



# Evidence-Based Training

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## Background

- EBT is an initiative to improve safety in flying operations
- To further reduce airline accident rate a review of recurrent and type-rating training was necessary
- So far – event based training, ... including lessons learned from past accidents/incidents into training sessions, leading to a systematic form of training, - checking off tick boxes

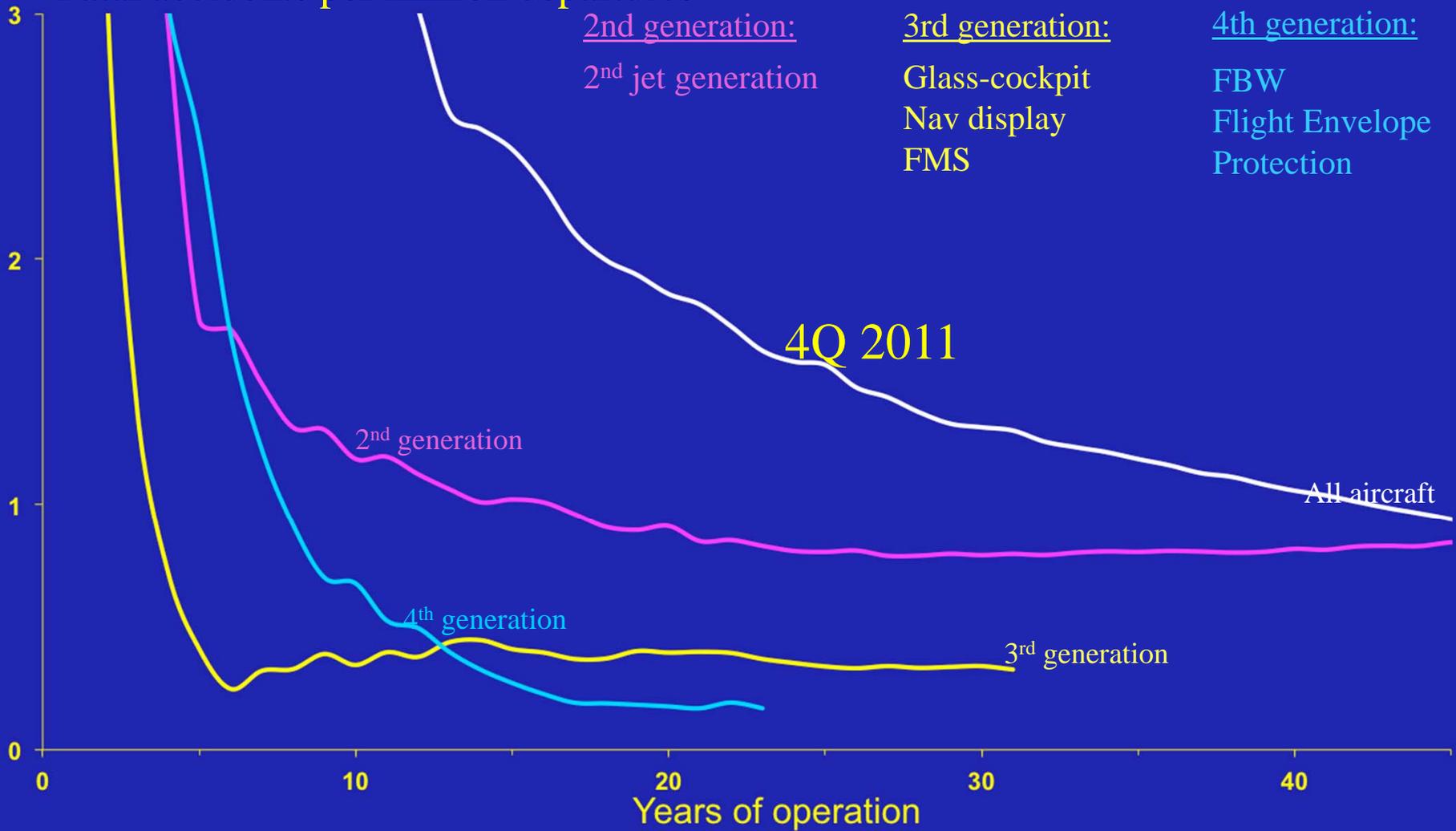


## Data research process

- Flight ops and training data from the past 20 years has been reviewed (i.e. LOSA programs, air safety reports, flight data analysis)
- Examination of threats, errors, undesired aircraft states and their relationship to unwanted consequences.
- These findings were compared with current training practices with the outcome, that the current training schema does not factor in the differences of the four aircraft generations in use today.
- One size training does NOT fit all aircraft types



## Fatal accidents per million departures





# Aircraft Generations

Aircraft by Generation	
Generation 4 Jet	A318/A319/A320/A321, A330, A340-200/300, A340-500/600, B777, A380, B787, A350, Bombardier C Series, Embraer E170/E175/E190/E195
Generation 3 Jet	A310/A300-600, B737-300/400/500, B737-600/700/800 (NG), B757, B767, B747-400, B747-8, B717, BAE 146, MD11, MD80, MD90, F70, F100, Bombardier CRJ Series, Embraer ERJ 135/145
Generation 3 Turboprop	ATR 42-600, ATR 72-600, Bombardier Dash 8 Q Series
Generation 2 Jet	A300 (except A300-600), BAC111, B727, B737-100/200, B747-100/200/300, DC9, DC10, F28, L1011
Generation 2 Turboprop	ATR 42, ATR 72 (all series except -600), Embraer EMB-120
Generation 1 Jet	DC8, B707

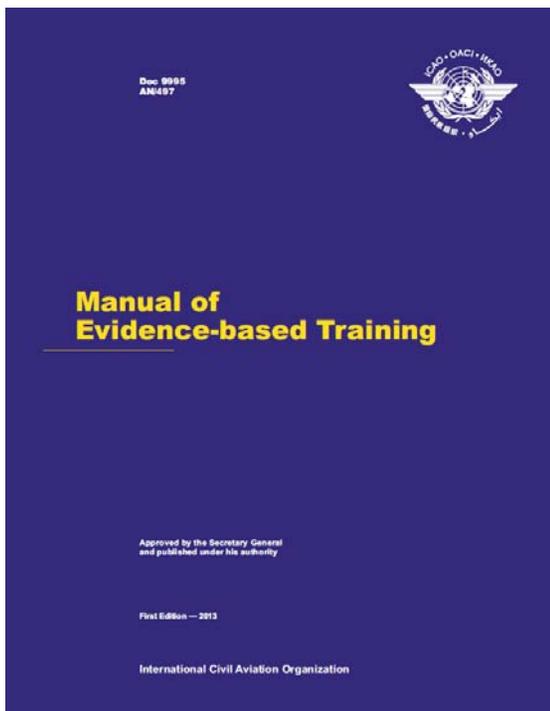


# Implementing EBT

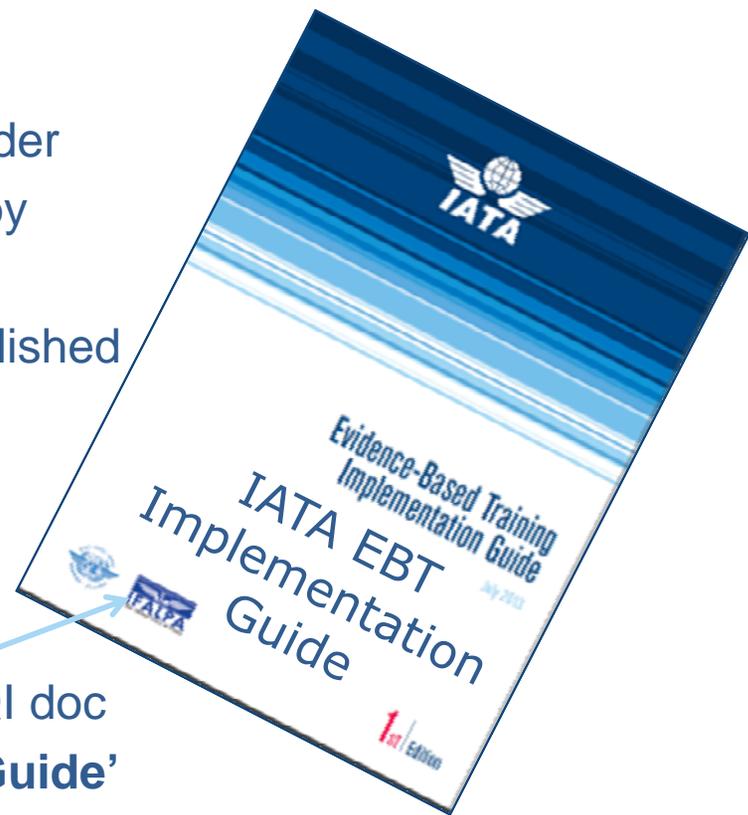




# Publications



EBT was developed with industry over 6 years, under ITQI, and jointly agreed by ICAO, IATA, and IFALPA. **ICAO doc 9995** was published in May 2013

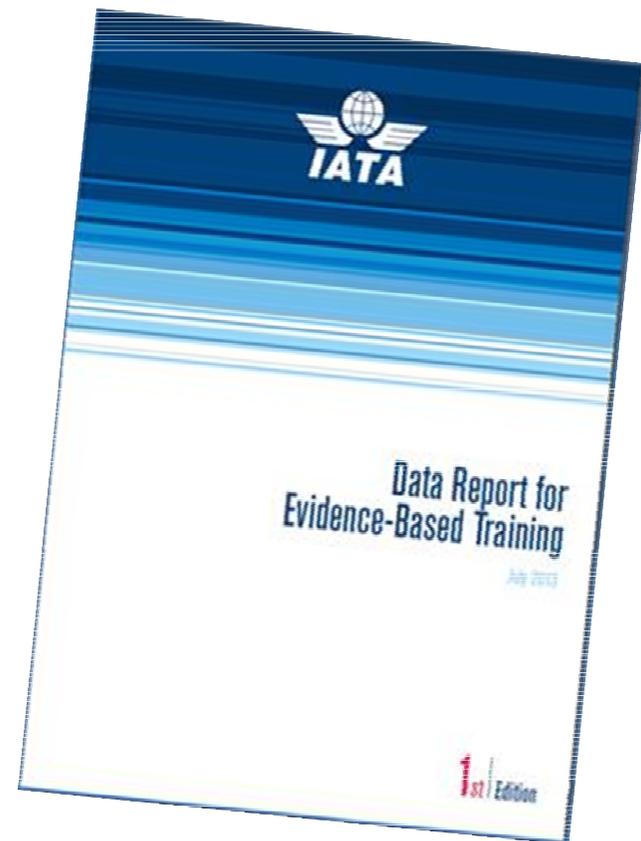


augmented by IATA ITQI doc 'EBT Implementation Guide'



## EBT Source Data

- LOSA reports
- Flight Data Analysis studies
- Accident/Incident analyses
- Studies-AQP/ATQP Airline results
- Studies-Skill Decay & Retention
- Flight deck Automation studies
- STEADES
- Airbus Special FDA Reports
- Pilot Survey





## Evidence from Data

- ★ Data from over **3 million** flights over multiple aircraft types over multiple airlines over several regions
- ★ Use of standardized event set
- ★ Analyzed for event frequency rate and clusters (drill down)
- ★ **LOSA data:**
  - Over **9,000 observed** flights
  - **50+** airlines
  - 90 page report from LOSA Archive
  - Subsidiary follow up report



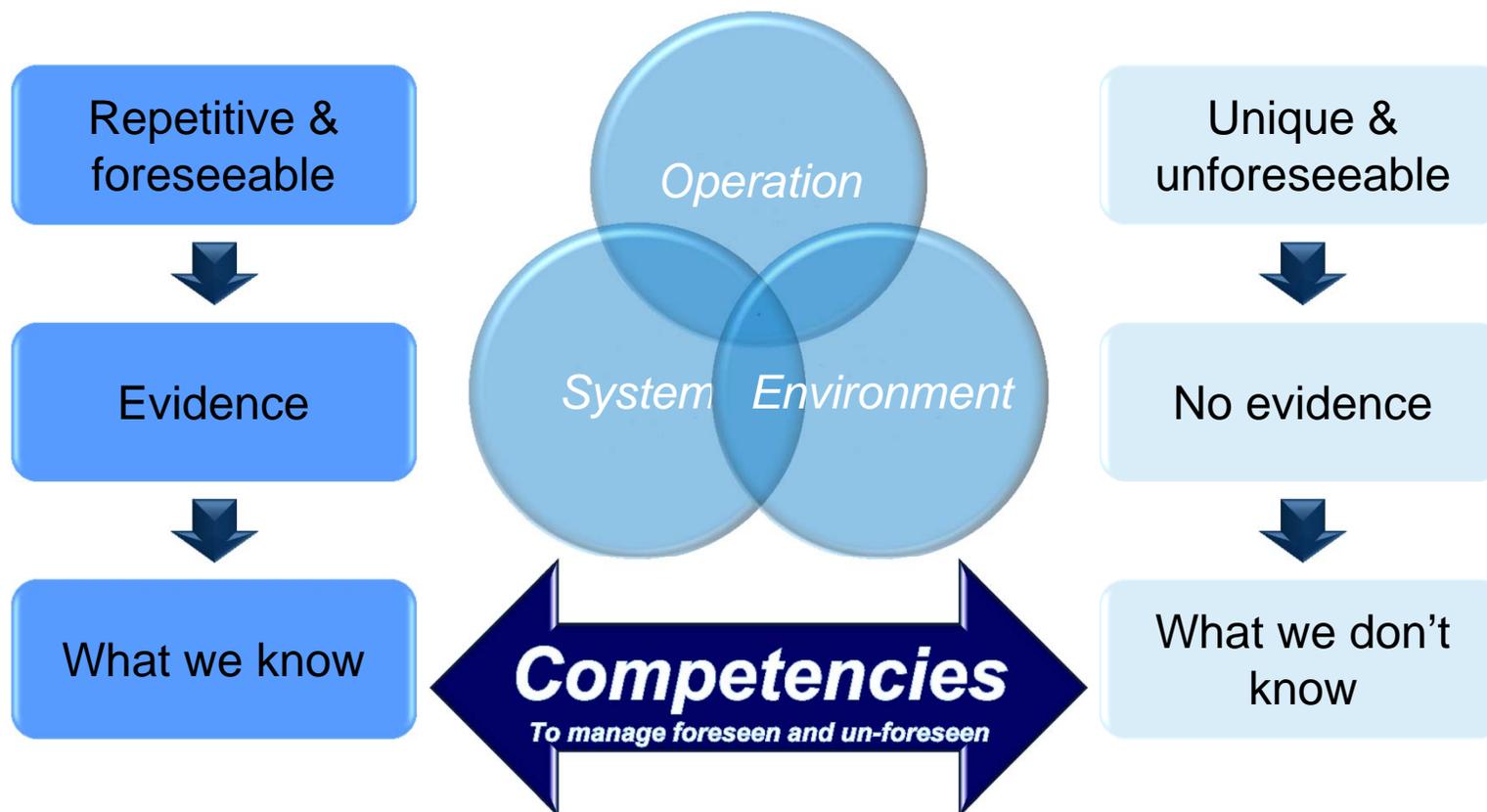


## LOSA:

- 4% of all approaches were unstable
- 97% of unstable approaches are continued to landing
  - 10% result in abnormal landings
- Only 3% of unstable approaches lead to a Go-Around
- When a GA occurs – it almost always poorly performed
  - Usually a surprise to the crew
  - Very rarely occurs at (the briefed) missed approach height



# Competencies to manage the unforeseen





## 8 Core Competencies

Application of Procedures

Communication

Flight path management - automation

Flight path management - manual

Leadership & teamwork

Problem solving & decision-making

Situation awareness

Workload management



# Competencies & related Knowledge, Skills and Attitudes

## ➤ Competency

## ➤ Competency Description

## ➤ Performance Criteria – observable behavior –

### **Situation Awareness**

- Is aware of what the aircraft and its systems are doing
- Is aware of where the aircraft is and what its environment is
- Keeps track of time and fuel
- Is aware of the condition of people involved in the operation including passengers
- Recognizes what is likely to happen, plans and stays ahead of the situation
- Develops “what if” scenarios and plans for contingencies
- Identifies threats to the safety of the aircraft and people, and takes appropriate action



Competency	Competency Description	Behavioral indicator
Application of Procedures	Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.	Identifies the source of operating instructions Follows SOP's unless a higher degree of safety dictates an appropriate deviation Identifies and follows all operating instructions in a timely manner Correctly operates aircraft systems and associated equipment Complies with applicable regulations. Applies relevant procedural knowledge
Communication	Demonstrates effective oral, non-verbal and written communications, in normal and non-normal situations.	Ensures the recipient is ready and able to receive the information Selects appropriately what, when, how and with whom to communicate Conveys messages clearly, accurately and concisely Confirms that the recipient correctly understands important information Listens actively and demonstrates understanding when receiving information Asks relevant and effective questions Adheres to standard radiotelephone phraseology and procedures Accurately reads and interprets required company and flight documentation Accurately reads, interprets, constructs and responds to datalink messages in English Completes accurate reports as required by operating procedures Correctly interprets non-verbal communication Uses eye contact, body movement and gestures that are consistent with and support verbal messages
Aircraft Flight Path Management, automation	Controls the aircraft flight path through automation, including appropriate use of flight management system(s) and guidance.	Controls the aircraft using automation with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Manages the flight path to achieve optimum operational performance Maintains the desired flight path during flight using automation whilst managing other tasks and distractions Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload Effectively monitors automation, including engagement and automatic mode transitions
Aircraft Flight Path Management, manual control	Controls the aircraft flight path through manual flight, including appropriate use of flight management system(s) and flight guidance systems.	Controls the aircraft manually with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Controls the aircraft safely using only the relationship between aircraft attitude, speed and thrust Manages the flight path to achieve optimum operational performance Maintains the desired flight path during manual flight whilst managing other tasks and distractions Selects appropriate level and mode of flight guidance systems in a timely manner considering phase of flight and workload Effectively monitors flight guidance systems including engagement and automatic mode transitions



Leadership and Teamwork	Demonstrates effective leadership and team working.	<p>Understands and agrees with the crew's roles and objectives.          Creates an atmosphere of open communication and encourages team participation          Uses initiative and gives directions when required          Admits mistakes and takes responsibility          Anticipates and responds appropriately to other crew members' needs          Carries out instructions when directed          Communicates relevant concerns and intentions          Gives and receives feedback constructively          Confidently intervenes when important for safety          Demonstrates empathy and shows respect and tolerance for other people.          Engages others in planning and allocates activities fairly and appropriately according to abilities          Addresses and resolves conflicts and disagreements in a constructive manner          Projects self-control in all situations</p>
Problem Solving and Decision Making	Accurately identifies risks and resolves problems. Uses the appropriate decision-making processes.	<p>Seeks accurate and adequate information from appropriate sources          Identifies and verifies what and why things have gone wrong          Employ(s) proper problem-solving strategies          Perseveres in working through problems without reducing safety          Uses appropriate and timely decision-making processes          Sets priorities appropriately          Identifies and considers options effectively.          Monitors, reviews, and adapts decisions as required          Identifies and manages risks effectively          Improvises when faced with unforeseeable circumstances to achieve the safest outcome</p>
Situation Awareness	Perceives and comprehends all of the relevant information available and anticipates what could happen that may affect the operation.	<p>Identifies and assesses accurately the state of the aircraft and its systems          Identifies and assesses accurately the aircraft's vertical and lateral position, and its anticipated flight path.          Identifies and assesses accurately the general environment as it may affect the operation          Keeps track of time and fuel          Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected          Anticipates accurately what could happen, plans and stays ahead of the situation          Develops effective contingency plans based upon potential threats          Identifies and manages threats to the safety of the aircraft and people.          Recognizes and effectively responds to indications of reduced situation awareness.</p>
Workload Management	Manages available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances.	<p>Maintains self-control in all situations          Plans, prioritizes and schedules tasks effectively          Manages time efficiently when carrying out tasks          Offers and accepts assistance, delegates when necessary and asks for help early          Reviews, monitors and cross-checks actions conscientiously          Verifies that tasks are completed to the expected outcome          Manages and recovers from interruptions, distractions, variations and failures effectively</p>

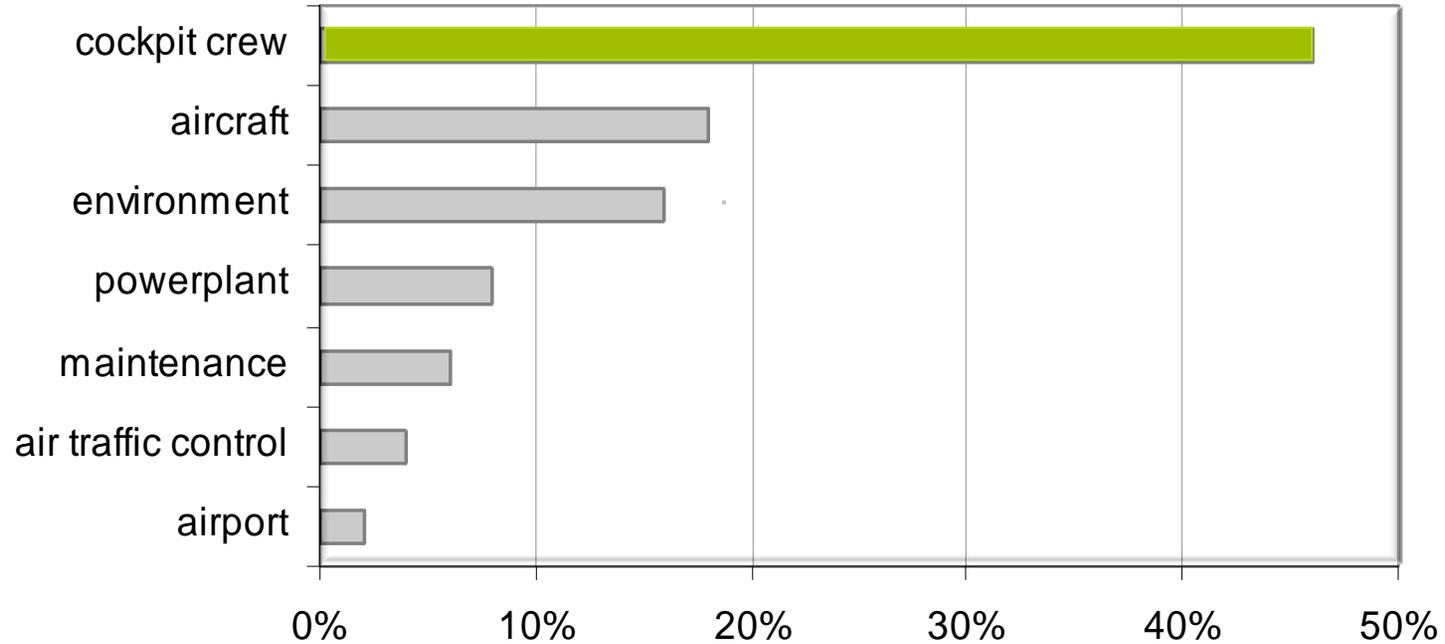


# EBT - Baseline Program



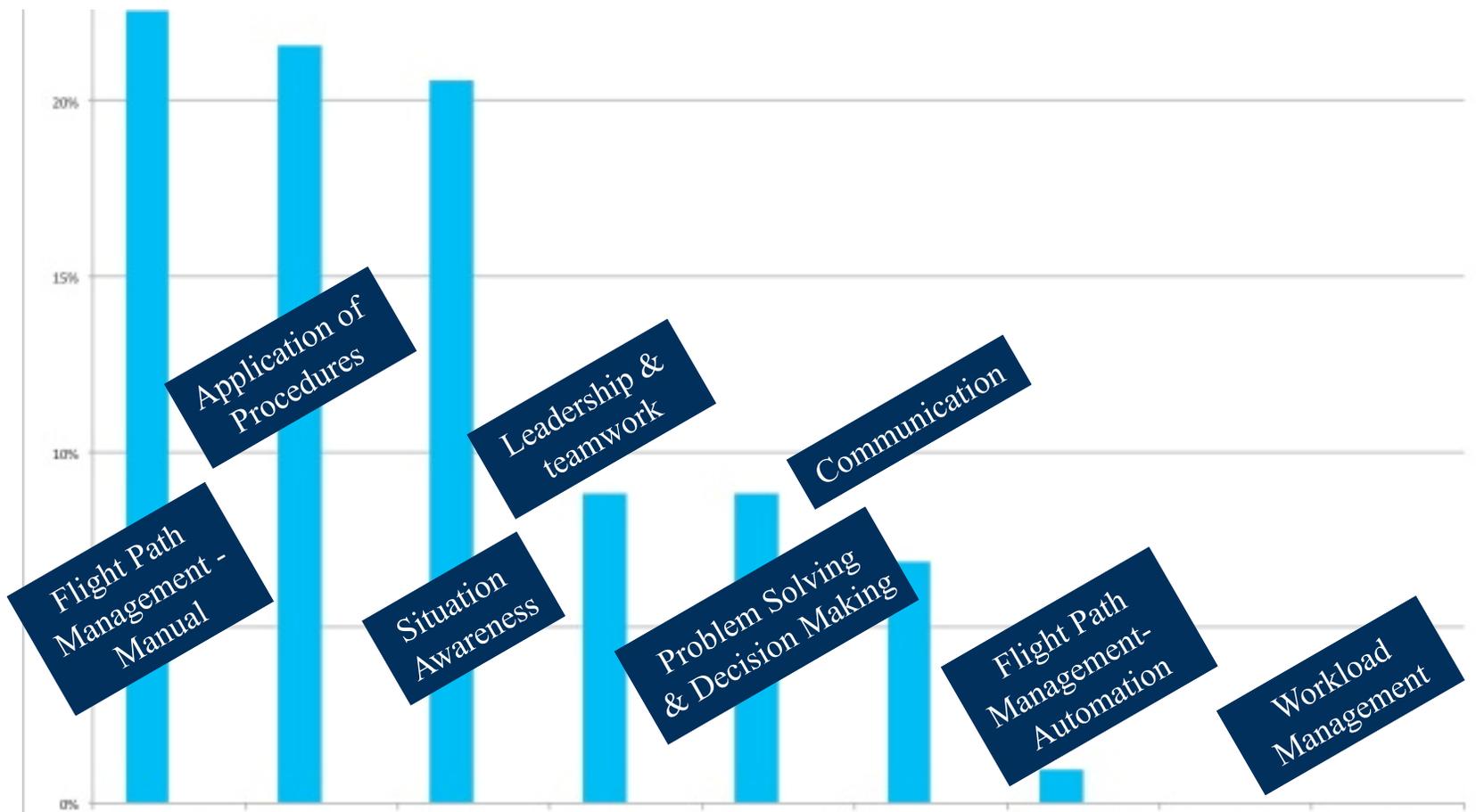


## Relative Importance of contributing factors in fatal accidents (Source: Civil Aviation Safety Data, 1989-2003)





## Deficient Competencies in Gen4 accidents over last 15 years





## The problem

- By regulation flight crew training and checking is **based on events**, which may be highly improbable in modern aeroplanes
- **Training** programmes are consequently saturated with items that may **not necessarily mitigate the real risks** or enhance safety in modern air transport operations



## Mandatory Training Items

- Flight Preparation
- Before take-off checklist
- Engine failure between V1 and V2
- Rejected take-off before reaching V1
- Instrument departure and arrival procedures
- Engine-out Precision Approach to minima
- Non-Precision approach to MDA
- Go-Around 1 engine-out at DA
- Landing critical engine inoperative



## Findings for 4<sup>th</sup> generation aircraft

- Adverse Weather Management
- Automation Management
- Go-Around Management
- Manual Aircraft Control
- Monitoring, cross checking, error detection
- Non – Compliance issues
- Unstable Approach (recognition and management)

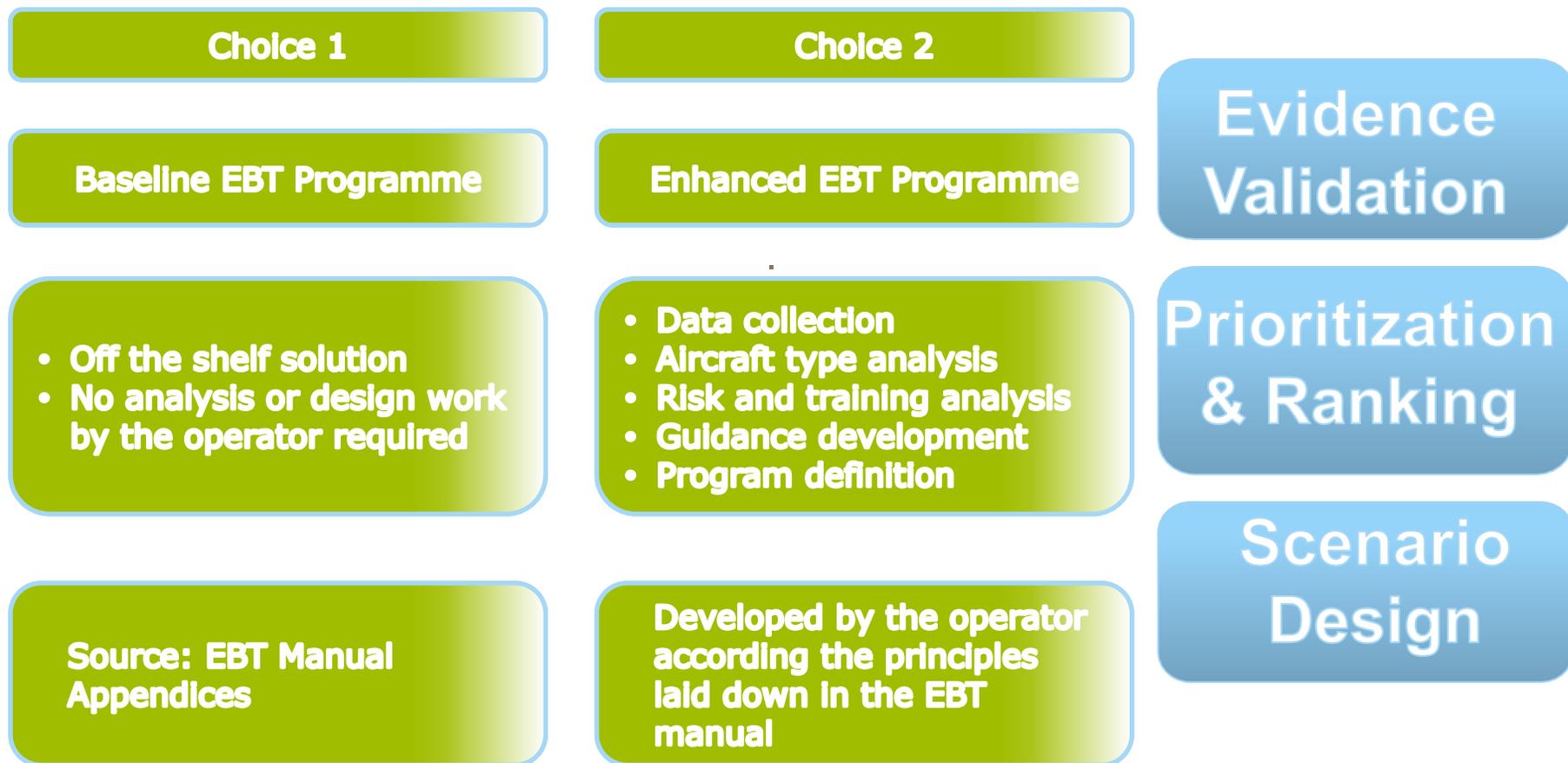


# EBT baseline program

Gen4 Jet Training Topics	A	Adverse weather	B	Adverse wind	C	ATC
		Automation management		Aircraft system malfunction		Engine failure
		Competencies non-technical (CRM)		Aircraft System management		Fire and smoke management
		Compliance		Approach, visibility close to minimum		Loss of communications
		Error management		Landing		Managing loading, fuel, performance errors
		Go-Around management		Runway or taxiway condition		Navigation
		Manual aircraft control		Surprise		Operations or type specific
		Mismanaged aircraft state		Terrain		Pilot incapacitation
		Monitoring & cross-checking		Workload, distraction, pressure		Traffic
		Unstable approach				Upset recovery
						Windshear recovery



# Program Implementation





# Example of recurrent training under EBT

	1	2	3
	Evaluation Phase	Maneuvers Training Phase	Scenario Based Training Phase
Objective	<ul style="list-style-type: none"> <li>Assess competence</li> <li>Identify training needs</li> <li>Validate training system performance</li> </ul>	<ul style="list-style-type: none"> <li>Train maneuver skills to proficiency.</li> <li>Validate system performance and skill decay</li> </ul>	<ul style="list-style-type: none"> <li>Manage the critical threats according to evidence</li> <li>Improve competency to manage foreseen &amp; unforeseen threats</li> </ul>
Conduct	<ul style="list-style-type: none"> <li>Line orientated</li> <li>One or more occurrence</li> <li>Assessment of one or more Competency Elements</li> </ul>	<ul style="list-style-type: none"> <li>Sequence of deliberate actions to achieve a prescribed flight path</li> <li>E.g. RTO, EF V1, OEI APP, OEI GA, Em..Descent</li> </ul>	<ul style="list-style-type: none"> <li>Line orientated flight scenarios</li> <li>One or more predictable or unpredictable threats</li> </ul>



## EBT Instructor qualities

Manage Safety  
Prepare the Training Environment  
Manage the Trainee  
Conduct Training  
Perform assessment  
Perform course evaluation  
Continuously improve performance

ICAO Doc 9868 Chapter 6

Patient and has a positive attitude

Shows humility and admits mistakes

Encourages and is honest

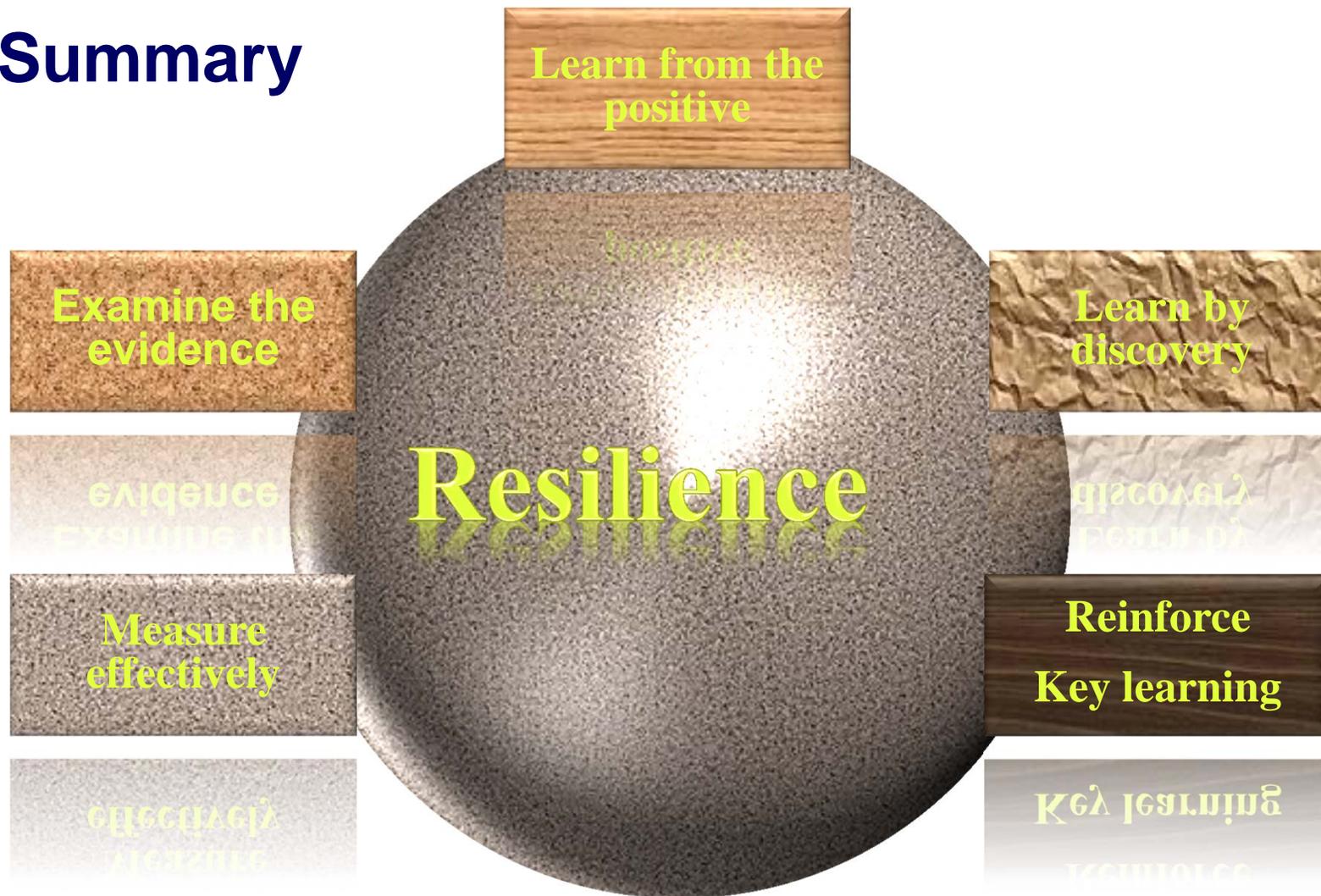
Non-judgmental and shows empathy

Supportive, respectful and honest

Good knowledge



# Summary





# Questions?

# Thank you!

<http://www.iata.org/whatwedo/ops-infra/itqi/Pages/index.aspx>

