ICAO Regional Accident Investigation Workshop (Asia and Pacific Regions)

Presentation by
Transport Safety Investigation Bureau (TSIB),
Singapore

Event Risk Classification

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

How do we classify an occurrence: Serious incident or Incident?

- Based on ICAO Annex 13's definition of serious incident
- Based on ICAO's list of examples in Annex 13 Attachment C, of what may be serious incidents (list is not exhaustive)
- Sometimes, the examples provided may be subjective and also there may be different opinions among investigators or AIAs

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Annex 13 Attachment C

Definition of Serious Incident

"An incident involving circumstances indicating that there was a **high probability** of an accident and associated with the operation of an aircraft…."

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

High Probability

There may be a high probability of an accident if there are few or no safety defences remaining to prevent the incident from progressing to an accident.

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

The origin of Event Risk Classification (ERC)

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Operational Risk Assessment

- Risk Assessment is a very challenging task with methods that have been characterised by high levels of subjectivity and other difficulties
- An industry working group, ARMS (Aviation Risk Management Solutions) was set up in 2007 to develop a new and better methodology for Operational Risk Assessment (ORA)*
- Process started with Event Risk Classification (ERC)

* UKAAIB shared this material with us

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Event Risk Classification (ERC)

The ERC value is based on two questions:

- If this event had escalated into an accident, what would have been the most credible accident outcome?
- What was the effectiveness of the remaining barriers between this event and the most credible accident outcome?

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Event Risk Classification (ERC) (cont'd)

Question 2

What was the effectiveness of the remaining barriers between this event and the most credible accident scenario?

Effective	Limited	Minimal	Not effective
50	102	502	2500
10	21	101	500
2	4	20	100
1			

Question 1

If this event has escalated into an accident outcome, what would have been the most credible outcome?		Typical accident scenarios
Catastrophic accident	Loss of aircraft or multiple fatalities (3 or more)	Loss of control, mid air collision, uncontrollable fire onboard, explosions, total structural failure of the aircraft, collision with terrain
Major accident	1 or 2 fatalities, multiple serious injuries, major damage to aircraft	High speed taxiway collision, major turbulence injuries
Minor injuries or damage	Minor injuries, minor damage to aircraft	Pushback accident, minor weather damage
No accident outcome	No potential damage or injury could occur	Any event which could not escalate to an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness

* UKAAIB has been using this ERC and shared it at the ECAC ACC workshop on treatment of incident

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

TSIB adopted methodology using simplified table

Question 1		Question 2			
What is the worst credible outcome		What was the effectiveness of the barrier remaining between the event and the worst credible outcome?			
		High	Medium	Low	Not Effective
Catastrophic	Loss of aircraft Multiple fatalities				
Serious	Multiple serious injuries Major damage to aircraft				
Minor	Minor injuries Minor damage to aircraft				
No further Potential	No potential damage or injury could occur				

Colour	Risk level	Action
	LOW	No action needed
	MODERATE	To investigate if safety lessons can be expected to be drawn. Otherwise, TSIB will monitor operator's investigation
	HIGH	Shall be classified as an incident requiring: • Instituting an investigation if there are lessons to be learnt • Short investigation note and follow-up with organisation involved on any safety action to be carried out
	EXTREME	Classified as serious incident requiring an investigation to be instituted

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

TSIB adopted methodology using simplified table (cont'd)

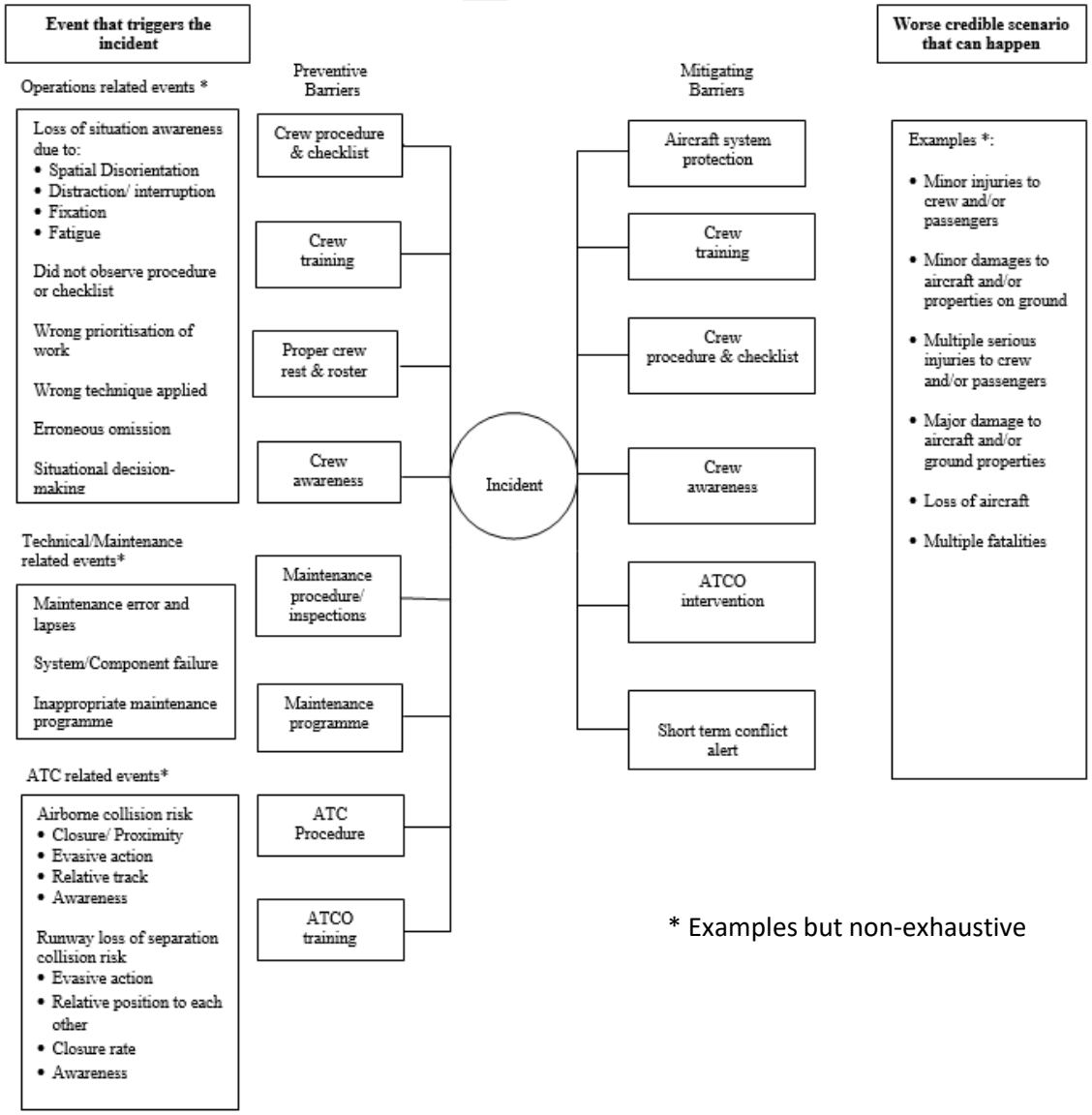
Using Event Risk Classification (ERC) to assess the severity of each incident by asking the following questions:

- Question 1 - What is the worst credible outcome that might have occurred if the event escalated? (This question is to identify the accident outcome that is of most concern when this type of incident occurs, or put another way "What is the accident that we are trying to prevent by having these incidents investigated?")
- Question 2 - What was the effectiveness of the safety barriers between what actually happened and the worst credible outcome?

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Identify remaining safety barriers

Example:



* Examples but non-exhaustive

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

ANNEX 13-EVENT RISK-BASED ANALYSIS

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Amendment 17 to Annex 13

- Attachment C to Annex 13 contained a list of incidents likely to be serious incidents to be used as a guidance
- States' discretion in using the list to classify incident, resulting in some serious incidents not being investigated and valuable safety lessons missed
- Amendment 17 provides a new guidance to States in applying an event risk-based analysis to determine if an incident should be classify as serious incident

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Annex 13-Event Risk-Based Analysis

Taking into account the most credible scenario had the incident escalated and assessing the effectiveness of the remaining defences between the incident and the potential accident by asking the following questions:

A. Is there is a credible scenario by which this incident could have escalated to an accident?

B. Effectiveness of the remaining defences between the incident and the potential accident –

- effective, if several defences remained and needed to coincidently fail, or
- limited, if few or no defences remained, or when the accident was only avoided due to providence

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Annex 13 Attachment C, 2.2

		b) Remaining defences between the incident and the potential accident	
		Effective	*Limited*
a) Most credible scenario	*Accident*	Incident	Serious Incident
	No accident	Incident	

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Case Study

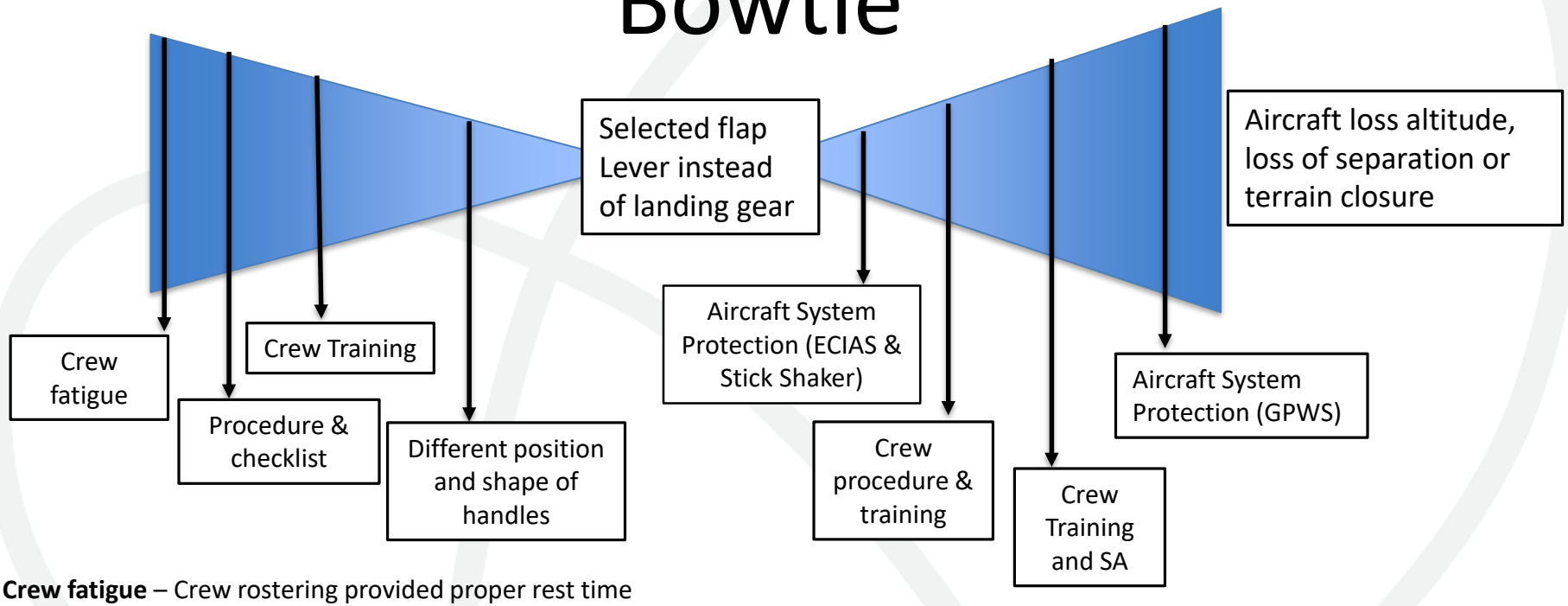
- B744F achieved positive rate of climb after lift-off, PF requested for gear retraction
- PM was distracted while trying to enable GPS Navigation on FMS (procedural requirement after take-off), selected flaps to flap one position instead of gear retraction
- At 600 feet, EICAS Caution Message “>AIRSPEED LOW” and “Stick-Shaker” activated momentarily
- PF immediately selected Full Take-off and Climb and pushed thrust levers forward for more power

Case Study (cont'd)

- Aircraft maintained height, accelerated and achieved positive rate of climb
- At 1000 feet, flight crew realised that flaps were selected instead of gear retraction
- Crew continued to clean up aircraft and flight continued without further event

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Bowtie



Crew fatigue – Crew rostering provided proper rest time

Failed protection barrier

Procedure and checklist – lack of clarity in instruction for crew operating out of WGS-84 airport to re-activate GPS when airborne

Crew Training – multitasking during critical phase of flight

Flight deck design - Both control handles are significantly apart. With knob of different shape. Flap selection has to go through at least 2 stop gates showing the level of distraction that additional workload caused

Existing protection barriers

Aircraft System – **high effectiveness,** EICAS Caution Msg and Stick Shaker serves to draw attention of the flight crew

Crew Procedure and Training – **high effectiveness**, Crew responded and carried out procedure to resolve flight path condition

Crew training & SA – **medium effectiveness**, recognition of problem and resolved condition after settling down

Aircraft System – This second aircraft system protection did not come into play, flight crew are trained in responding to GPWS activation (likely to be **high effectiveness**)

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Event Risk Classification

Question 1		Question 2			
What is the worst credible outcome?		What was the effectiveness of the barrier remaining between the event and the worst credible outcome?			
		High	Medium	Low	Not effective
Catastrophic	Loss of aircraft Multiple fatalities				
Serious	Multiple serious injuries Major damage to aircraft	√			
Minor	Minor injuries Minor damage to aircraft				
No further Potential	No potential damage or injury could occur				

Overall, the effectiveness of the safety remaining barriers was assessed to be High effectiveness.

Based on a worst credible outcome of serious severity, and High effectiveness of remaining barriers, this event is classified as a 'low- risk' event. There is potential safety lesson that may be derived from this occurrence:

- Operator to provide clarity on when to activate GPS when flying out of WGS-84 airports
- Flight crew's adherence to performing critical task during critical phase of flight to avoid distraction

Investigation was delegated to the operator for them to address their procedure at operator level.

* Serious severity – aircraft could have stalled if the crew did not immediately respond to correct the condition

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Using the Event Risk-Based analysis

2.2 The combination of these two assessments helps to determine which incidents are serious incidents:

		b) Remaining defences between the incident and the potential accident	
		Effective	*Limited*
a) Most credible scenario	*Accident*	Incident	Serious Incident
	No accident	Incident	

TSIB has changed its methodology to adopt the event risk-based analysis suggested in the Amendment 17 to Annex 13

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE

Thank you

MINISTRY OF TRANSPORT
CONNECTING SINGAPORE