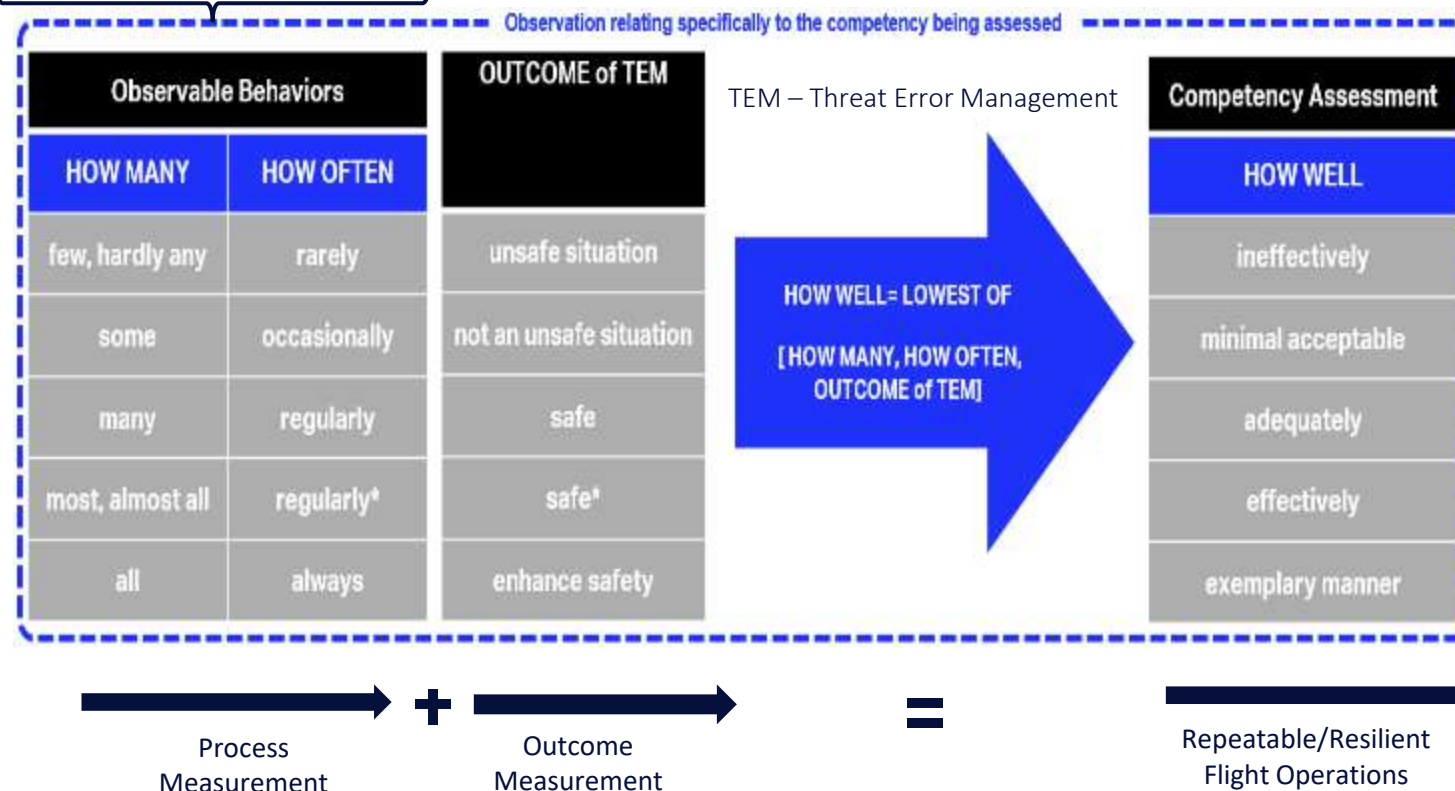
Competencies are TEM countermeasures.

Pilots demonstrate relevant observable behaviours to manage safety margins.

Measuring Competence – Current IATA model

Focus equally on
process and
outcomes, to
ensure
reliable/resilient
flight operations.

What is relevant?



One Key for accurate application of this method of assessing process, is to define the Observable Behaviours **relevant** to the training event.

CBTA Training Data and Metrics (adding context)

Example of CBTA grading metrics

Level 0 (competent metrics): The information whether the pilot(s) is (are) competent or not.

Level 1 (competency metrics): Level of performance reflected by numeric grade of the competencies (e.g., 1 to 5).

Level 2 (observable behavior metrics): The instructors record OBs predetermined or required by the organization (Regulatory or Policy requirements).

Level 3 (TEM metrics): The instructor records Threats, Errors or Reduction of Safety Margin predetermined or required by the organization.

CBTA data collection

THREATS (occurs outside the influence of the flight crew)

E - Environmental Threats

E01 Meteorology (see breakdown)

E01.01 Thunderstorm

E01.02 Poor Visibility/IMC

E01.03 Gusty wind/ windshear

E01.04 Icing conditions

E01.05 Hail

E02 Lack of Visual Reference

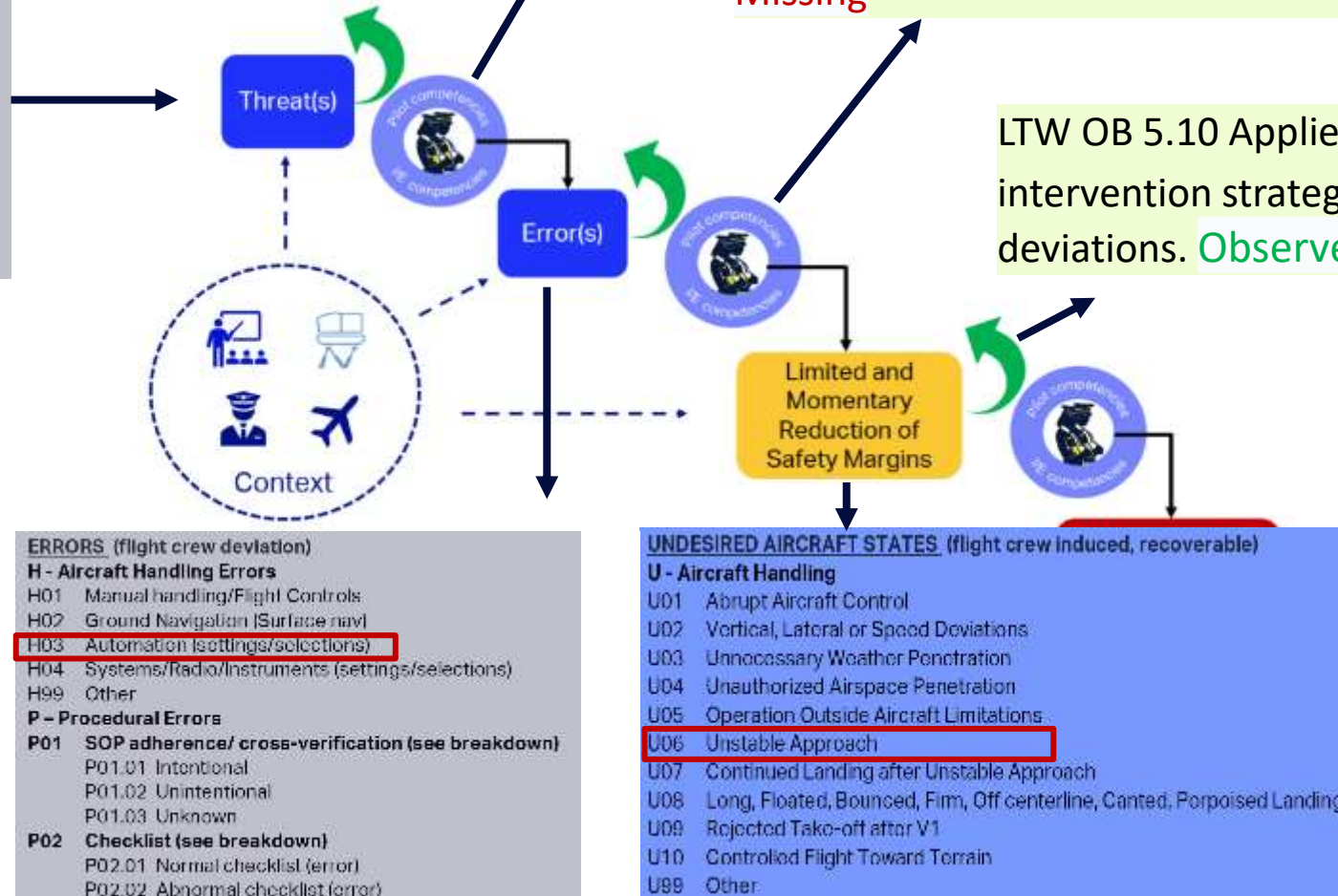
E03 Air Traffic Services

E04 Birds/foreign objects

E04.01 Birds

E04.02 Wildlife

E04.03 Foreign objects



SAW OB 7.3 Monitors and assesses the general environment as it may affect the operation. **Missing**

OB 3.4 Maintains the intended flight path during flight using automation while managing other tasks and distractions. **Missing**

LTW OB 5.10 Applies effective intervention strategies to resolve identified deviations. **Observed**

ERRORS (flight crew deviation)

H - Aircraft Handling Errors

H01 Manual handling/Flight Controls

H02 Ground Navigation (Surface nav)

H03 Automation (settings/selections)

H04 Systems/Radio/Instruments (settings/selections)

H99 Other

P - Procedural Errors

P01 SOP adherence/ cross-verification (see breakdown)

P01.01 Intentional

P01.02 Unintentional

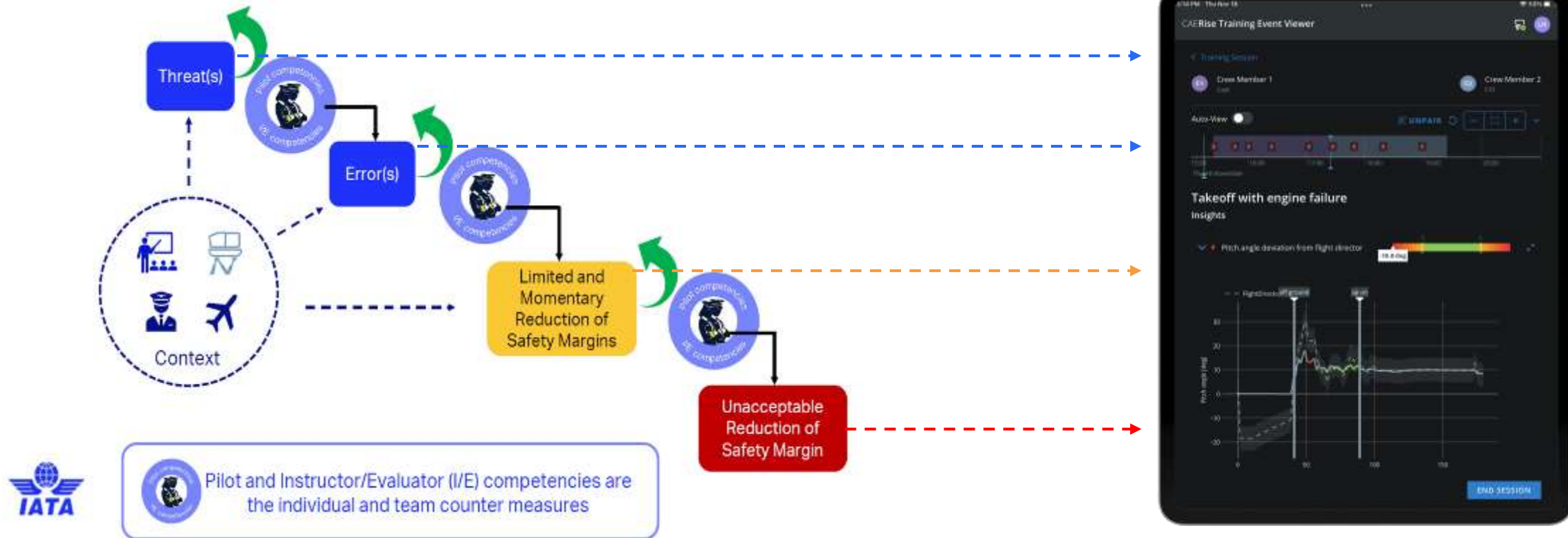
P01.03 Unknown

P02 Checklist (see breakdown)

P02.01 Normal checklist (error)

P02.02 Abnormal checklist (error)

Use technology to support the Instructor



1. Use **Technology** to capture **Threats**, **Errors** and **Safety Margin** exceedances– allowing the **Instructor** to focus on the **Crew Behaviors** required to Evaluate Pilot Competence.
2. Use **Technology** to overcome **observation** limitations due to instructor seating position.

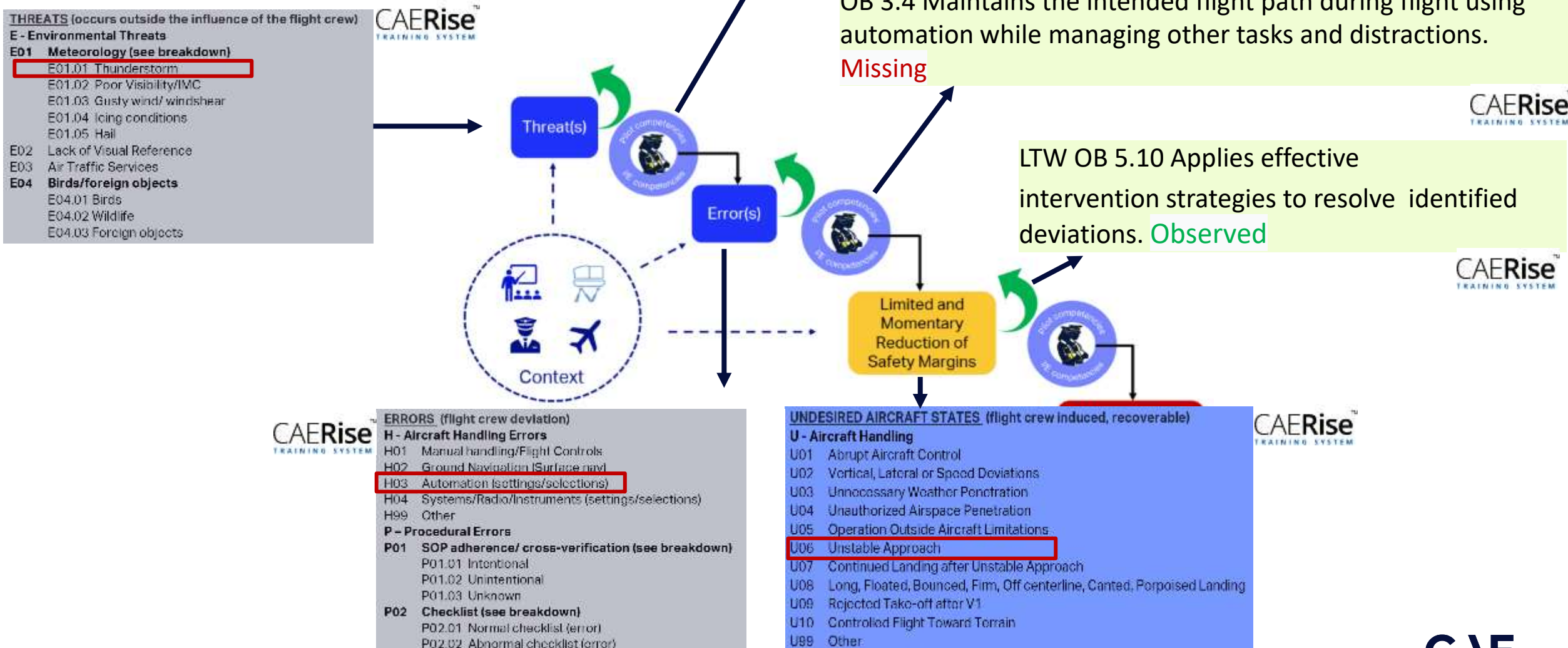
Use technology to support the Instructor

Instructor monitored

SAW OB 7.3 Monitors and assesses the general environment as it may affect the operation. **Missing**

OB 3.4 Maintains the intended flight path during flight using automation while managing other tasks and distractions. **Missing**

LTW OB 5.10 Applies effective intervention strategies to resolve identified deviations. **Observed**



Use modern technology to overcome limitations to instructor observation

The instructor's seating position in a simulator does not allow them to **effectively evaluate crew behaviours that address:**

- Active monitoring; e.g.
 - *“Observe that the autothrottles apply go-around thrust....”*
 - *“Verify positive rate of climb and call “Positive rate”.*
- Effective scan patterns; e.g.
 - *“When the threshold passes under the airplane nose and out of sight, shift the visual sighting point to the far end of the runway.”*
- Some OEM/Operator techniques; e.g.
 - *“Control column movement forward of neutral should not be required.”*



We can use simulator telemetry and biometric data to mitigate these challenges.

Assisting the instructor with automated data collection

Landing with engine failure

1 **Situation**

6 **Watch Replay**

Initial Weight: 195605 kg Initial Flap Lvr: 30 Initial Gear Lvr: DOWN Initial AP/FD/AT: ON/ON/ON Surface Wind: CALM Runway Crosswind: 0 kt Runway Headwind: 0 kt Windshear detected: No Minimum RVR: CAVOK OEI detected: Yes

Pilot Flying side: Left (VREF/VAPP): (145/150) kt Reference runway: CYUL - RW24L Runway condition: DRY Initial AutoBrake: DISABLED Flare detected: No

2 **Monitoring Observable Behaviours relevant to the training event**

3 **Detecting Threats, Errors and Undesired Aircraft States related to the training event**

4 **Maneuver Performance against tolerances**

5 **Procedure Performance against SOP _ Assessing Monitoring**

Monitoring Observable Behaviours relevant to the training event

Landing with engine failure

Watch Replay

Situation

CompetenciesTEMSim DataEye tracking

C1 Crew Member 1
CAPT/PF

PRO • Observed - system

OB 1.2 Applies relevant operating instructions, procedures and techniques in a timely manner

PRO • Observed - system

OB 1.3 Follows SOPs unless a higher degree of safety dictates an appropriate deviation

FPM • Not observed - system

OB 4.5 Maintains the intended flight path during manual flight while managing other tasks and distractions

FPM • Observed - system

OB 4.7 Effectively monitors flight guidance systems including engagement and automatic mode transitions

PSD • Not observed - system

OB 6.1 Identifies, assesses and manages threats and errors in a timely manner

WLM • Instructor

OB 8.7 Monitors, reviews and cross-checks actions conscientiously

C2 Crew Member 2
FO/PM

PRO • Observed - system

OB 1.2 Applies relevant operating instructions, procedures and techniques in a timely manner

PRO • Observed - system

OB 1.3 Follows SOPs unless a higher degree of safety dictates an appropriate deviation

FPM • Observed - system

OB 4.7 Effectively monitors flight guidance systems including engagement and automatic mode transitions

WLM • Instructor

OB 8.7 Monitors, reviews and cross-checks actions conscientiously

Monitoring Observable Behaviours relevant to the training event

The screenshot displays a dark-themed interface with three rows of observable behaviours (OB) being monitored. Each row includes a status indicator (a blue pill with a label), a status description (a green dot followed by text), and the specific observable behaviour description.

- Row 1:** Status indicator **FPM**, status description **• Observed - system**, and OB description **OB 4.7 Effectively monitors flight guidance systems including engagement and automatic mode transitions**.
- Row 2:** Status indicator **PSD**, status description **♦ Not observed - system**, and OB description **OB 6.1 Identifies, assesses and manages threats and errors in a timely manner**.
- Row 3:** Status indicator **WLM**, status description **• Instructor**, and OB description **OB 8.7 Monitors, reviews and cross-checks actions conscientiously**.

At the bottom left of the interface, there is a small text string: `Device: R00000342 Start: 1725535106`.

Detecting Threats, Errors and Undesired Aircraft States related to the training event

Landing with engine failure

> Situation

Competencies **TEM** Sim Data

Watch Replay

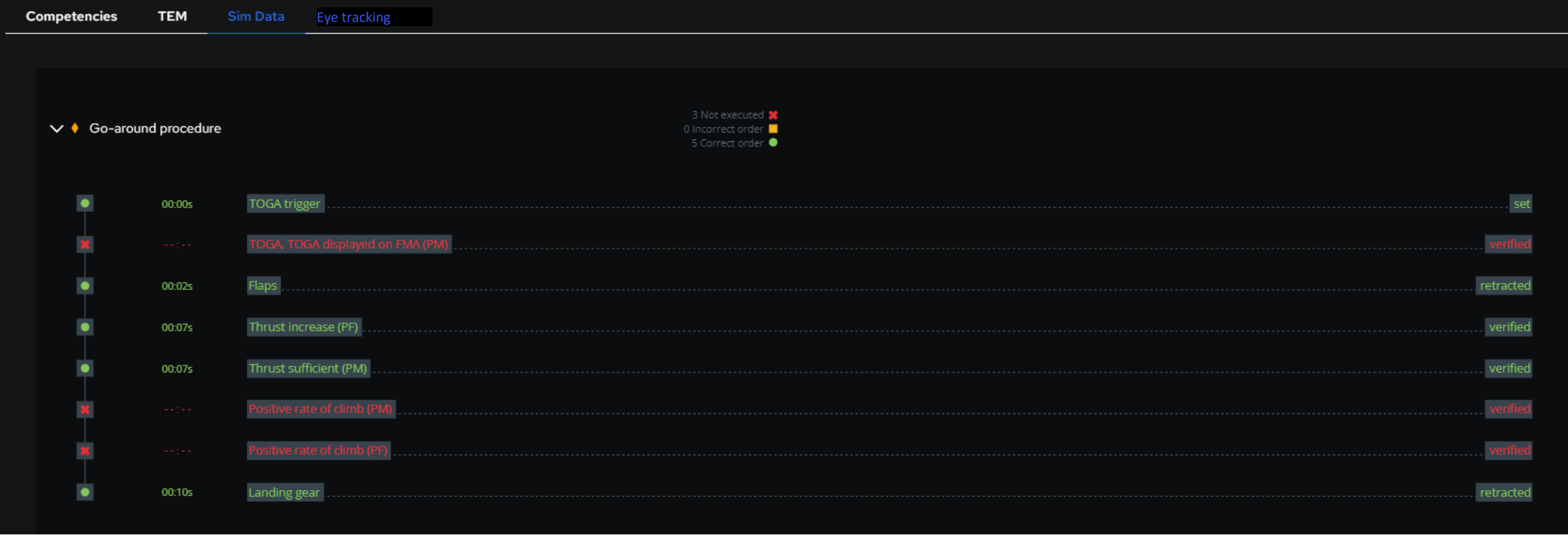
THREAT	ERROR	OUTCOME
A01.02 Contained engine failure	H01 Manual handling (Flight Controls) H02 Ground Navigation (Surface nav)	Vertical, Lateral or Speed Deviations

Maneuver Performance against tolerances



Note: The data point of each parameter represent the highest measure for this maneuver

Procedure/Maneuver Performance against SOP



Procedure Performance against SOP _ Assessing Monitoring

●	00:07s	Thrust increase (PF)	verified
●	00:07s	Thrust sufficient (PM)	verified
✖	--:--	Positive rate of climb (PM)	verified
✖	--:--	Positive rate of climb (PF)	verified

PF



PM



Technology to support Competency Based Training Programs

The collection and analysis of
accurate training data

Accurate grading data is required to drive accurate insights.

GM2 ORO.FC.231(d)(2) Evidence-based training

ED Decision 2021/002/R



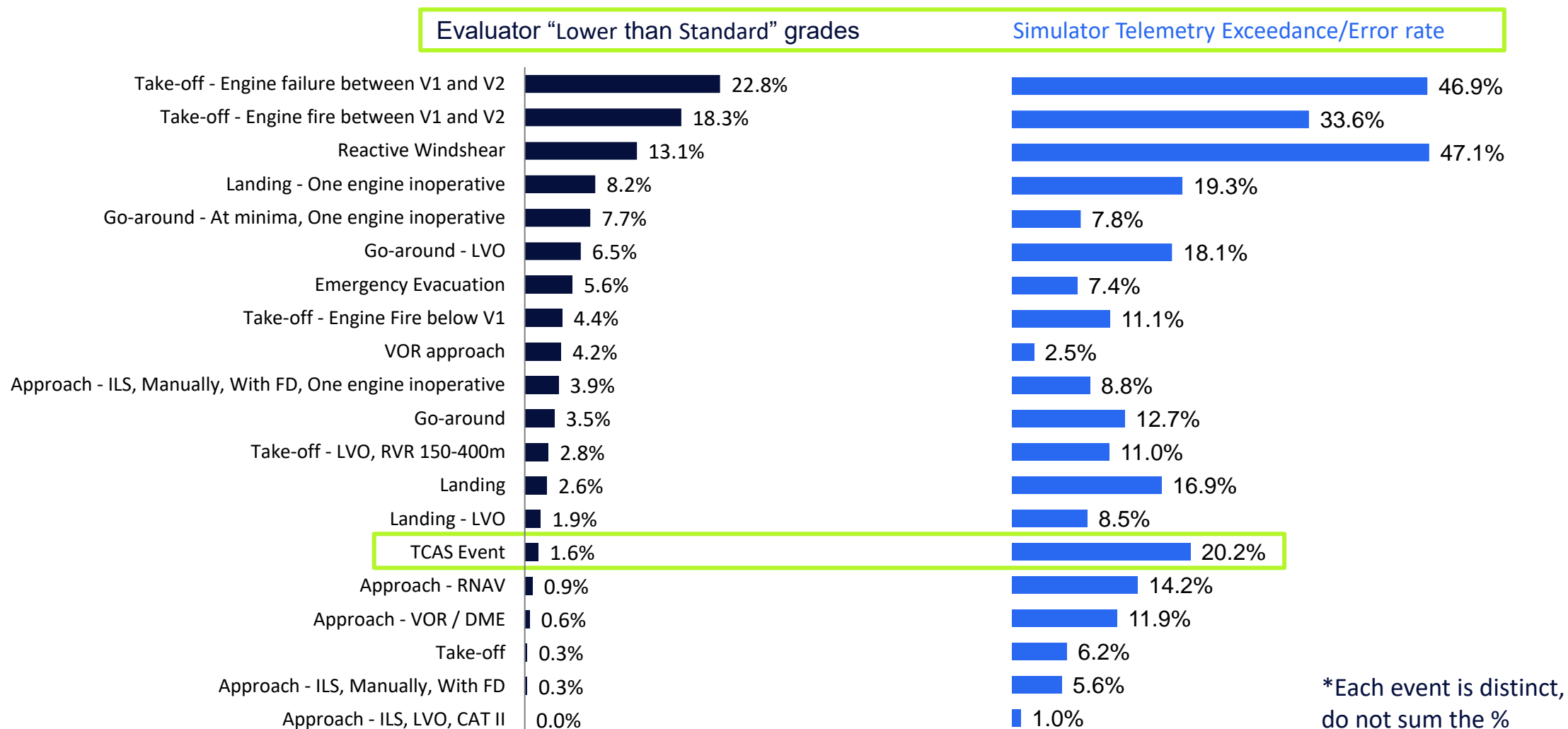
VERIFICATION OF THE ACCURACY OF THE GRADING SYSTEM — FEEDBACK PROCESS

Concordance agreement between instructors may be high; **however, the whole community of instructors may be grading too low or too high (accuracy).**

The statistical result of the verification against Appendix 9 (check) criteria can provide the operator with a criterion-referenced system to adjust the accuracy of the grading system.

The comparative use of Rise telemetry data may be an acceptable means of statistical verification.

Evaluator grades vs. simulator telemetry data



Comparison from independent sources can provide increased confidence of grading data quality.

Benchmark data

Landings

All Landings

Telemetry

Grading

Aircraft Type

Training Program

Analysis Time Frame

A320

All Programs

All Cycles

All Filters

Crosswind: No filter

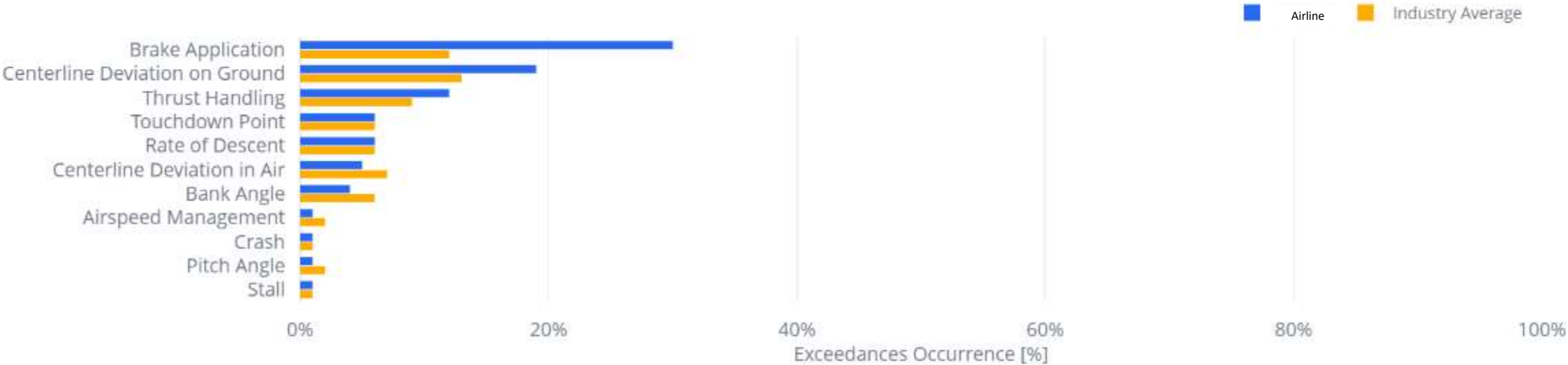
RVR: No filter

Flap/Slat Fault: No filter

Engines: No filter






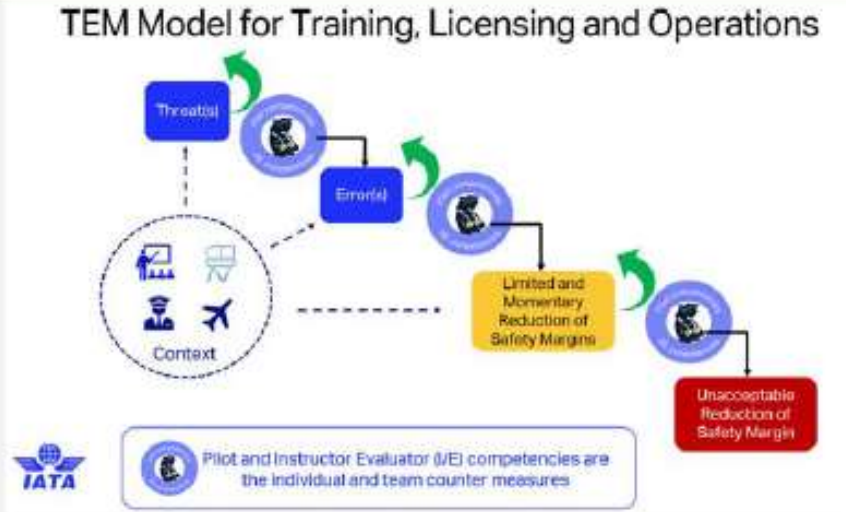
Training Event Elements

☐ Shows only top 5 elements



Feedback

Proactive/Predictive Safety Management Partnership

Reactive	Reactive/Proactive	Proactive	Proactive/Predictive
E.g. Analysis Accident-Incidents	E.g. Analysis of event including Undesired Aircraft States	E.g. Analysis of Threat and Error Management	E.g. Analysis of CBTA -EBT Training metrics (Grading/Telemetry/Biometric data)
	<div>Flight Data Analysis (FDA)</div>  <div>Mandatory Occurrence reporting</div> 	<div>Line Oriented Safety Audits (LOSA)</div>  <div>Voluntary Safety reporting</div> 	<div>TEM Model for Training, Licensing and Operations</div> 

Valid training data enables Proactive/Predictive Safety Management

Source: IATA whitepaper

Summary

Competency Based Training & Assessment

- Reducing Experience levels.
- A training response to accelerate the acquisition of relevant experience.

Supporting Technology

- AI to simulate real time ATC. (voice and digital)
- Simulation of “Subtle” and/or “Highly Improbable” scenarios.
- Automated simulator Lesson Plans.
- Telemetry to capture error, exceedances.
- Biometrics to supplement instructor observations.

Using Training Data

- Data use challenges:
 - Data Taxonomies.
 - Data acquisition and ownership.
 - Data integrity, security, privacy and compliance .
- We need to work together:
 - Unions, OEMs, Operators, ATOs, Regulators, and pilots

Use existing and emerging technology to optimize competency-based training programs.



Thank you!

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