



A Page From An Aviation Experts' Handbook

'How To Conduct Risk Assessment in an Aviation Safety Program'

Formal risk assessment is needed for known hazards in an existing operation. The assessment is one of the first steps to an aviation safety investigation from events reported through the safety reporting system. Ideally, assessments are best done by persons who are not directly responsible for the area being investigated. The team should possess subject matter expertise. Risk assessment may be effectively conducted using the following seven step methodology:

Step 1 – Identifying Hazards

The first step to risk assessment is to identify a hazard. Hazards may be discovered through a variety of information gathering tools such as the internal safety reporting system, audits, safety surveys and more.

Step 2 – Assessing Severity

To discern the range of consequences that can result from a hazard, real or potential severity must be assessed. Severity assessment should consider all possible consequences related to the unsafe condition or object, considering the worst credible outcome. Criteria used to assess the severity of hazards is the impact on operations, environment, aircraft and its occupants (pilots, mechanics, crew, and ramp operators).

The level of severity ranges between 1 (insignificant) to 5 (severe). Indicating factors to be considered are:

- | | |
|-------------------------|------------------------------------|
| a. Safety | f. Reputation |
| b. Injury (People/ OHS) | g. Human Factors |
| c. Asset Damage | h. Regulator Breach |
| d. Operation | i. Realization of Program/ Project |
| e. Environment | j. Management Effort |

More than one category can be selected and assessed. The category of record is the one with the highest risk value. If the highest one is mitigated, the next highest risk number becomes the risk value of record.

When assessing severity for an identified hazard, current mitigation measures should be considered. This drives a more accurate assessment of how severe the outcome of the given hazard/ event could be. It also allows for the review of current measures to ensure they remain appropriate and effective, or if they require re-evaluation.

Refer to the Severity Rating chart in **Table 1**.

Rating Severity					
Impact	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Severe
Safety (ICAO SMM 9859)	<ul style="list-style-type: none"> Little Consequence 	<ul style="list-style-type: none"> Nuisance Operating Limitations Use of Emergency Procedures Minor Incident 	<ul style="list-style-type: none"> A significant reduction in safety margins, a reduction in the ability to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency Serious Incident Injury to Persons 	<ul style="list-style-type: none"> A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely Major Equipment Damage 	<ul style="list-style-type: none"> Equipment Destroyed Death(s)
Injury (People/ OHS)	No injury or first aid injury with no healthcare required	Minor injury that resulted in healthcare but no lost time	Injury that required medical treatment, and results in modified duties or loss of time. WSIB \$10-50K	Loss time injury to a worker. WSIB \$50-100K	Critical injury or fatality
Asset Damage	Minor damage that can be deferred without repair	Minor damage requiring sign-off	Considerable damage, requiring structural repair	Substantial damage	Hull loss
Operation	Delay <15 min	Delay 15-60	Cancellation	Multiple cancellations	Fleet grounded for extended period
Environment	Limited effect to minimum area	Small scale impact over short-medium term	Moderate impact over short-medium term	Serious/ reversible impact on-site and off-site	Serious/ irreversible impact with long term wide spread effects
Reputation	Local media articles	Extended local media coverage	Short-term province wide media coverage	Extended province wide media coverage	Material change in public perception of business and safety
Human Factors	Operational Pressures	Errors	Violations	Unsafe Supervision	Company mandated Unsafe Acts
Regulator Breach	Small breaches by company and/or individual staff members	Small fine but no disruption to services	Substantial fine but no disruption to services	Substantial fine and disruption to services	Executive jailed or significant disruption over an extended period
	Nil	Error	Negligence	Reckless/ PiNC	Criminal
Realisation of Program/ Project	No time delay with the initiative but will incur a minor decrease in benefits realised/ increase in cost	Minor delay with the initiative and/or a minor decrease in benefits realised/ increase in cost	Significant delays with the initiative and/or major decrease in benefits realised/ high levels of additional cost	Severe delays with the initiative, which impacts on the segment(s) and/or significant decrease in benefits realised/ additional costs approaching unacceptable limits	Failure to realise benefits which adversely affects several segments and/or has an unacceptable level of cost
Management Effort	An event, the impact can be absorbed through normal activity	An event, the impact can be absorbed but some additional management effort is required	A significant event which can be absorbed but substantial management effort is required.	A critical event which required extensive management effort but can be survived	A critical event with the potential to lead to the collapse of the business.

Table 1: Severity Rating

Step 3 – Assessing Probability

To determine the range of consequences that can result from a hazard, the second component that must be assessed is the probability. Probability is the 'likelihood' or 'frequency' of a hazard/event occurring. The estimation of probability is achieved by a structured review using a defined classification scheme, as shown in **Table 2**. The estimate is based on historical data and direct numerical values (ex. Failure of hardware components).

Not all assessments of probability will have meaningful empirical data. In some cases a subjective assessment is the most appropriate. This should be conducted by people with extensive experience in their respective fields and informed judgment.

Probability is determined on a scale of 1 (rare) to 5 (almost certain).

Rating	Probability	Description
1	Rare	Could occur but only in exceptional circumstances. Unknown in the aviation industry Has happened in the aviation industry. Has happened in our company once
2	Unlikely	Could occur in some circumstances. More than once in our company (but less than once a year)
3	Possible	Will occur in some circumstances. More than once a year in our company (but less than once a month)
4	Likely	Will occur in most circumstances. Once a month or more (but less than once a week) in our company Seasonal events
5	Almost Certain	Is expected to occur. Once a week or more in our company

Table 2: Probability Rating

Step 4 – Classification & Tolerability

A risk categorization tool is used in the form of an assessment matrix, as shown in **Table 3**. Using the number values from the severity and probability assessments, the values are cross-multiplied. The product determines the safety risk index and thus categorizes the risk.

Severity	5 Severe	5	10	15	20	25
	4 Major	4	8	12	16	20
	3 Moderate	3	6	9	12	15
	2 Minor	2	4	6	8	10
	1 Insignificant	1	2	3	4	5
		1 Rare	2 Unlikely	3 Possible	4 Likely	5 Almost Certain
		Probability				

Table 3: Risk Categorization

The risk mitigation chart, as shown in **Table 4**, determines which approach is to be taken, as well as the urgency and level of Management to be involved for the corrective action. The risk level and the urgency then determine whether the risk is accepted and/or tolerated.

1: Extremely Low Risk – Make corrective actions as time permits.

2: Low Risk – Make changes to operation if possible.

3: Moderate Risk – Action should be taken at a Manager level to mitigate the hazard and reduce the risk level to as low as possible.

4: High Risk – Action must be taken at the Director level to mitigate the hazard and reduce the risk level.

5: Severe Risk – All operation related to the hazard must be ceased until action is taken to reduce the risk. Action must be taken at the Director and COO level.

Risk Level		Urgency of Action	Level of Management for Action
S	Severe Risk 20-25	Stop operation as currently conducted. Control measures must be implemented to reduce the risk back to moderate or lower.	COO and Director Level
H	High Risk 15-19	Control measures must be implemented to reduce risk back to moderate or lower.	Director Level
M	Moderate Risk 5-14	Action taken to manage risk and reduce it to as low as possible	Director, Manager, Chief Pilot, Chief Engineer Level
L	Low Risk 1-4	Make changes to operation if possible	As appropriate

Table 4: Risk Mitigation

Step 5 – Risk Mitigation

A footnote to the risk management process. There are several ways to deal with adverse risk. They include:

- Avoid / eliminate** – I’ll always remember James Reason’s drawing of a bug infested marsh with the caption: “If you want to kill the mosquitos you have to drain the swamp.”
- Mitigate / reduce** – A corrective action plan to assist.
- Accept / y’all be careful now, ya hear?** Simply be aware of the risk and proceed. Consider the old adage from my US Coast Guard days: “You have to go out, but you don’t have to come back.”
- Transfer / pass the buck / subcontract** – This is not allowed in helicopter ambulance operations when the weather is considered too poor to fly.
- Share.** Peanut butter the risk around to various entities. Insurance companies do this routinely when underwriting aviation operators.

There are three general approaches to mitigation:

- Engineer away the problem:** Traditionally, this is considered the best solution as the issue is eliminated. Think; drain the swamp.
- Policy change:** Considered second best but can be just as effective. For example, one airline’s approach to Fatigue Risk Management and back of the clock flying is to stop flying at midnight. No flight ops in the window of circadian low.
- Training, PPE:** Considered the least effective as it is easily circumvented or forgotten.

Step 6 – Investigation & Corrective Action Process

All occurrences or hazards reported to the Aviation Safety Office shall undergo an investigation and corrective action process. The standard process shall include a risk assessment, causal factor analysis, initial and preventative corrective action.

The safety risk index plays an important role in the investigation, as it drives the decision-making process to determine the need to implement risk mitigation measures, as well as timelines for their completion. The objective of the mitigation should be to either avoid the hazard or reduce the exposure to the hazard as much as possible. Table 5 outlines the deadlines for investigation, short & long-term corrective action and follow-up, based on risk value.

Low Risk	Occurrences as deemed by Aviation Safety	Initial Corrective Action	30 Calendar Days
		Preventative Action	60 Calendar Days
		CAR Closure	90 Calendar Days
Moderate Risk	Occurrences as deemed by Aviation Safety	Initial Corrective Action	15 Calendar Days.
		Preventative Action	30 Calendar Days
		CAR Closure	60 Calendar Days
High Risk	Occurrences as deemed by Aviation Safety	CAR Review	Next Safety Review Meeting
		Initial Corrective Action	Immediately
		Preventative Action	7 Calendar Days
Severe Risk	Occurrences as deemed by Aviation Safety	CAR Closure	15 Calendar Days
		CAR Review	Next Safety Review Meeting
		Initial Corrective Action	Stop operation until CA implemented.
		Preventative Action	48 Hours
		CAR Closure	7 Calendar Days
		CAR Review	Continually monitor until preventative measures are in place, and review at next safety review meeting.

Table 5: Corrective Action Timelines

Step 7 – Follow-Up & Re-Evaluation

All corrective actions are to be reviewed to ensure they are appropriate, effective and complete. The resulting risk rating should be lower than the initial assessment prior to the implementation of the corrective action.

- a. If the risk remains the same, the corrective action requires revision.
- b. If the risk cannot be lowered, acceptance and/or tolerance should be reconsidered.

It is important to follow up by audit or other means to ensure that risk mitigation has not introduced other hazards. In an aviation safety investigation, this evaluation is done during the follow-up stage.

SUMMARY

Risk Assessment is the backbone of the modern Safety Management System. It dictates the speed with which hazards are managed. The risks facing the organization are evaluated for overall exposure, collectively. All this sets the stage for hazard management and continuous improvement of policies, standard operating procedures (SOPs) and practices.

About the Author



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