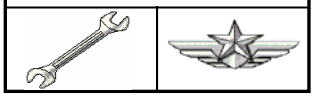
Information Notice

SUBJECT: GENERAL

Aid to introduction of a Safety Management System (SMS) - Operational risk management methodology provided by EUROCOPTER

Comment: This Information Notice (IN) is mainly intended for the managers of Safety Management Systems, for Flight Safety Officers, Maintenance Managers, Managers of In-Flight Operations and more generally for any person participating in the introduction of a Safety Management System.

For the attention of



AIRCRAFT CONCERNED	Version(s)	
	Civil	Military
EC120	B	
AS350	B, BA, BB, B1, B2, B3, D	L1
AS550		A2, C2, C3, U2
AS355	E, F, F1, F2, N, NP	
AS555		AF, AN, SN, UF, UN
EC130	B4	
SA360	C	
SA365 / AS365	C, C1, C2, C3, N, N1, N2, N3	F, Fs, Fi, K
AS565		AA, MA, MB, SA, SB, UB
SA366	G1	GA
EC155	B, B1	
SA321	Ja	Ga, Gb, Gc
SA330	J	Ba, Ca, Ea, H, L, Jm, S1, Sm
SA341	G	B, C, D, E, F, H
SA342	J	L, L1, M, M1, Ma
ALOUETTE II	313B, 3130, 318B, 318C, 3180, 3180B, 3180C	
ALOUETTE III	316B, 316C, 3160, 319B	
LAMA	315B	
EC225	LP	
EC725		AP
AS332	C, C1, L, L1, L2	B, B1, F1, M, M1
AS532		A2, U2, AC, AL, SC, UC, UE, UL
BO105	A, C (C23, CB, CB-4, CB-5), D (D, DS, DB, DBS, DB-4, DBS-4, DBS-5), S (CS, CBS, CBS-4, CBS-5), LS A-3	E-4, CBS-5 KLH
BK117	A-1, A-3, A-4, B-1, B-2, C-1, C-2	
EC135	T1, T2, T2+, P1, P2, P2+, 635 T1, 635 T2+, 635 P2+	

Improving global flight safety is the top priority for EUROCOPTER. On this account, EUROCOPTER is fully involved in the work of IHST (International Helicopter Safety Team) who aims at reducing the helicopter accident rate worldwide by 80% by the year 2016.
The principles described below come as a supplement to the "SMS Toolkit", which can be downloaded on the IHST website (http://www.ihst.org) and EHEST website (http://www.easa.europa.eu/essi/ehest/), and to the documentation on this subject issued by the Aviation Authorities.

EUROCOPTER would like to make you aware of the importance of hazard identification and risk management which are the core of any safety risk management system and proposes you in this Information Notice a methodology for dealing with this subject.
This methodology will enable you to:
- Draw up a list of generic and specific hazards encountered during your daily activity.
- Identify and qualify potential repercussions of these hazards on your activity.
- Define corrective and protective measures in order to prevent such hazards and eliminate or mitigate their consequences.

1 - Scope:

This notice is more particularly dedicated to Commercial Air Transportation, but can generically be used for aerial work, aerial emergency missions, training or general aviation flights, and generally for every activity associated with operations in flight or on the ground.

2 - Glossary:

ASR:	Air Safety Report
CAA:	Civil Aviation Authority
CFIT:	Controlled Flight Into Terrain
EASA:	European Aviation Safety Agency
ICAO:	International Civil Aviation Organization
EHEST:	European Helicopter Safety Team
EI:	Undesirable Event
EU:	Ultimate Event (accident)
IHST:	International Helicopter Safety Team
SSP:	State Safety Program

3 - Definitions:

Safety:
Situation in which the risks of personal injury or material damage are limited to an acceptable level and are maintained at this level or a lower level due to the continued hazard identification and risk management process (ICAO SMS Manual Doc 9859).

Safety culture:
The following definition was proposed by Dr. James Reason in 1997 to define Safety culture: *Safety culture comprises "fairness", interchange of information, and learning from events which occurred in the past. A "fair" culture is a culture that establishes an atmosphere of trust in which personnel is encouraged (or even rewarded) to provide information essential to safety, and where the limit between an acceptable and unacceptable behavior is clearly set.*

Air accident (ICAO Appendix 13):
Event related to aircraft operation, which occurs between the time a person boards the aircraft with the intention of performing a flight and the moment when all the persons having boarded the aircraft with this intention, have disembarked, and during which:

a) A person is fatally or seriously injured because the person is:
- in the aircraft, or
- in direct contact with any part of the aircraft, including parts which have become detached, or
- directly exposed to engine jet wash, unless the injuries are due to natural causes, injuries caused by the person himself or by other persons, or injuries sustained by a stowaway hidden outside the passenger and flight crew access areas, or

b) The aircraft sustains damage or a structural failure:
- altering its structural strength, its performance or flight characteristics, and
- normally requiring a substantial repair or the replacement of the damaged component, except for an engine failure or engine fault if the damage is limited to the engine, the engine cowlings or engine accessories, or damage limited to the propellers, the wing tips, the antennas, the tires, the brakes, the fairings or to small notches or perforation of the skin, or

c) The aircraft has disappeared or is completely inaccessible:

Incident:
An incident is defined in this document as an event, other than an accident associated with aircraft preparation or operation, which would or could affect the safety of aerial operations. An Undesirable Event is considered as an in-flight incident which may be caused by technical, organizational or operational occurrences.

Undesirable Event:
Also called forerunner event, an Undesirable Event identifies any deviation from what is expected and may cause personal injury or material damage. *This event can be defined as a loss of control of the situation, i.e., any event which may give rise to an accidental sequence if no efficient recovery action is taken*. Consequently, the Undesirable Event behaves like a signal whose systemic analysis makes it possible to improve the risk prevention mechanisms of the organization.

Hazard:
A condition or object potentially causing injuries, damage to equipment or the structure, loss of material or reducing the ability to perform the assigned functions (ICAO SMS Manual Doc 9859).

Safety risk management:
The “Safety risk management“ indication was defined to transmit the idea that this risk management was not directly associated with the management of financial, statutory, legal, economic and other risks, but that it was mainly limited to Safety risks (ICAO SMS Manual Doc 9859).

Safety risks:
They are defined by assessment, expressed in terms of probability and severity of the consequences of a hazard, by taking into account the most unfavorable hypothesis. A risk level is generally defined through alphanumeric convention to assess its criticality (ICAO SMS Manual Doc 9859):
- Probability: possibility of occurrence of an event (engine power loss: 10^{-5} per Flying Hour).
- Severity (or seriousness): consequence of the occurrence of this event (aircraft damage, slight injuries, etc.).
- Criticality: measurement of the combination of the two factors: C = P x S.

4 - Aim of an analysis & operational risk management process:

The analysis & operational risk management process is applied to detect, analyze and determine the steps to be taken in order to reduce the risk level:
- during aircraft preparation or in flight,
- during maintenance operations or maintenance instructions,
- for any new activity, modifications to procedures or work organization, etc. to be introduced in the normal functioning of a company and which may have an effect on the flight safety.

The previous paragraph indicated that an Undesirable Event (EI) was *defined as a loss of control of the situation, i.e., any event which may give rise to an accidental sequence if no efficient recovery action is taken.*

The process of identification of hazards and risk management therefore focuses on:
- the measures to be taken to counter the occurrence of an Undesirable Event and to remain in the zone of control,
- the bounds of recovery if ever it occurred, in order to come back to the zone of control and prevent the initiation of an accidental sequence,
- the protective (mitigation) measures to be taken, in order to limit/mitigate the consequences of an accident, if it occurred despite all efforts.

This process can be summarized according to the safety model indicated below:

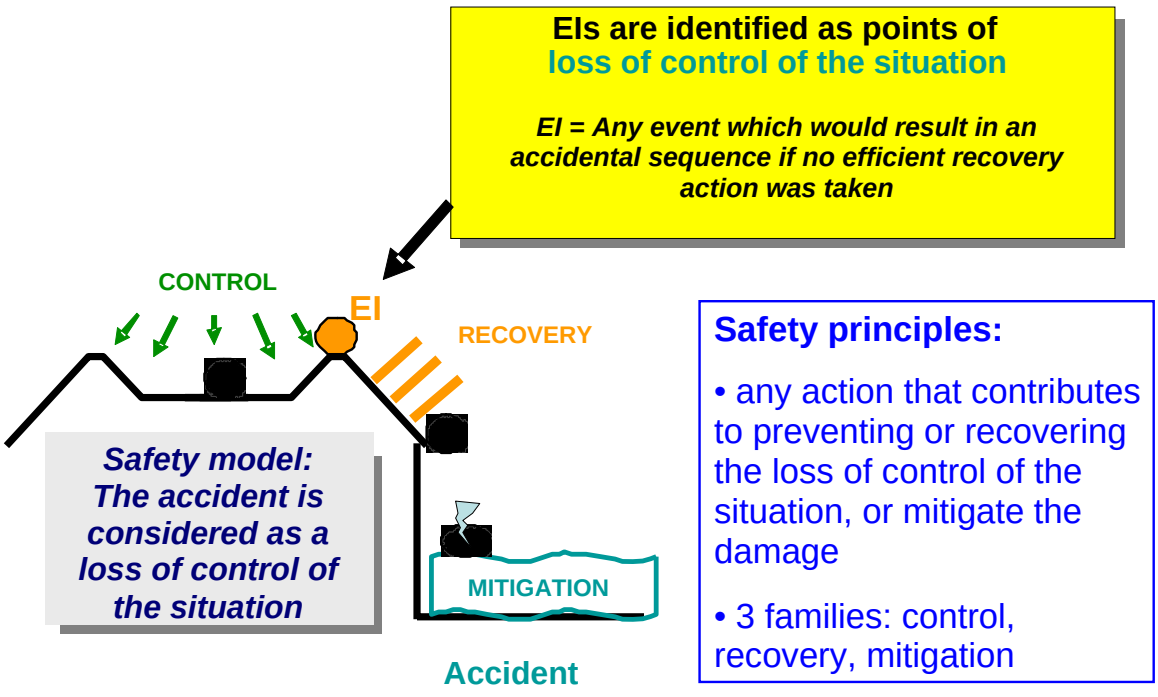


Figure 1: Source Air France Consulting/Qualit Audit

This figure shows a ball which rolls in a bowl. The purpose of the game is to prevent the ball from reaching the edge of the bowl and falling, i.e. to remain in the zone of control.
If the ball reaches the edge of the bowl, an Undesirable Event occurs, we have quit the zone of control. It is then mandatory to return to the zone of control or, failing this, to prevent the ball from falling. This materializes the bounds of recovery of the EI.
The MITIGATION "mattress" symbolizes all of the protective measures which may be implemented to limit/mitigate the consequences of an accident. In the case of the figure, the fall of the ball on the ground must be damped so as to prevent it from breaking.

How to implement this process of hazard identification and risk management?
To do this, we suggest that you answer the following questions:
1. What could happen in my activity (hazard identification)?
2. How could it happen (identification of causes)?
3. Which would be the consequences?
4. How to proceed to prevent or limit the probability that it occurs (risk mitigation)?
5. How to proceed to eliminate it or failing this, to limit its consequences (protection)?
6. How to introduce these risk limitation measures (implementation)?

5 - What could happen in my activity (hazard identification):

There a several kinds of hazards. For example:
- Natural hazards (earthquakes, volcanic phenomena, etc.).
- Environmental hazards (cyclones, snow or sand storms, etc.).
- Technological hazards (related to the aircraft design, their maintenance, their operation, etc.).
- Organizational hazards (related to the company itself, to its operating manner).
- Statutory hazards (if the organization encounters difficulty in complying with the statutory requirements and with their evolution, etc.).
- Human hazards (related to training, competence, job culture, etc.).
- Physiological hazards (epidemic diseases, etc.).

There are two types of sources of identification of hazards, i.e. Undesirable Events:
- Internal sources:
  They cover, for instance, incident report analyses, ASRs, voluntary event reports of the organization, flight data analyses of Flight Data Monitoring programs, reports of safety-audits, follow-ups of safety indicators, statements of employees, etc.
- External sources:
  They cover the exchange of information with other companies, the subscription to an incident/accident data bank, the study of reports of national and international organizations, the analysis of manufacturer recommendations, the study of accident reports of the different Air Accident Investigation Boards, specialized publication, etc.

Using these information sources, it is recommended to draw up a list of Undesirable Events which may impact the activity. We also suggest that you use the "Brainstorming" method to conduct this study. A meeting composed of one representative from each expert field shall be held to implement the process of identification of hazards and risk management as described in the following paragraphs of this document.

We recommend that you proceed per risk factor family, e.g.:
- Design.
- Organization.
- Communication.
- Working environment.
- Regulations.
- Human Performance.
- Procedures and operational practices.

To help you, EUROCOPTER has drawn up a non-exhaustive list of Undesirable Events which can be related to the State Safety Program (Appendix 1). Concerning this subject, you can also consult the ICAO website at the following address: http://www2.icao.int/en/ism/iStars/Pages2/Occurence%20Category%20Relationship.aspx

6 - How could it happen (identification of causes):

There are several methods for analyzing the causes (the FMECA “5 why’s” method, the “tree of causes” method, etc.). Every operator should select the method the most suitable to the size and activity of his company.
In the SMS 9859 manual, the ICAO proposes the use of the "Bow Tie"-method.

The "bow tie" is a tool which combines a fault tree and an event tree.
The central point of the bow tie is called "Unwanted Incident". The LH part of the bow tie is similar to a fault tree and identifies the causes of the feared central event. The RH part of the bow tie determines the consequences of the unwanted incident in the same manner as an event tree.

The identification of causes focuses on the upstream part of the Feared Event. It is the return to the root causes of the potential accident.
This process is summarized below in Figure 2.

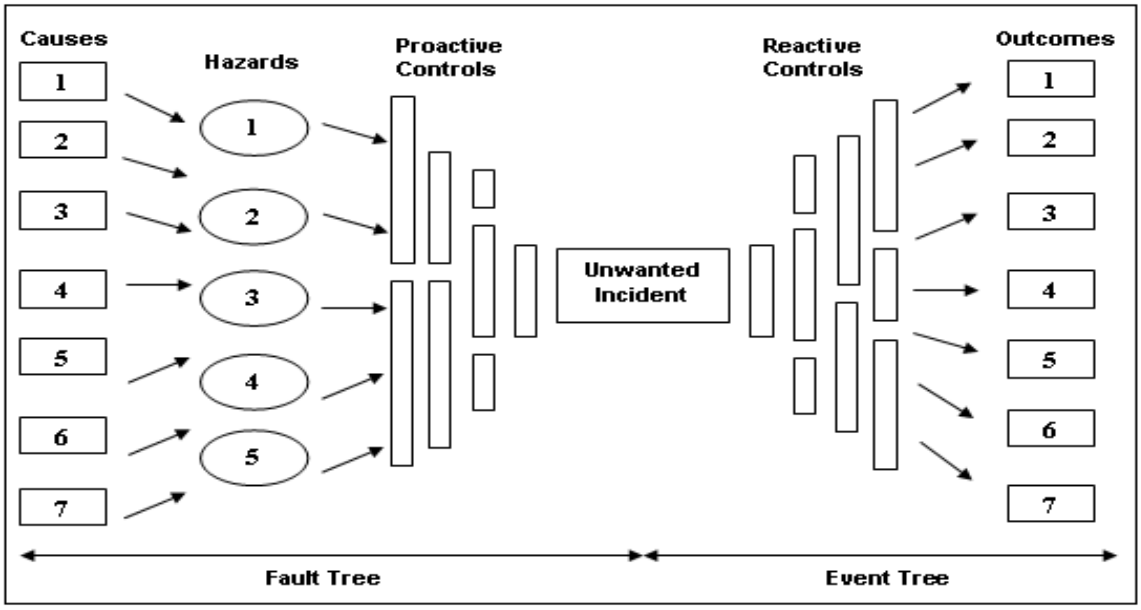


Figure 2: "Bow tie" analysis method

7 - Which would be the consequences?

The list of potential consequences of an accident, if it occurred, must now be drawn up, i.e. the focus must now be set on the downstream part of the Unwanted Incident of figure 2.

We recommend that you answer (at least) the following questions:
- Which would be the consequences for:
  · the persons on board the aircraft and tasked with preparing the aircraft or third parties near the scene of the accident (injuries, fatality)?
  · the aircraft, the working tool? Will it be necessary to rent another aircraft? Another tool? Find another place for the operations (case of fire in a hangar)?
  · the environment (destruction of goods, pollution, fires, etc.)?
  · the company image (loss of credibility, withdrawal of customers, media impact, legal proceedings, etc.)?

8 - How to proceed to prevent or limit the probability that it occurs (risk mitigation):

It is necessary to assign a risk level (criticality) to the feared event. Remember, risk level is the potential severity of event multiplied by the probability of its occurrence.
It is highly advisable to use a risk matrix to determine the risk levels.
We suggest that you use the following risk matrix. It is inspired by the matrix presented by Mr Tony Cramp, SHELL Aircraft International's Air Senior Advisor, during the CHC Safety & Quality Summit in 2010.

CATASTROPHIC					
CRITICAL					
MAJOR					
MINOR					
NEGLIGIBLE					
	IMPROBABLE	**RARE**	**LOW**	**PROBABLE**	**FREQUENT**

Color code:

ACCEPTABLE MEDIUM SERIOUS UNACCEPTABLE UNACCEPTABLE +

Key to severity indices and associated codes in the matrix:

SEVERITY	Personnel	Environment	Material	Image
NEGLIGIBLE	Superficial injuries	Negligible effects	Damage < 10K€	Light impact
MINOR	Slight injuries	Little impact	Damage < 50K€	Limited impact
MAJOR	Serious injuries	Noteworthy local effects	Damage < 250K€	Considerable impact
CRITICAL	Fatality	Effects difficult to repair	Damage < 1 M€	National impact
CATASTROPHIC	Multiple fatalities	Massive effects (pollution, destruction, etc.)	Damage > 1 M€	International impact

Key to probabilities and associated codes in the matrix:

IMPROBABLE	**Almost unthinkable that the event occurs; it has never occurred in the history of the aviation industry**
RARE	**Very unlikely to occur, but has already occurred in the aviation history**
LOW	**Unlikely to occur, but has already occurred, in the company, at least once**
PROBABLE	**Has already occurred in the company (Frq < 3x year)**
FREQUENT	**Has already occurred in the company (Frq > 3x year)**

Acceptable or Medium risk level: Lowest risk level likely to be reasonably reached and under which the remaining part of risk can be controlled appropriately. No measure is required to mitigate the risk.
This risk level is not fixed on a long-term basis. It depends on the complexity of the operation to be performed (environment, availability of existing documentation, personnel qualification, duration of the mission, etc.), on the existing objective data enabling a qualitative analysis of the risks, on the resources specific to the organization to conduct this risk analysis, etc.

Serious risk level: Risk level at which the organization accepts to move in order to benefit from some advantages for its activity and on the condition that the risk is mitigated as much as possible.

Unacceptable and Unacceptable+ risk level: Means that the activity cannot be continued as is and that it cannot be resumed unless the risk is brought back to the “Acceptable” or “Medium” level or at least to the “Serious” level.

Concerns risks considered as "SERIOUS" to "UNACCEPTABLE**+**" during the assessment process and requiring measures to bring the risks back to a "MEDIUM" level at least. It is at this stage that a corrective measure plan is defined.

There are **two risk reduction strategies**:
- **prevention**, by taking any actions to reduce the frequency of occurrence of an incident/accident (probability),
- **protection**, by eliminating/reducing the severity of the consequences of an incident/accident if it were to occur.

9 - Implementation of protective measures:

In-depth defense concept:

The prevention and protection measures are also referred to as "defenses" against the accident. They are intended to suppress, or failing this to counteract the hazard (both external and internal), to contain its effects and to eliminate or limit its consequences.
These defenses may be of technical (static or dynamic), organizational, procedural or human order.
The expression “in-depth defense” stems from the military language. Its principle is that the defenses should be:
- suitable for the threat,
- at least 3 in series, and independent from one another, in order to avoid the domino effect (hence the expression "in-depth"),
- flexible for proper adaptation to the evolution of the threat. The Safety Manager should periodically check the relevance of his or her risk analyses. He or she should proceed systematically in case of any change in the organizational scheme, the regulations or the operations (change management)
- maintained.

All solutions are possible, but they all involve costs. It is mandatory to conduct a cost analysis prior to taking any steps. The cost of protective measures should not exceed the cost of the consequences of a risk; otherwise, this may jeopardize the survival of the organization.

You can use the decision matrix below as a decision-making aid.

		BENEFIT		
		High	**Medium**	**Low**
COST	**Low**	**1**	**2**	**3**
	Medium	**2**	**3**	**4**
	High	**3**	**4**	**5**

Figure 3: Cost/Benefit analysis matrix

Score from 1 to 2: The preventive and protective measures can be adopted as are.
Score equal to 3: If possible, reduce the cost of the implementation of the preventive and protective measures.
Score higher than 3: Review the risk analysis to find new solutions.

It is advisable to draw up an implementation plan of these measures with an associated schedule.
The implementation of the actions must be supervised by identified managers. Any corrective measures must be taken. The results obtained will be used to feed the safety indicators of the SMS.

10 - Concrete case:

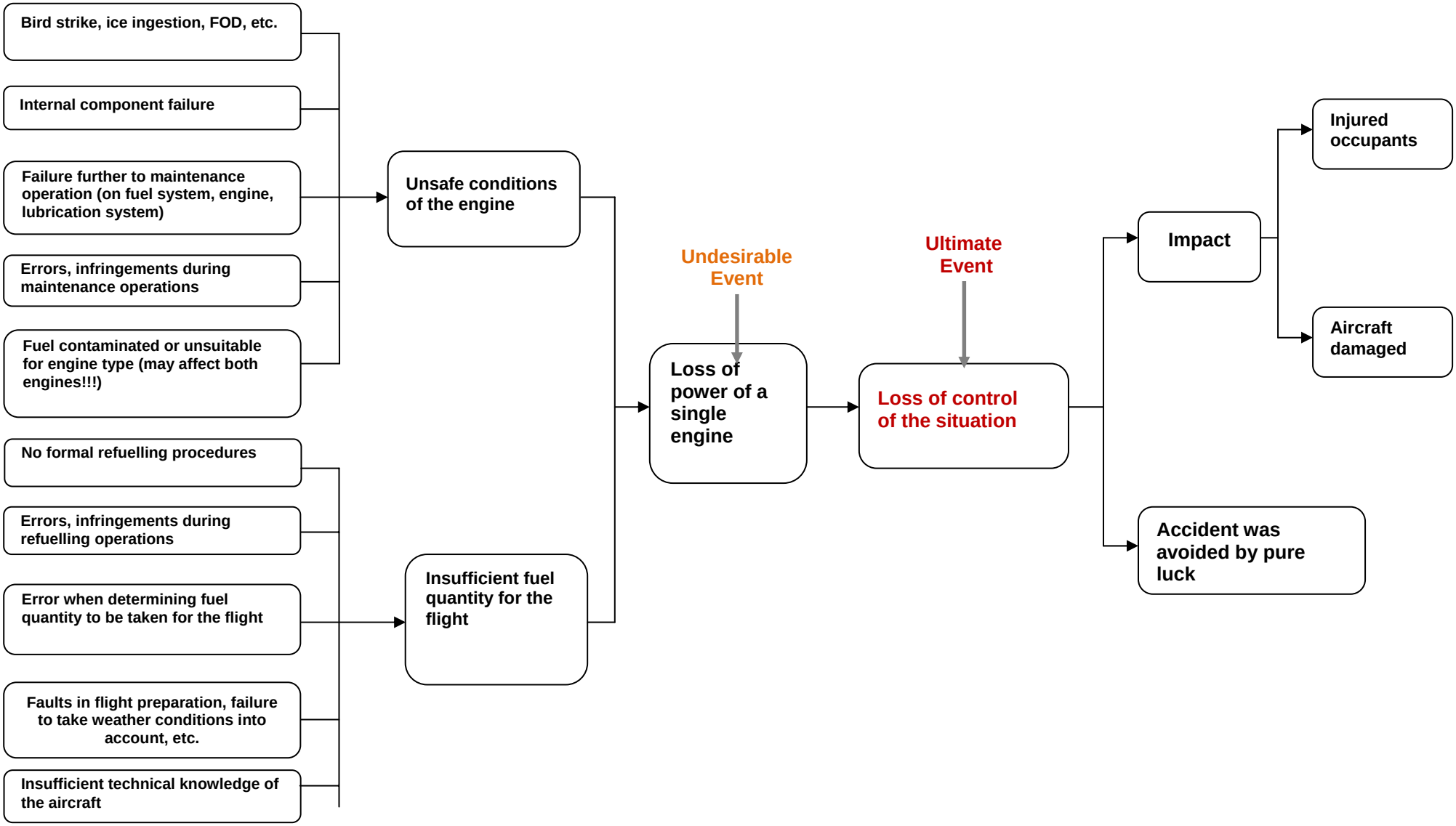
10-1 Step 1, identification of hazards:

We will take the example of the partial or total engine power loss in cruise flight on a twin-engine aircraft. This is a failure considered as rare according to the certification criteria (1.10^{-5} per flying hour).
However, the reality shows that this type of event occurs at a higher frequency than that taken into account for the turbo-shaft power plant certification. For this reason, we must search, within our aviation company, for the root causes which may cause this type of event in order to be able to eliminate them, prevent them and protect ourselves against them.

For the purpose of that drill, we will consider ourselves in a public passenger transport context, in single-pilot operation, in IFR flight rules, and in IMC conditions.

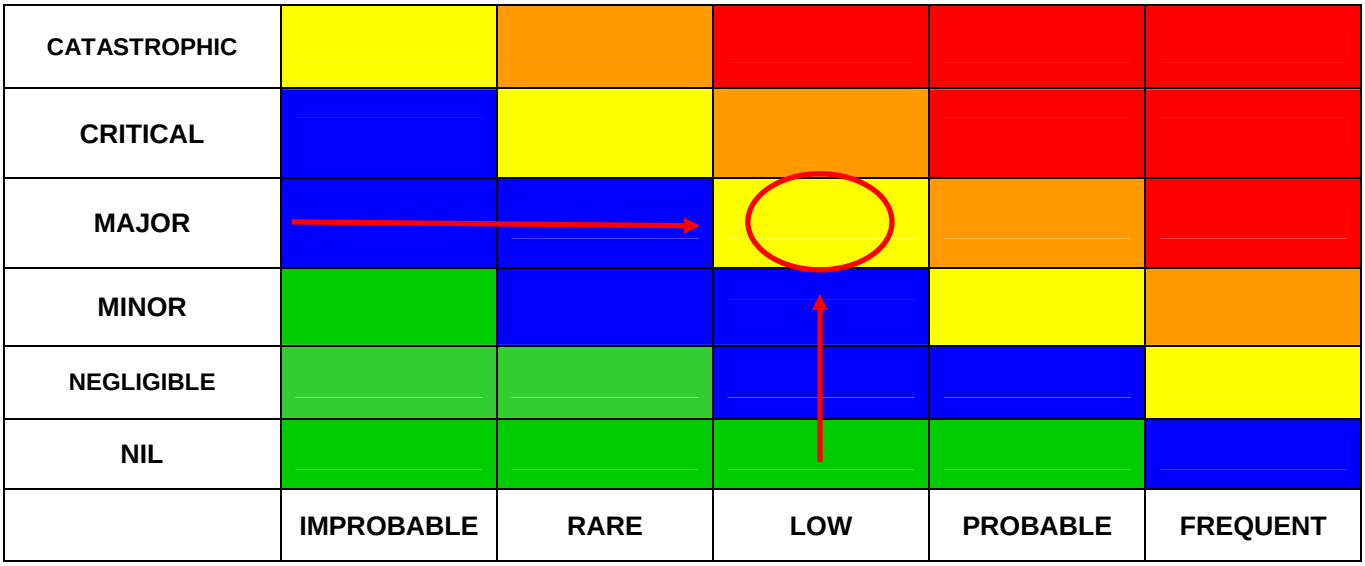
10-2 Steps 2 and 3, identification of causes and consequences:

We use the "bow tie" method described in paragraphs 7 and 8.


Bird strike, ice ingestion, FOD, etc.
Internal component failure
Failure further to maintenance operation (on fuel system, engine, lubrication system)
Errors, infringements during maintenance operations
Fuel contaminated or unsuitable for engine type (may affect both engines!!!)
No formal refuelling procedures
Errors, infringements during refuelling operations
Error when determining fuel quantity to be taken for the flight
Faults in flight preparation, failure to take weather conditions into account, etc.
Insufficient technical knowledge of the aircraft
Unsafe conditions of the engine
Insufficient fuel quantity for the flight
Undesirable Event
Loss of power of a single engine
Ultimate Event
Loss of control of the situation
Impact
Injured occupants
Aircraft damaged
Accident was avoided by pure luck

10-3 Step 4, risk analysis:

We use the risk matrix proposed on page 7.
Being intentionally conservative, we assume that this incident has already occurred in the company, at least once. The occurrence probability can therefore be qualified as LOW. At present, in this company, the rare occurrences have always been controlled and the aircraft have always landed without incident, because the flight manual procedures have always been perfectly complied with.
However, the consequences of this event should not be disregarded, because things can go wrong at any time. Certain consecutive events following engine failure should not be disregarded, such as a bad management of the fuel to be used in flight or a sudden movement during landing causing the loss of control of the aircraft.
Lastly, even if the event is perfectly managed, its impact on the company image must not be overlooked as the passengers do not expect to live this kind of experience during the flight.
We then qualify its severity as MAJOR.



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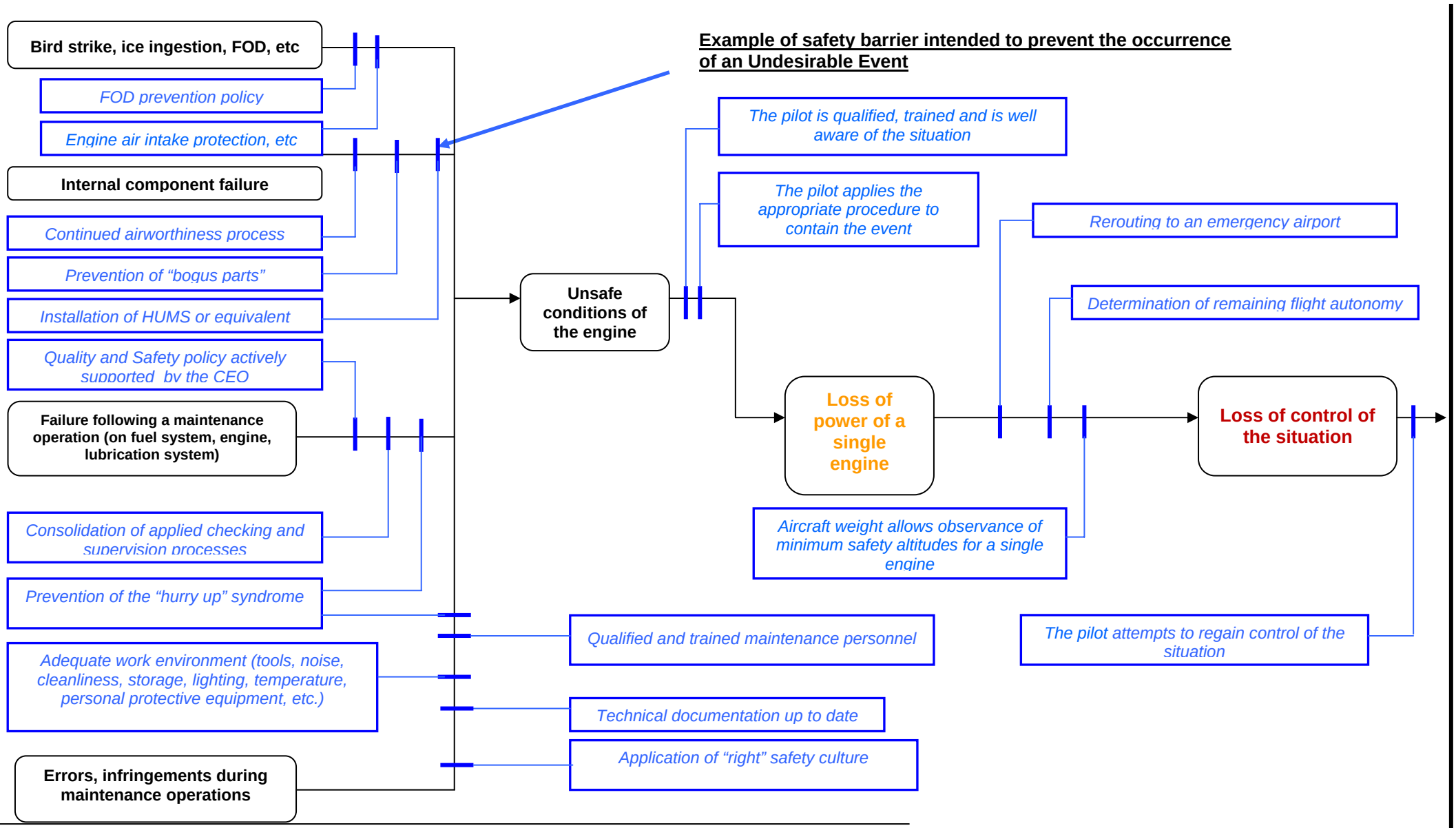
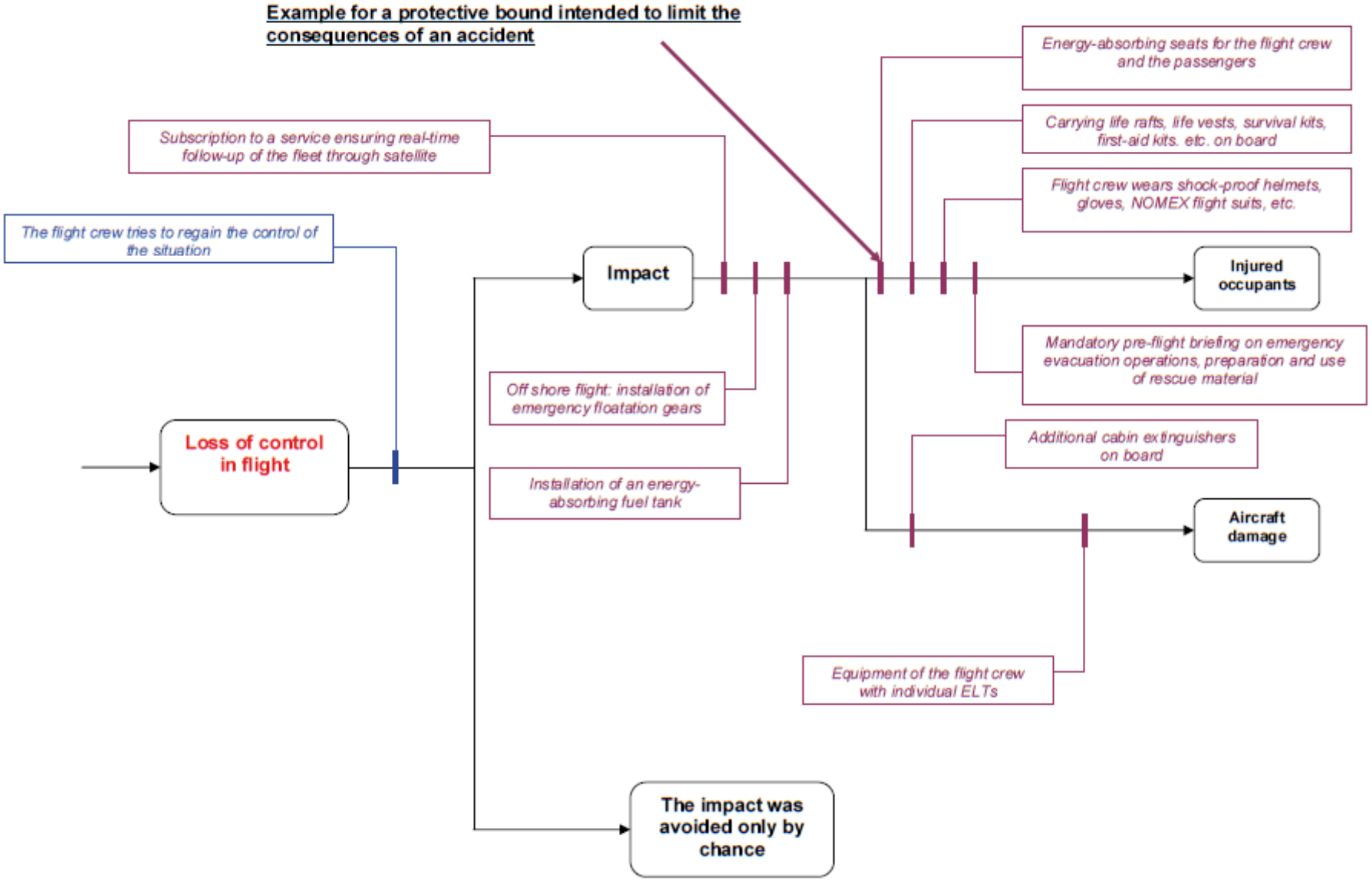
This Undesirable Event is therefore qualified as SERIOUS and risk reducing measures must be taken.
The existence and efficiency of preventive and protective measures must therefore be checked.

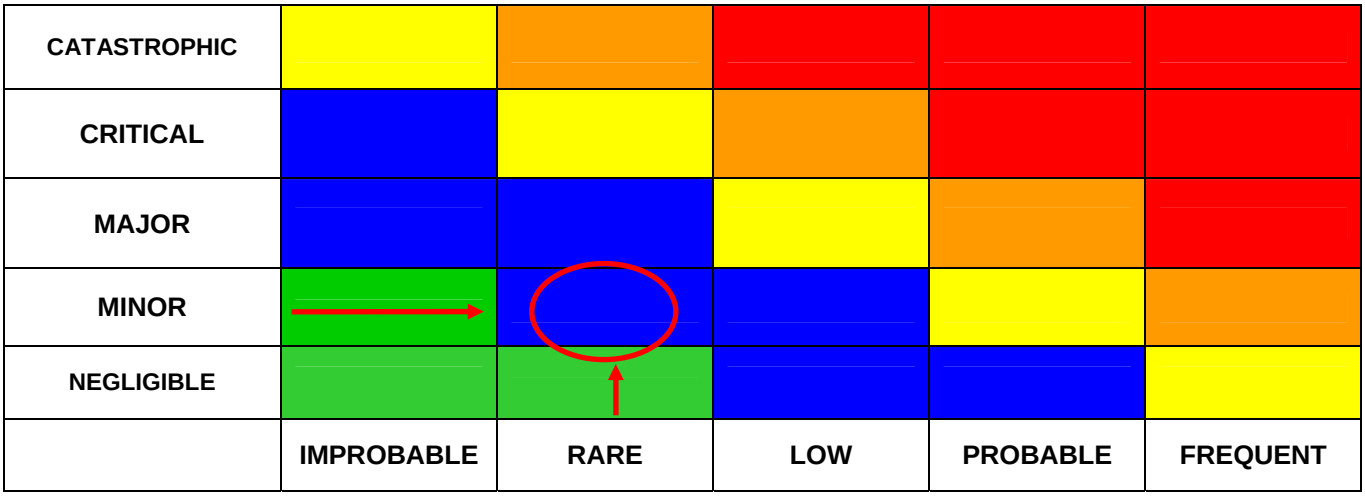
On the following pages, we will only deal with the first four root causes of the analysis, for demonstration purposes, i.e.:
- Ingestion of foreign bodies (FOD, ice, bird strike, etc.)
- failure of an internal component,
- failure due to a maintenance operation,
- errors, infringements during maintenance operations.


Example of safety barrier intended to prevent the occurrence of an Undesirable Event
Bird strike, ice ingestion, FOD, etc
FOD prevention policy
Engine air intake protection, etc
Internal component failure
Continued airworthiness process
Prevention of "bogus parts"
Installation of HUMS or equivalent
Quality and Safety policy actively supported by the CEO
Failure following a maintenance operation (on fuel system, engine, lubrication system)
Consolidation of applied checking and supervision processes
Prevention of the "hurry up" syndrome
Adequate work environment (tools, noise, cleanliness, storage, lighting, temperature, personal protective equipment, etc.)
Errors, infringements during maintenance operations
Qualified and trained maintenance personnel
Technical documentation up to date
Application of "right" safety culture
Unsafe conditions of the engine
The pilot is qualified, trained and is well aware of the situation
The pilot applies the appropriate procedure to contain the event
Loss of power of a single engine
Rerouting to an emergency airport
Determination of remaining flight autonomy
Aircraft weight allows observance of minimum safety altitudes for a single engine
Loss of control of the situation
The pilot attempts to regain control of the situation


Example for a protective bound intended to limit the consequences of an accident
Energy-absorbing seats for the flight crew and the passengers
Carrying life rafts, life vests, survival kits, first-aid kits. etc. on board
Flight crew wears shock-proof helmets, gloves, NOMEX flight suits, etc.
Subscription to a service ensuring real-time follow-up of the fleet through satellite
The flight crew tries to regain the control of the situation
Impact
Injured occupants
Mandatory pre-flight briefing on emergency evacuation operations, preparation and use of rescue material
Off shore flight: installation of emergency floatation gears
Loss of control in flight
Additional cabin extinguishers on board
Installation of an energy-absorbing fuel tank
Aircraft damage
Equipment of the flight crew with individual ELTs
The impact was avoided only by chance

10-4 Step 5, resulting risk level:

Implementing these preventive measures, we can now assume that the occurrence probability of this EI will be qualified as RARE.
We can also assume that the consequences of the EI, if it was not controlled and degenerated into an accident, can be qualified as MINOR due to the implementation of additional protective measures.



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This Undesirable Event can be qualified as MEDIUM due to the implementation of the risk reducing measures.

10-5 Step 6, introduction of protective and risk management measures:

In Appendix 2 you will find a follow-up form for the implementation of the protective and risk management measures. This document sums up the risks and main protective measures (defenses against accidents) defined following the study of this concrete case.
Please note that a person is made responsible for each protective measure. This person must make sure that the accident defense measure for which he/she is responsible is valid and sustainable. Otherwise, the Safety Manager must be kept informed until the defense measure has regained its full efficiency or is replaced with a more efficient measure.

Each Undesirable Event or risk identified in the risk mapping of the company should have a similar paper or computerized follow-up record.

11 - Risk mapping:

You will find in appendix 3 some simplified accident scenarios (no AND/OR logic). These scenarios are intended to be used as a basis to prepare your own risk mapping and to help you select events with the highest probability of occurrence.

These scenarios were prepared for public passenger transport operations but may also serve as a base of reflection for any other activity (aerial work, EMS, training, etc.).

Scenario 1: High-energy collision with the ground without loss of control of the aircraft (CFIT, etc.),

Scenario 2: Loss of control in flight.

Scenario 3: In-flight collision between two aircraft.

Scenario 4: Loss of control on ground

Scenario 5: Collision on ground

12 - Summary of the course of actions:

The course of actions described in this guide can be summarized according to the block diagram below:

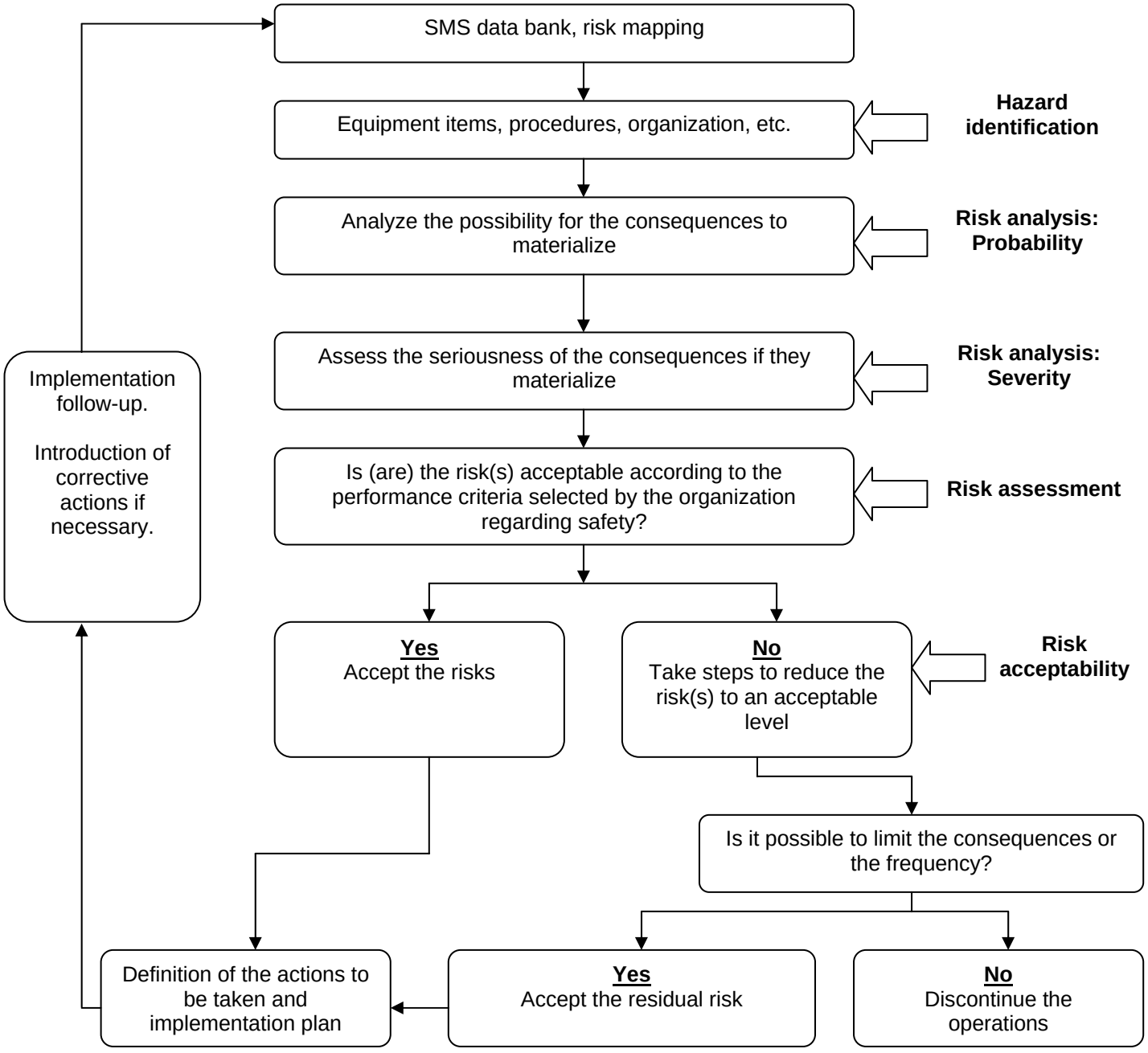


Figure 4: Source ICAO

The analysis and management of the operational risk, associated with an organization minimizing the risk of errors, are components essential to flight safety.

Appendix 1: List of Undesirable Events (EIs) (Cont'd)

SERIOUS
UNACCEPTABLE
UNACCEPTABLE+

No.	Identification of Undesirable Events (EI)	EU1 - CFIT	EU2 - Crash after loss of control in flight	EU3 - Collision in flight	EU4 - Collision on ground	EU5 - Runway excursion	EU6 Damage /injuries in flight	EU7 Dammage/injuries on ground
EI01	Non stabilized approach	X	X			X	X	
EI02	Incorrect weight/center of gravity determination and insertion of these data in the FMS		X			X	X	
EI03	Incursions on runways				X	X		X
EI04	Incident associated with icing conditions or deicing procedures		X				X	
EI05	Hazardous phenomena encountered (thunderstorms, strong winds, wind shear, hailstorms, fog, etc.).		X			X	X	
EI06	Failure of a single engine on multi-engined aircraft (failure, no fuel left, etc.).		X			X	X	
EI07	Flight path deviation "en route"	X		X			X	X
EI08	Loss of (IFR/IFR or special IFR/VFR) separation in flight			X			X	
EI09	Unsuitable action of the flight crew (FH, regulation)	X	X	X	X	X	X	X
EI10	Failure of ground/onboard interfaces	X		X			X	
EI11	Events associated with contaminated runway					X		X
EI12	Aircraft system failure (other than engine failure)	X	X	X	X	X	X	X
EI13	Fire, smoke, accidental contact of an oxidizer with a source of ignition		X				X	X
EI14	Events associated with work/maintenance operations/dimensions on the helipad	X			X	X		X
EI15	Events associated with an incident in maintenance	X	X	X	X	X	X	X
EI16	Critical aircraft damage not detected before flight	X	X	X	X	X	X	X
EI17	Failure of a single engine on single-engined aircraft (failure, no fuel left, etc.)		X			X	X	X
EI18	Malfunctioning of the communicaton system (ATC/aircraft, aicraft/ground team, etc.)			X	X			X
EI19	Obstacle unknown to the flight crew, likely to produce interference with the flight path	X			X		X	
EI20	Bird strike		X				X	X
EI21	Inadvertent entry in IMC, loss of visual reference in flight		X	X			X	
EI22	Exceedance of weight limitation and center-of-gravity position affecting the controllability		X				X	
EI23	Cargo load moving in flight (with or without tie-down failure)		X				X	

Appendix 1: List of Undesirable Events (EIs) (Cont'd)

No.	Identification of Undesirable Events (EI)	EU1 - CFIT	EU2 - Crash after loss of control in flight	EU3 - Collision in flight	EU4 - Collision on ground	EU5 - Runway excursion	EU6 Damage /injuries in flight	EU7 Dammage/injuries on ground
EI24	Unsuitable size of landing areas (helidecks and helipads)	X	X		X		X	
EI25	Nature of landing areas (narrow, sloping, mud, etc.) and/or their environment (hostile, urban, etc.)	X				X		X
EI26	Poor /comprehension/communication between contributors (phraseology flight crew/ATC, ground team, etc.)	X		X	X	X	X	X
EI27	Unsuitable ATC instruction	X		X	X	X	X	X
EI28	Confusion between TWY, runway and airport, etc.			X	X	X	X	X
EI29	Aeronautical documentation/database incorrect or incomplete	X		X	X		X	X
EI30	Incapacity of the flightcrew affecting the controllability		X	X	X	X	X	X
EI31	Malfunctioning of one or more systems, components, charging elements causing a fire or an explosion		X				X	X
EI32	Illicite act (sabotage, terrorism, etc.)		X		X	X	X	X
EI33	Splashing of liquids (failure of an hydraulic pipe, fuel, etc.)						X	X
EI34	Material falling off the helicopter, luggage not stowed		X				X	
EI35	Debris and rubble propelled by the rotor stream							X
EI36	Loss of components in flight		X				X	X
EI37	Loss of objects/external loads in flight							X
EI38	Crew member falling off in flight (flight with opened door)						X	
EI39	Crew member falling from the aircraft on ground							X
EI40	Damage to the RAC during external load carrying (hoisting, lifting, etc.)		X				X	X
EI41	Poor coordination with the ground team/ship during external load carrying operations		X				X	X
EI42	Injury to personnel caused by electric shock (static current)						X	X
EI43	Loss of visual reference during night flight in SAR instruction		X				X	X
EI44	Inadequate helideck (Off shore)	X				X	X	X
EI45	Incident during refueling on helideck (hot refueling)							X
EI46	Runway beaconing, lanes, parking, etc insufficient or inadquate				X	X		X
EI47	Incursion of vehicles/aircraft/personnel/animals in airport service areas.				X			X
EI48	Injury caused to personnel by rotor blades							X
EI49	Occupants not strapped in, in flight						X	
EI50	Loss of lift (VORTEX)		X				X	
EI51	Jackstall threshold reached by the controls		X				X	

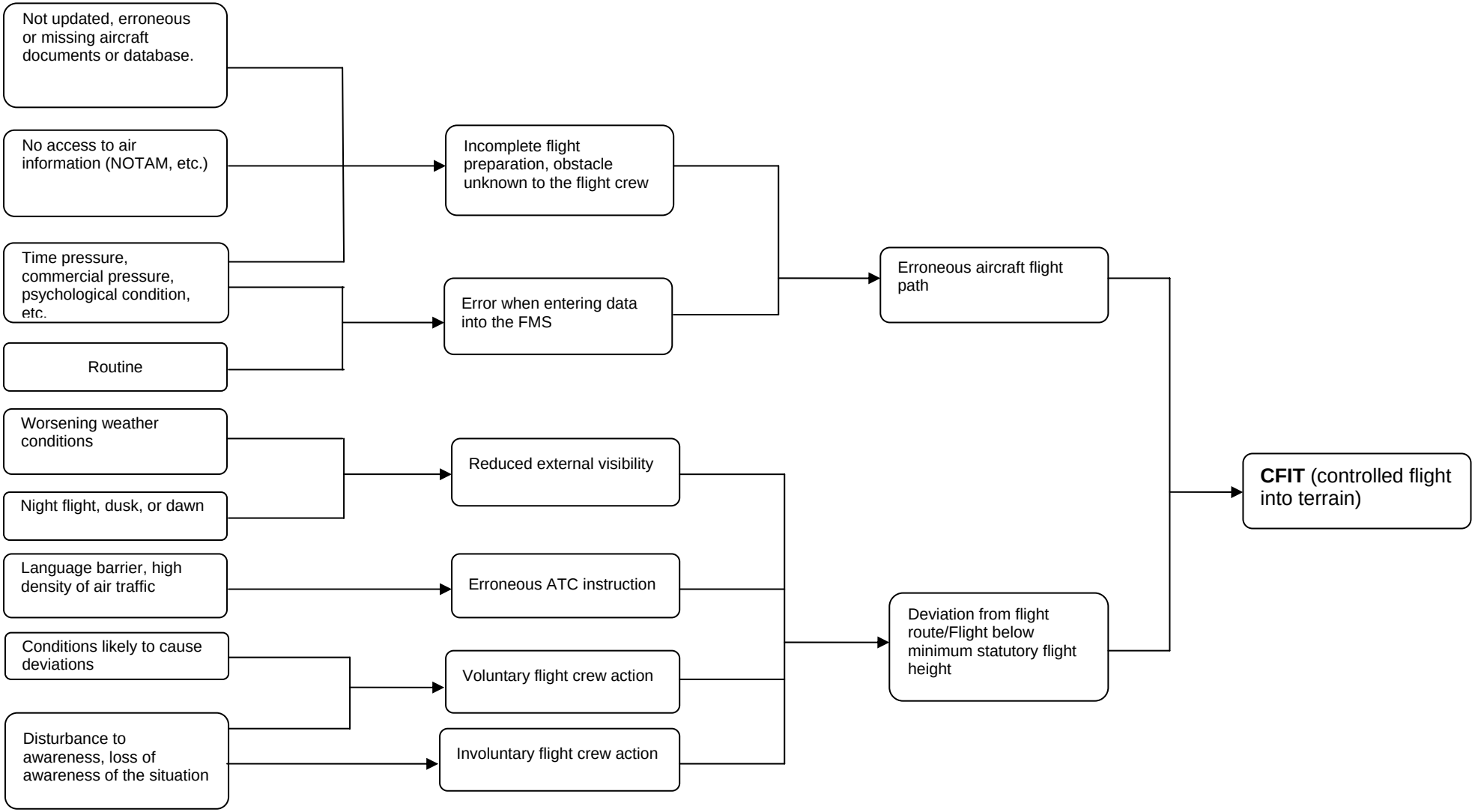
Appendix 2

UNDESIRABLE EVENT	One engine inoperative on multiengine aircraft (single pilot operation)		Revised on DD/MM/YYYY
ULTIMATE LINKED EVENT	- Crash after loss of control in flight - Damage/injuries in flight - Damage/injuries on the ground	Risk level Initial: SERIOUS	Present: MEDIUM

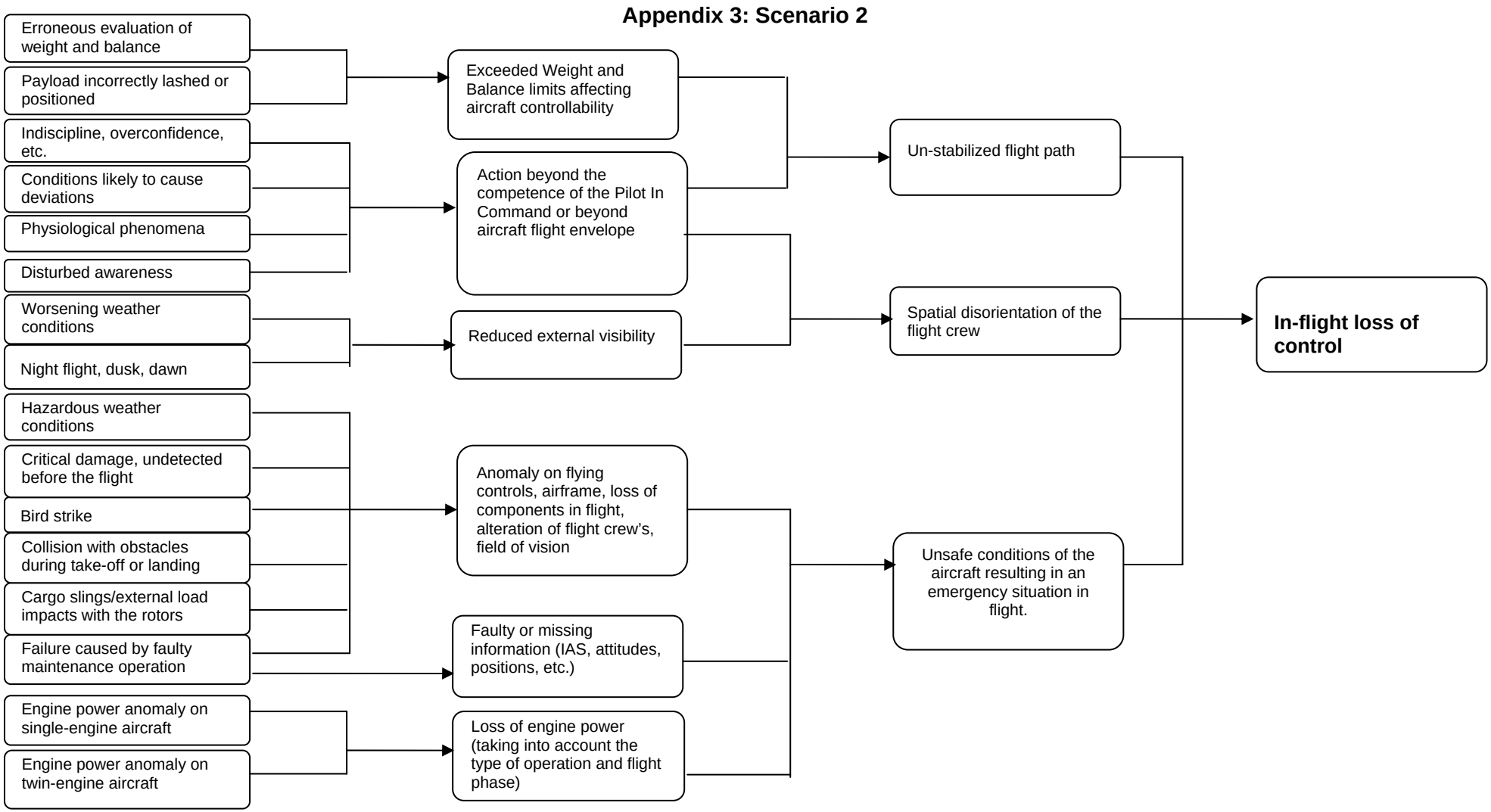
Forerunner of the Undesirable Event	Defense: Control and recovery measures	Implemented		
		Yes	No	Partly
Mechanical failure, malfunctioning of the fuel system	The engine systems and components are maintained and configured according to an approved program applied by an approved organization	X		
	The organization has a continued airworthiness program	X		
	The qualification of flight crews is up-to-date and they follow a regular training program covering normal and emergency procedures	X		
	The flight crew is aware of the situation and apply the suitable procedure	X		
Ingestion of FOD	The organization has a FOD prevention program	X		
	Protection of the engine air intake, anti-icing system	X		
Unsuitable use of the engine	The qualification of flight crews is up-to-date and they follow a regular training program covering aircraft operating procedures	X		
	The company has introduced a Helicopter Flight Data Monitoring (HFDM) program	X		
Loaded fuel quantity insufficient for the flight (Flight planning error, error during refueling operation)	The refueling company has clear and relevant procedures concerning refueling operations	X		
	The operators comply with the refueling procedures	X		
	The flight crews cross-check the loaded fuel quantities before every flight	X		
	The company has introduced a policy to determine the quantity of fuel to be loaded for the flight	X		
	The fuel system is maintained and checked in accordance with the approved program	X		
Fuel contaminated or unsuitable for this type of engine	The company has clear and relevant procedures concerning refueling operations, including anti-contamination tests	X		
	The flight crews systematically cross-check the type and quality of the loaded fuel before flight	X		
Unsuitable fuel management	The company has introduced an in-flight fuel management policy	X		
	During preparation for flight, the flight crew has taken into account any change in the weather conditions and the relevant impact on the flight path	X		
	Briefings covering fuel management and aircraft fuel system operation are given at regular intervals	X		

	In flight, the flight crews check the fuel consumption and its change at regular intervals		X		
	In the event of a system malfunctioning, the flight crews apply the suitable procedure		X		
	According to the over flown area, the flight crew has selected suitable and accessible alternate fields		X		
Unplanned change of flight path	The flight crew takes into account these events and their consequences on fuel management		X		
Meteorological phenomena (icing, heavy rain, etc.)	The flight crew is aware of the meteorological phenomena encountered and acts accordingly (avoidance action, use of MPA, deicing, etc.)		X		
Ultimate events (if insufficient defenses)	**Protection measures:**	**Person responsible**	**Yes**	**No**	**Partly**
Crash following in-flight loss of control Damage/injuries on the ground	Determination of a risk exposure time in performance class 2.(refer to Appendix 1, OPS paragraph 3.517)		X		
	Offshore flight: emergency flotation gear installation		X		
	Installation of energy-absorbing seats (flight crews and passengers)		X		
	Subscription to a service ensuring real-time follow-up of the aircraft flight path		X		
	Carrying and wearing rescue equipment (life rafts, life vests, waterproof flight suits, etc.		X		
	Carrying survival kits in addition to approved kits for flight over inhospitable areas		X		
	Carrying individual emergency locator (according to the type of mission)		X		
	Provision of shock-proof helmets, gloves and fire-proof flight suits for flight crews according to the type of flight		X		
	Emergency evacuation training (HUET type) performed at regular intervals		X		
	Routine safety briefing for passengers upon boarding reminding them of the dangers of rotors, safety routings, aircraft evacuation rules, emergency exit operating procedure use of rescue equipment, etc.		X		
			X		

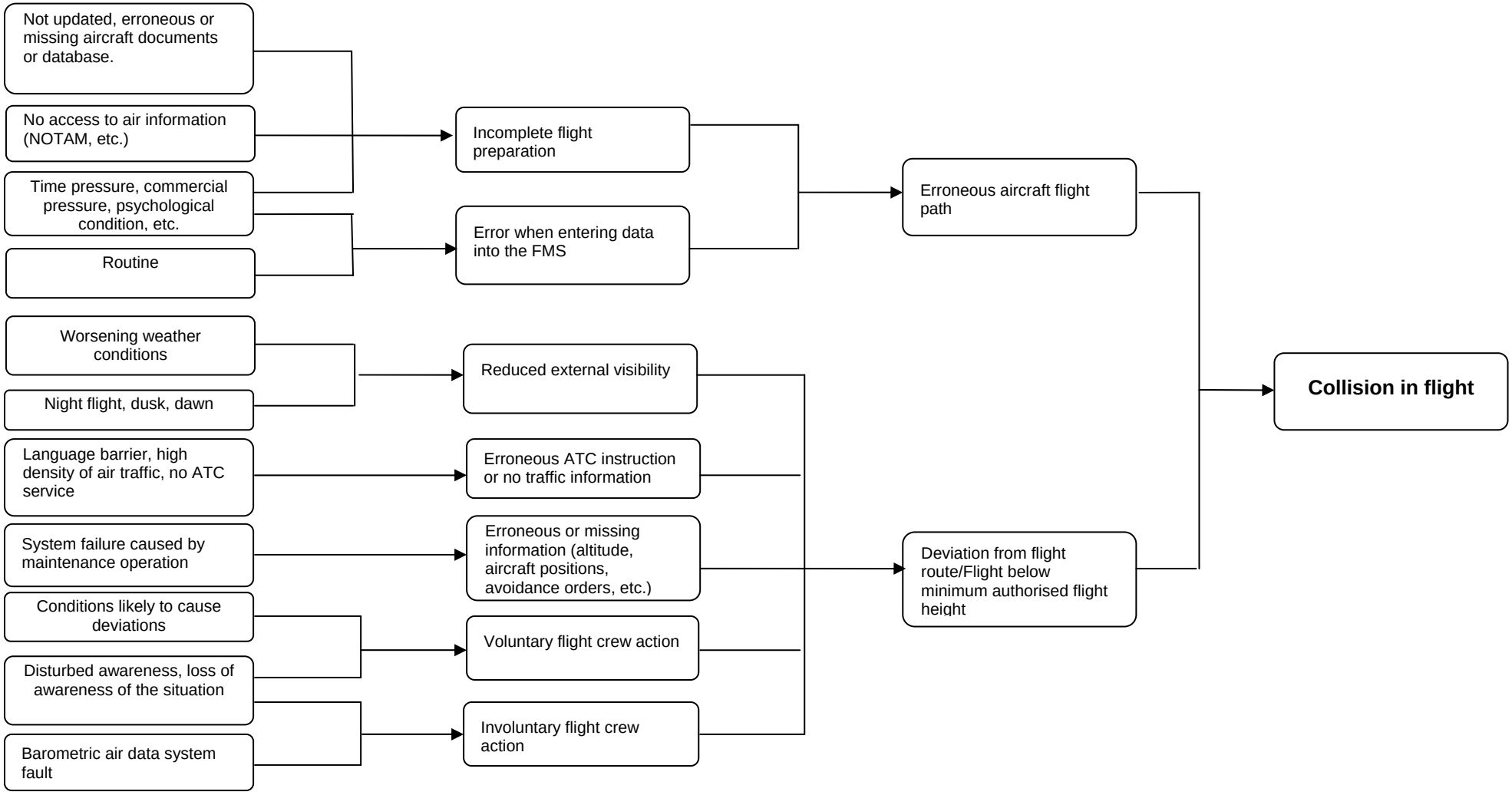
Appendix 3: Scenario 1



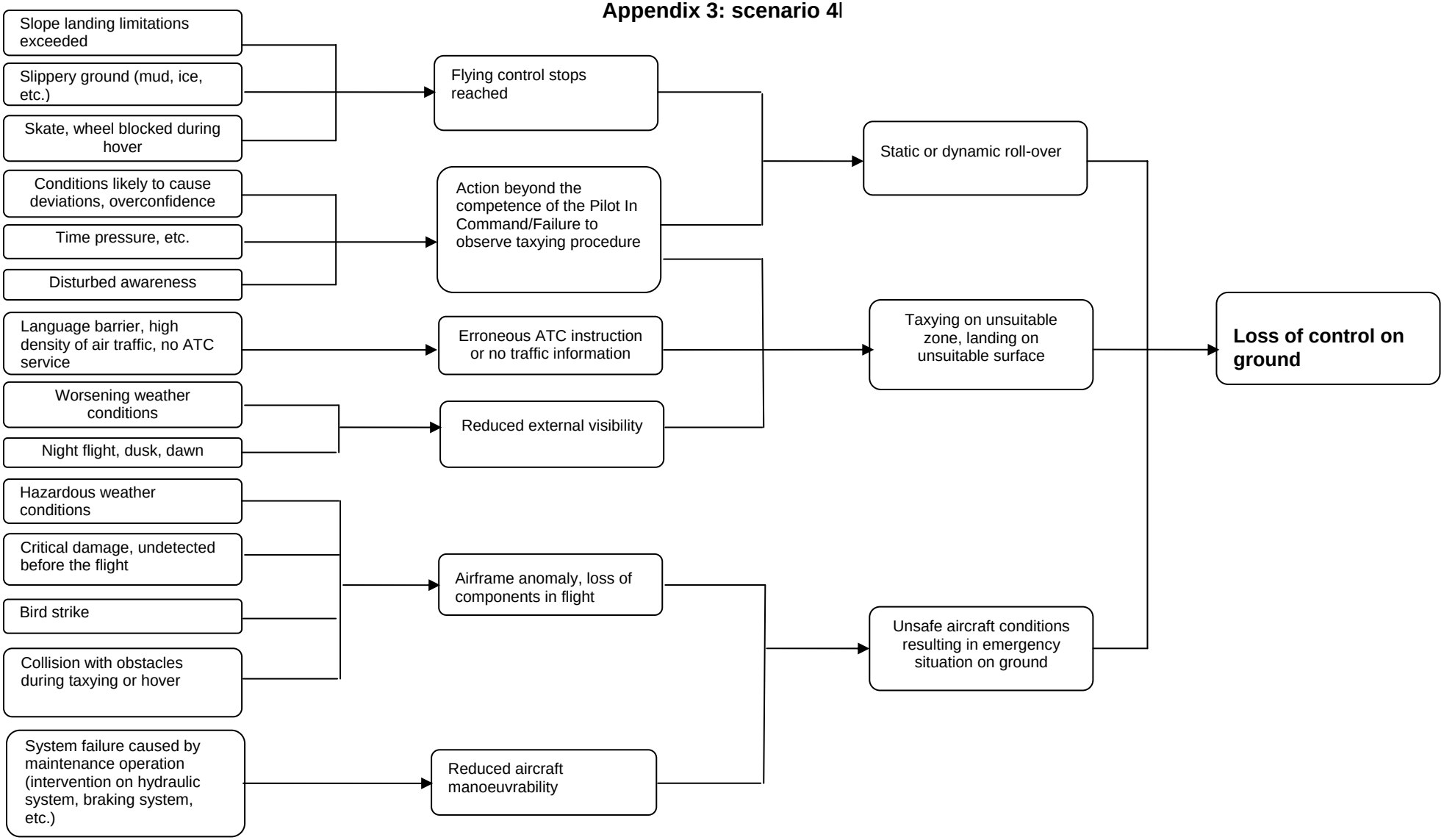
Appendix 3: Scenario 2



Appendix 3: scenario 3



Appendix 3: scenario 4



Appendix 3: scenario 5