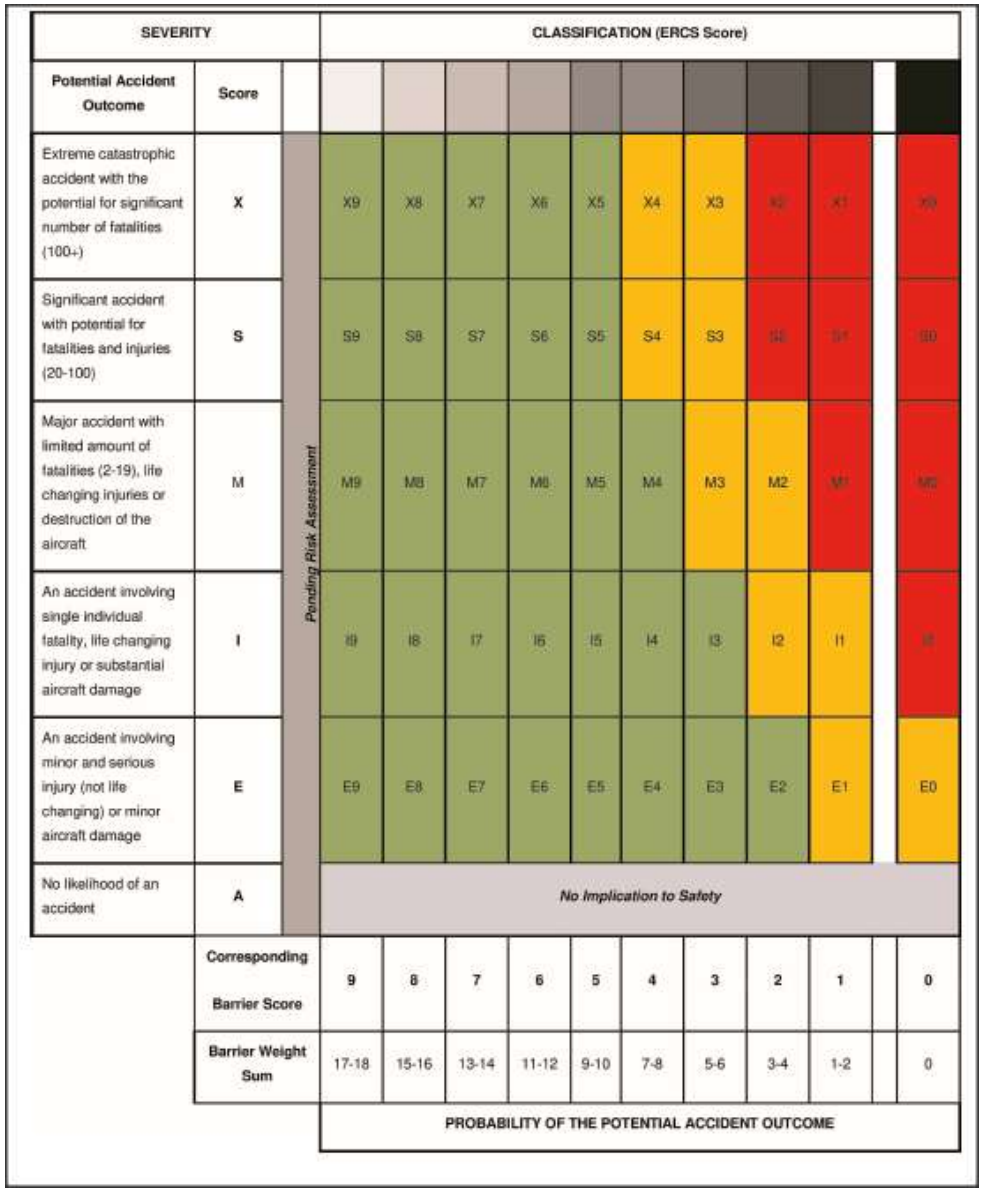
Introducing the European Safety Risk Classification Scheme

Sofema Aviation Services (SAS) www.sassofia.com Considers the Role of EASA ERCS - Risk Classification compliant with Commission Delegated Regulation (EU) 2020/2034 of 6 October 2020 Supplementing Regulation (EU) No 376/2014.

Introduction

Effective 1 January 2021 the ERCS is a required process to manage operational risk assessment (unless alternative means of compliance are agreed with the Relevant European Competent Authority).



SEVERITY		CLASSIFICATION (ERCS Score)										
Potential Accident Outcome	Score											
Extreme catastrophic accident with the potential for significant number of fatalities (100+)	X	X9	X8	X7	X6	X5	X4	X3	X2	X1		X0
Significant accident with potential for fatalities and injuries (20-100)	S	S9	S8	S7	S6	S5	S4	S3	S2	S1		S0
Major accident with limited amount of fatalities (2-19), life changing injuries or destruction of the aircraft	M	M9	M8	M7	M6	M5	M4	M3	M2	M1		M0
An accident involving single individual fatality, life changing injury or substantial aircraft damage	I	I9	I8	I7	I6	I5	I4	I3	I2	I1		I0
An accident involving minor and serious injury (not life changing) or minor aircraft damage	E	E9	E8	E7	E6	E5	E4	E3	E2	E1		E0
No likelihood of an accident	A	*No Implication to Safety*										
	Corresponding Barrier Score	9	8	7	6	5	4	3	2	1		0
	Barrier Weight Sum	17-18	15-16	13-14	11-12	9-10	7-8	5-6	3-4	1-2		0
		PROBABILITY OF THE POTENTIAL ACCIDENT OUTCOME										

Pending Risk Assessment

Terminology used to Support this Regulation

'European risk classification scheme' or 'ERCS'

- The methodology applied for the assessment of the risk posed by an occurrence to civil aviation in the form of a safety risk score;

'ERCS matrix'

- A grid made up of the variables described which serves for the illustrative representation of the safety risk score;

'Safety Risk Score'

- Means the result of the risk classification of an occurrence by combining the values of the variables described.

'High-Risk Area'

- An area where an aircraft impact would cause numerous injuries, result in a high number of fatalities, or both because of the nature of the activities in that area, such as nuclear or chemical plants;

'Populated Area'

- An area with clustered or scattered buildings and a permanent human population, such as city, settlement, town, or village;

'Life Changing Injury' means an injury reducing the person's quality of life in regard to reduced mobility or reduced cognitive or physical ability in daily life.

ERCS Methodology

The ERCS shall be based on the ERCS matrix composed of the following two variables:

- Severity: identification of the worst likely accident outcome that would have resulted if the occurrence under assessment had escalated into an accident;
- Probability: identification of the likelihood of the occurrence under assessment to escalate into the worst likely accident outcome.

Key Risk Areas

EASA has identified the following key risk areas

- **Airborne collision:** a collision between aircraft while both aircraft are airborne; or between aircraft and other airborne objects (excluding birds and wildlife);

- **Aircraft upset:** an undesired aircraft state characterized by unintentional divergences from parameters normally experienced during operations, which might ultimately lead to an uncontrolled impact with terrain;

- **Collision on runway:** a collision between an aircraft and another object (other aircraft, vehicles, etc.) or person that occurs on a runway of an aerodrome or other predesignated landing area. It does not include collisions with birds or wildlife;

- **Excursion:** an occurrence when an aircraft leaves the runway or movement area of an aerodrome or landing surface of any other predesignated landing area, without getting airborne.
    - It includes high-impact vertical landings for rotorcraft or vertical take-off and landing aircraft and balloons or airships; e. fire, smoke and pressurization:
    - An occurrence involving cases of fire, smoke, fumes or pressurization situations that may become incompatible with human life.
    - This includes occurrences involving fire, smoke or fumes affecting any part of an aircraft, in flight or on the ground, which is not the result of impact or malicious acts;

- **Ground damage:** damage to aircraft induced by operation of aircraft on ground on any other ground area than a runway or predesignated landing area, as well as damage during maintenance;

- **Obstacle collision in flight:** collision between an airborne aircraft and obstacles rising from the surface of the earth.
    - Obstacles include tall buildings, trees, power cables, telegraph wires and antennae as well as tethered objects;

- **Terrain collision:** an occurrence where an airborne aircraft collides with terrain, without indication that the flight crew was unable to control the aircraft.
    - It includes instances when the flight crew is affected by visual illusions or degraded visual environment;

- **Other injuries:** an occurrence where fatal or non-fatal injuries have been inflicted, which cannot be attributed to any other key risk area;

- **Security:** an act of unlawful interference against civil aviation.
    - It includes all incidents and breaches related to surveillance and protection,
    - Access control.
    - Screening.
    - Implementation of security controls and any other acts intended to cause malicious or wanton destruction of aircraft and property.
    - Endangering or resulting in unlawful interference with civil aviation and its facilities.
    - Includes both physical and cyber security events.

Loss of Life Categorization

- More than 100 possible fatalities

  - Large A/C over 100 Pax
  - Equivalent size aircraft for cargo;
  - One aircraft of any type in a high risk or heavily populated area
  - Any situation, any type of aircraft possibility over 100 fatalities.

- Between 20 to 100 possible fatalities
  - Medium certified aircraft with 20 to100 pax
  - Equivalent size aircraft for cargo
  - Any situation where 20 to 100 fatalities may be possible;

- Between 2 to 19 possible fatalities:
  - One small A/C up to 19 Pax
  - Equivalent size aircraft for cargo
  - Any situation where 2 to 19 fatalities may be possible;

- 1 possible fatality – (A/C not EASA certified)
  - Any situation where a single fatality may be possible;

- 0 possible fatalities – personal injuries only
  - Regardless of the number of minor and serious

Measure of Severity

A	No Likelihood of an Accident
E	Minor and Serious Injury (not life changing) or Minor Aircraft Damage
I	Single Fatality, Life Changing Injury or Substantial Damage Accident
M	Major Accident with Limited Amount of Fatalities, Life Changing Injuries or Destruction of the Aircraft
S	Significant Accident with Potential for Fatalities and Injuries
X	Extreme catastrophic accident with the potential for significant number of fatalities.

KEY RISK AREA	CATEGORY	SEVERITY SCORE
Airborne collision	More than 100 possible fatalities Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality	X S M I
Aircraft upset	More than 100 possible fatalities Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality	X S M I
Collision on runway	More than 100 possible fatalities X Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities	X S M

	1 possible fatality 0 possible fatalities	I E
Excursions	Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality 0 possible fatalities	S M I E
Fire, smoke and pressurization	More than 100 possible fatalities X Between 20 to 100 possible fatalities S Between 2 to 19 possible fatalities M 1 possible fatality	X S M I
Ground damage	Between 2 to 19 possible fatalities 1 possible fatality 0 possible fatalities	M I E
Obstacle collision in flight	More than 100 possible fatalities Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality	X S M I
Terrain collision	More than 100 possible fatalities Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality	X S M I
Other injuries	Between 20 to 100 possible fatalities S Between 2 to 19 possible fatalities M 1 possible fatality I 0 possible fatalities	S M I E
Security	More than 100 possible fatalities Between 20 to 100 possible fatalities Between 2 to 19 possible fatalities 1 possible fatality 0 possible fatalities	X S M I E

The purpose of the ERCS barrier model is to assess the effectiveness (that is the number and the strength) of the barriers which were remaining between the actual occurrence and the worst likely accident outcome.

- Ultimately, the ERCS barrier model shall determine how close the occurrence under assessment has been to the potential accident.

Considering the Applicable Barrier

Barrier Number	Barrier	Barrier Weight
1	Aircraft, equipment and infrastructure design', includes maintenance and correction, operation support, the prevention of problems related to technical factors that could lead to an accident.	5
2	Tactical planning', includes organizational and individual planning prior to the flight or other operational activity that supports the reduction of the causes and contributors to accidents.	2

3	Regulations, procedures, processes', includes effective, understandable and available regulations, procedures and processes that are complied with (with the exclusion of the use of procedures for recovery barriers).	3
4	'Situational awareness and action', includes human vigilance for operational threats which ensures identification of operational hazards and effective action to prevent an accident.	2
5	Warning systems operation and action' that could prevent an accident and which are fit for purpose, functioning, operational and are complied with.	3
6	Late recovery from a potential accident situation'	1
7	'Protections', when an event has occurred, the level of the outcome is mitigated or prevents the escalation of the occurrence by intangible barriers or providence	1
8	'Low energy occurrence' scores the same as 'Protections', but for low-energy key risk areas only (ground damage, excursions, injuries). 'Not applicable' for all other key risk areas.	1

Calculation

Calculation The probability of the potential accident outcome is the numerical value resulting of the following steps:

- A sum of all the barrier weights of all the assessed barriers that were scored either
  - 'Stopped',
  - 'Remaining known' or
  - 'Remaining assumed'

Note - The 'Failed' and 'Not Applicable' barriers shall not be counted for the final score, as those barriers could not have prevented the accident.

Barrier Weight	Barrier Score
0	0
1-2	1
3-4	2
5-6	3
7-8	4
9-10	5
11-12	6
13-14	7
15-16	8
17-18	9

The resulting barrier weight sum is a numerical value between 0 and 18.

The barrier weight sum corresponds to a barrier score between 0 and 9 as per the following table, covering the full range between strong and weak remaining barriers.

Scoring of the Safety Risk within the ERCS Matrix.

The safety risk score is a two-digit value where

- The first digit corresponds to the alphabetic value resulting from the calculation of the severity of the occurrence (severity score A to X).
- The second digit represents the numerical value from the calculation of the corresponding score of the occurrence (0 to 9).

  The safety risk score shall be put into the ERCS matrix. For each given safety risk score there is also a numerical equivalent score for aggregation and analysis purposes which is explained below under '**Numerical equivalent score'**.

Building an ERC

Red XO, X1, X2, S0, S1, MO, M1, I0 - High Risk
Yellow X3 X4 S3, S4, M2, M3, I1,I2, E0, E1 - Elevated Risk (Intermediate
Green X5 to X9, S5 to S9, M4 to M9, I3 to I9, E2 to E9 -Low Risk

SEVERITY		CLASSIFICATION (ERCS Score)										
Potential Accident Outcome	**Score**											
Extreme catastrophic accident with the potential for significant number of fatalities (100+)	X	X9	X8	X7	X6	X5	X4	X3	X2	X1		X0
Significant accident with potential for fatalities and injuries (20-100)	S	S9	S8	S7	S6	S5	S4	S3	S2	S1		S0
Major accident with limited amount of fatalities (2-19), life changing injuries or destruction of the aircraft	M	M9	M8	M7	M6	M5	M4	M3	M2	M1		M0
An accident involving single individual fatality, life changing injury or substantial aircraft damage	I	I9	I8	I7	I6	I5	I4	I3	I2	I1		I0
An accident involving minor and serious injury (not life changing) or minor aircraft damage	E	E9	E8	E7	E6	E5	E4	E3	E2	E1		E0
No likelihood of an accident	A	*No Implication to Safety*										
	Corresponding Barrier Score	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**		**0**
	Barrier Weight Sum	17-18	15-16	13-14	11-12	9-10	7-8	5-6	3-4	1-2		0
		PROBABILITY OF THE POTENTIAL ACCIDENT OUTCOME										

Pending Risk Assessment

Numerical equivalent score Each ERCS score is assigned a corresponding numerical value of risk magnitude to facilitate the aggregation and numerical analysis of multiple occurrences with an ERCS score:

ERCS Score	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0
Corresponding numerical value	0,001	0,01	0,1	1	10	100	1000	10000	100000	1000000
ERCS Score	S9	S8	S7	S6	S5	S4	S3	S2	S1	S0
Corresponding numerical value	0,0005	0,005	0,05	0,5	5	50	500	5000	50000	500000
ERCS Score	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0
Corresponding numerical value	0,0001	0,001	0,01	0,1	1	10	100	1000	10000	100000
ERCS Score	I9	I8	I7	I6	I5	I4	I3	I2	I1	I0
Corresponding numerical value	0,00001	0,0001	0,001	0,01	0,1	1	10	100	1000	10000
ERCS Score	E9	E8	E7	E6	E5	E4	E3	E2	E1	E0
Corresponding numerical value	0,000001	0,00001	0,0001	0,001	0,01	0,1	1	10	100	1000

SEVERITY			CLASSIFICATION (ERCS Score)											
Potential Accident Outcome	Score													
Extreme catastrophic accident with the potential for significant number of fatalities (100+)	X		Pending Risk Assessment	X9=0,001	X8=0,01	X7=0,1	X6=1	X5=10	X4=100	X3=1000	X2=10000	X1=100000		X0=1000000
with potential for fatalities and injuries (20-100)	S			S9=0,0005	S8=0,005	S7=0,05	S6=0,5	S5=5	S4=50	S3=500	[illegible]	[illegible]		[illegible]
Major accident with limited amount of fatalities (2-19), life changing injuries or destruction of the aircraft	M			M9=0,0001	M8=0,001	M7=0,01	M6=0,1	M5=1	M4=10	M3=100	M2=1000	[illegible]		[illegible]
An accident involving single individual fatality, life-changing injury or substantial aircraft damage	I			I9=0,00001	I8=0,0001	I7=0,001	I6=0,01	I5=0,1	I4=1	I3=10	I2=100	I1=1000		I0=10000
minor or serious injury (not life-changing) or minor aircraft damage	E			E9=0,000001	E8=0,00001	E7=0,0001	E6=0,001	E5=0,01	E4=0,1	E3=1	E2=10	E1=100		E0=1000
No likelihood of an accident	A			No Implication to Safety										
	Corresponding Barrier Score			9	8	7	6	5	4	3	2	1		0
	Barrier Weight			17-18	15-16	13-14	11-12	9-10	7-8	5-6	3-4	1-2		0
				POSSIBILITY OF THE POTENTIAL ACCIDENT OUTCOME										