

# European Risk Classification Scheme Development Update

**Your safety is our mission.**

An agency of the European Union 

TE.GEN.00409-001



# Background Reminders

- ERCS mandated by Regulation (EU) 376/2014 to be developed by May 2017
- Development tasked to EASA from the European Commission in late 2014
- Development Group established - includes involvement from across industry
- 6 meetings held in 2015 to develop initial ERCS matrix
- Task 1 on initial development of the ERCS matrix was completed in 2015
- Task 2 for 2016/7 focussed on refining the processes, testing, guidance, training material and implementation



# Key Points of Implementation

- Regulation (EU) 376/2014 only requires Competent Authorities to use the ERCS
- Organisations can use any risk classification scheme from their SMS
  - What a scheme in the context of SMS? (e.g. ARMS/ RAT)
  - Useful to understand what risk methods your organisations are using and how to translate into ERCS scores
- ERCS is however designed to be simple and attractive to encourage as many organisations as possible to use it
- One thing is vital – good risk classification requires good reporting and investigation processes



# Testing Feedback and Changes

- General feedback positive some confusion about who has to use the ERCS - States and not organisations
- Concern about workload
  - Detailed look up tables for quick classification have been developed and will be provided with the guidance material
  - Quick scoring for minor occurrences (Column 9)
- Actual outcome vs potential accident outcome
  - The key is the potential outcome of which there should always be something even with many barriers remaining
- New mind set in terms of process and information
  - ERCS requires certain information and reporting/ occurrence investigation should be aligned to collect more relevant data



# Testing Feedback and Changes - Process

- Need for numerical output
  - ERCS has been redeveloped so that each barrier has a numerical probability value and therefore number output
- What to do about barriers that are not relevant
  - ERCS has been updated to enable each barrier to be assessed as Stopped, Remaining, Failed and Not Applicable
  - The ERCS score counts only Stopped and Remaining Barriers
  - System still allows for analyst judgement to enable an element of subjective assessment of the risk
- Fixed barriers (0 to 9) are too restrictive
  - ERCS updated with barriers beyond 9 to make it more realistic to actual probabilities – scores above 9 are scored as 9



# Testing Feedback and Changes - Tools

- ERCS should not be a barrier to reporting
- Simple tools would be needed to help classification
  - Integration in ECCAIRS and the core software of different SMS providers
  - Link between existing schemes such as ARMS and RAT
- Extensive guidance needed to reduce burden
  - Such guidance will be provided to help NAAs and operators who are interested in using the ERCS within their airline
- Guidance and tools must be continually updated
  - This is indeed envisaged to ensure continual improvement
  - The barrier model approach will link to a clearly defined process for occurrence investigation



# Final ERCS Matrix

Potential Accident Outcome										
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1	X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000	1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1	S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000	500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1	M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000	100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1	I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1	E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000
	A/0									



# Process – Based on 2 Questions

- Question 1 - What is the most credible accident outcome?
- For the occurrence being scored, if it had escalated into an accident, what type of accident would it have been?
- Importantly, this is an accident outcome and not what actually happened – the ERCS is designed to address potential risk
- The process is broken into 2 steps





# Question 1 – Step 1

- Use the look-up table based on the list of reportable occurrences to find the most credible accident outcome
- For Technical Events a further list links system failures to most credible accident outcome based on the aircraft system involved
- Types of Outcome: Injuries, Airborne Collision, Aircraft Upset, Excursions, Ground Damage, Obstacle/ Terrain Collision, Runway Collision, Unsustainable Aircraft Environment (e.g. Fire)



## Question 1 – Step 2

- From the Outcome Category the Degree/ Seriousness (the row score) is calculated depending on the aircraft involved
- Criteria based on the size/ capacity of the aircraft (not actual number of passengers)
  - Large Commercial Aircraft (CS25) 100+ POB
  - Small Commercial Aircraft (CS25/29) 19-100 POB
  - Small Ac (CS23/27) less than 19 POB
  - Small Ac (Uncertified) less than 19 POB
  - No aircraft - potential for fatalities/ injuries



## Process – Question 2

- What is the likelihood of the occurrence escalating into the potential accident outcome
- Uses a weighted barrier model for each outcome category
- Barrier Scores – First two below give the score
  - Stopped – stopped the accident outcome
  - Remaining – likely to have prevented the accident if it had been reached
  - Failed
  - Not Applicable – not relevant to occurrence



# Barrier Models

- Aircraft, Equipment and Infrastructure
- Tactical Planning
- Regulations, Processes, Procedures and Compliance
- Situational Awareness and Action
- Warning System Operation and Compliance
- Avoiding Action
- Providence



# Example Barrier Models

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Aircraft Upset	Technical Factors	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of problems related to technical factors that may lead to aircraft upset.	Maintenance activities are effectively planned at the tactical level to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent aircraft upset.	Warning systems that could prevent aircraft upset (e.g. stall warning) are fitted, functioning, operate correctly and are complied with to prevent aircraft upsets.	Late recovery following a loss of control to prevent an accident.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known" if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Not Applicable (High Energy Scenario)	Used when worst outcome is not the result.	
		Size of Barrier	5	2	3	2	3	1	0	1	17
		Actors	Aircraft/ Equipment		Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Runway Collision	Aircraft vs Aircraft	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of runway collisions (Aerodrome Design, Stop Bar Failure, Aircraft Brake Failure).	Planning is effective (e.g. taxi patterns and departures/arrivals) to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent runway collisions.	Warning systems that could prevent runway collisions (e.g. RIMCAS) are fitted, functioning, operate correctly and are complied with to prevent runway collisions.	Late recovery to prevent an actual collision.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known" if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Only one of these barriers apply in any given situation if no barriers remain. You don't know it's luck until you have it.		
		Size of Barrier	5	2	3	2	3	1	1	1	18
		Actors	Aircraft/ Equipment		Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0



# Example 1 – Large CAT Aircraft

- On July 13 aircraft has departed from Domodedovo (DME) airport at 23:08.
- At 00-20 Crew noted drop of oil quantity and oil pressure in Engine # 2 system.
- At 00:39 oil quantity drops to critical point and crew decided to turn around to DME.
- At 00:45 crew turns shut down engine # 2. At 2:20 aircraft safely landed at DME airport



# Example 1 – Question 1

- Most credible accident outcome – Aircraft Upset due to Technical Factors
- Large CAT Aircraft – Row X (Top Row)

Potential Accident Outcome										
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1	X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000	1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1	S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000	500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1	M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000	100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1	I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1	E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000
	A/0									



# Example 1 – Question 2

- Barrier Model – Aircraft Upset (Technical Factors)
  - Aircraft, Equipment and Infrastructure – Failed
  - Tactical Planning – Not Applicable
  - Regulations, Procedures, Processes and Compliance – Stopped Barrier
  - No need to assess other barriers – Score X9

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Aircraft Upset	Technical Factors	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of problems related to technical factors that may lead to aircraft upset.	Maintenance activities are effectively planned at the tactical level to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent aircraft upset.	Warning systems that could prevent aircraft upset (e.g. stall warning) are fitted, functioning, operate correctly and are complied with to prevent aircraft upsets.	Late recovery following a loss of control to prevent an accident.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known" if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Not Applicable (High Energy Scenario)	Used when worst outcome is not the result.	
		Size of Barrier	5	2	3	2	3	1	0	1	17
		Actors	Aircraft/ Equipment	Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0





## Example 2 – Large CAT Aircraft

- Airbus A340 had a cabin pressurisation warning whilst Enroute over the Atlantic
- Emergency descent
- Some crew reported feeling the effects of hypoxia



# Example 2 – Question 1

- Most credible accident outcome – Unsustainable Aircraft Environment (Pressurisation)
- Large CAT Aircraft – Row X (Top Row)

Potential Accident Outcome										
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1	X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000	1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1	S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000	500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1	M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000	100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1	I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1	E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000
	A/0									



# Example 2 – Question 2

- Barrier Model – Unsustainable Aircraft Environment (Pressurisation)
- Latent Barriers – All Failed or Not Applicable
- Situation Awareness – Not Applicable
- Warning System Operation and Compliance - Stopped
- Other Barriers Assumed to Work – Score X5

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Unsustainable Aircraft Environment	Pressurisation and Conditioning	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of Pressurisation and Conditioning related accidents.	Planning is effective to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent Pressurisation and Conditioning related accidents.	Warning systems that could prevent unsurvivable aircraft environments (e.g. pressurisation warnings) are fitted, functioning, operate correctly and are complied with.	Late recovery (e.g. rapid landing) to prevent an accident.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known " if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system is fitted, operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Only one of these barriers apply in any given situation if no barriers remain. You don't know it's luck until you have it.		
		Size of Barrier	5	2	3	2	3	1	1	1	
		Actors	Aircraft/ Equipment	Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0



## Example 3 – Small CAT Aircraft

- Embraer ERJ-175 veered right off the runway. There were no injuries, the aircraft damage is being assessed
- Captain of the flight was taken to a hospital with a stroke suffered at or after the landing.
- The airline reported no injuries occurred, all occupants disembarked via stairs



# Example 3 – Question 1

- Most credible accident outcome – Runway Excursion (Veer Off)
- Small CAT Aircraft – Row S (2nd Row)

Potential Accident Outcome										
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1	X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000	1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1	S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000	500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1	M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000	100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1	I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1	E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000
	A/0									



# Example 3 – Question 2

- Barrier Model – Runway Excursion (Veer Off)
  - Latent Barriers – All Failed or Not Applicable
  - Situational Awareness and Recovery Action – Failed
  - Warning System Operation and Compliance – Not Applicable
  - Protections - Stopped (Actual fatal accident) Score S1

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure (Normal Operations)	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Excursions	Veer Off	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of Runway Excursions (This includes aerodrome design, flight control and undercarriage systems).	Planning is effective (e.g. take-off/ approach paths) to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent runway excursions.	Warning systems that could prevent a runway excursion (e.g. overrun equipment) are fitted, functioning, operate correctly and are complied with to prevent an excursion.	Late recovery to prevent an actual excursion.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known" if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system is fitted, operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Aircraft and aerodrome design minimises the impact.	Not Applicable in Scenario	
		Size of Barrier	5	2	3	2	3	1	1	0	17
		Actors	Aircraft/ Equipment	Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0



## Example 4 – Offshore Helicopter

- Agusta 139 landed on the wrong helideck platform whilst flying to an offshore installation
- Helideck where the actual landing took place was not configured and prepared for landing helicopter
- Cranes and other potential obstacles were not controlled on the landing platform



# Example 4 – Question 1

- Most credible accident outcome – Obstacle Conflict
- Small Helicopter <19 – Row M (3rd Row)

Potential Accident Outcome										
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1	X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000	1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1	S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000	500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1	M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000	100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1	I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1	E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000
	A/0									





# Example 4 – Question 2

- Barrier Model – Runway Excursion (Veer Off)
  - Latent Barriers – All Failed or Not Applicable
  - Situational Awareness – Failed
  - Warning System – Not Applicable
  - Recovery Action – Stopped (Safe Landing Made)
  - Protections – Remaining Score M2

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Obstacle Collision in Flight	All	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of Obstacle collisions.	Planning is effective (e.g. take-off/ approach paths) to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent obstacle collisions.	Warning systems that could prevent obstacle collisions (e.g. map warnings) are fitted, functioning, operate correctly and are complied with to prevent obstacle collisions.	Late recovery to prevent an actual collision.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known " if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system is fitted, operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Only one of these barriers apply in any given situation if no barriers remain. You don't know it's luck until you have it.		
		Size of Barrier	5	2	3	2	3	1	1	1	18
		Actors	Aircraft/ Equipment	Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0



## Example 5 – GA Aeroplane

- Issoire Aviation SA-APM-20/21 Lionceau (Certified aircraft)
- The pilot was on final approach to the paved runway 26 with a speed of 65kt
- At the runway threshold, the pilot reduced the engine power and started the flare
- The aircraft touched down hard



# Example 5 – Question 1

- Most credible accident outcome – Runway Excursion (Low Energy Accident)
- Certified GA <19 – Row I (4th Row)

Potential Accident Outcome											
Extreme catastrophic accident with significant potential fatalities (100+)	X/9	X/8	X/7	X/6	X/5	X/4	X/3	X/2	X/1		X/0
	1.00E-03	0.01	0.10	1	10	100	1,000	10,000	100,000		1,000,000
Significant accident with significant potential for fatalities and injuries (19-100)	S/9	S/8	S/7	S/6	S/5	S/4	S/3	S/2	S/1		S/0
	5E-04	5E-03	0.05	0.5	5	50	500	5,000	50,000		500,000
Major accident with potential for some fatalities/life changing injuries (2-19) or major aircraft destroyed	M/9	M/8	M/7	M/6	M/5	M/4	M/3	M/2	M/1		M/0
	1E-04	1E-03	0.01	0.1	1	10	100	1,000	10,000		100,000
Single Individual fatality/life changing injury or substantial damage accident	I/9	I/8	I/7	I/6	I/5	I/4	I/3	I/2	I/1		I/0
	1E-05	1E-04	1E-03	0.01	0.1	1	10	100	1,000		10,000
Minor and Serious Injury (not life changing) accidents and Minor Damage	E/9	E/8	E/7	E/6	E/5	E/4	E/3	E/2	E/1		E/0
	1E-06	1E-05	1E-04	1E-03	0.01	0.1	1	10	100		1,000
	A/0										



# Example 5 – Question 2

## ➤ Barrier Model – Runway Excursion (Veer Off)

➤ Latent Barriers – All Failed or Not Applicable

➤ Situational Awareness – Failed

➤ Warning System – Not Applicable

➤ Recovery Action – Stopped

➤ Protections – Remaining Score 12

Key Risk Area	Scenario	Barrier	Aircraft, Equipment and Infrastructure	Tactical Planning	Regulations, Procedures, Processes and Compliance	Situational Awareness and Action	Warning System Operation and Compliance	Recovery Action	Protections	Unknown	Final Score
Unsustainable Aircraft Environment	Pressurisation and Conditioning	Barrier Definition in Scenario	Aircraft, equipment and infrastructure design, maintenance and correction operation support the prevention of Pressurisation and Conditioning related accidents.	Planning is effective to avoid the outcome.	Effective, understandable and available Regulations, Procedures and Processes that are complied with. Use of procedures for recovery barriers are not included here.	Human vigilance for operational threats identifies hazards and takes effective action to prevent Pressurisation and Conditioning related accidents.	Warning systems that could prevent unsurvivable aircraft environments (e.g. pressurisation warnings) are fitted, functioning, operate correctly and are complied with.	Late recovery (e.g. rapid landing) to prevent an accident.	Protections reduce the significance of the outcome.	All barriers failed worst outcome not realised.	Total Barrier Model Size
		Applicability in Scenario	Information on these barriers is useful to understand related Technical or Planning Issues. Normally scored as "Failed Known " if information is available or "Not Applicable" if no information is available. These barriers individually don't apply where there are events to the right in the scenario model.			Barrier scored as remaining when human action prevents a potential injury in normal operation.	Barrier scored when a warning system is fitted, operates and an human takes the correct action to prevent the outcome.	Scored when last minute action prevents outcome.	Only one of these barriers apply in any given situation if no barriers remain. You don't know it's luck until you have it.		
		Size of Barrier	5	2	3	2	3	1	1	1	
		Actors	Aircraft/ Equipment	Total System	Total System	Total System	Flight Ops	Flight Ops	Flight Ops	Flight Ops	Final Score
		Barrier Score									0



# Some Observations

- The ERCS process requires information
- Therefore it will require improvements to the reporting and investigation process – e.g. better guidance on what information to provide for different types of occurrence
- ERCS will lead to
  - Changes to taxonomy – part of current Strategic Taxonomy Review
  - Update to mandatory fields and list of reportable occurrences in Regulation 376



## Further Work

- Further testing and refinement of the process
- Develop easy translation from other Risk Classification Processes (e.g. ARMS/ RAT)
- Develop supporting guidance and training material
- Support technical implementation in ECCAIRS, SMS Software and provide standalone tools
- Support ERCS evolution and develop longer term reporting improvements