ANNEX A TO AC 138-05 V2.1

Sample risk assessment process - limited aerial work operator

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The sample below considers an operator intending to conduct a mustering operation on their own cattle station using their own aircraft and pilots. This operation meets the criteria in paragraph 138.030(2)(b) of CASR and is considered a limited aerial work operation.

The process outlined in section 3 of the AC is used as a reference for the conduct of the risk assessment (RA). This example will demonstrate the step-by-step process for conducting the RA.

Scenario

A cattle station has elected to use their privately owned R44 to conduct this year's mustering operation with the help of appropriately qualified pilots. The operator is aware of regulation 138.370 of CASR and the Chapter 13 of the Part 138 MOS and their obligation to conduct a RA prior to the commencement of the operation.

Process

To assist with the conduct of the RA the operator has referenced the CASA SMS-3 booklet and has utilised the RA process outlined on page 5 of the booklet as reproduced below.

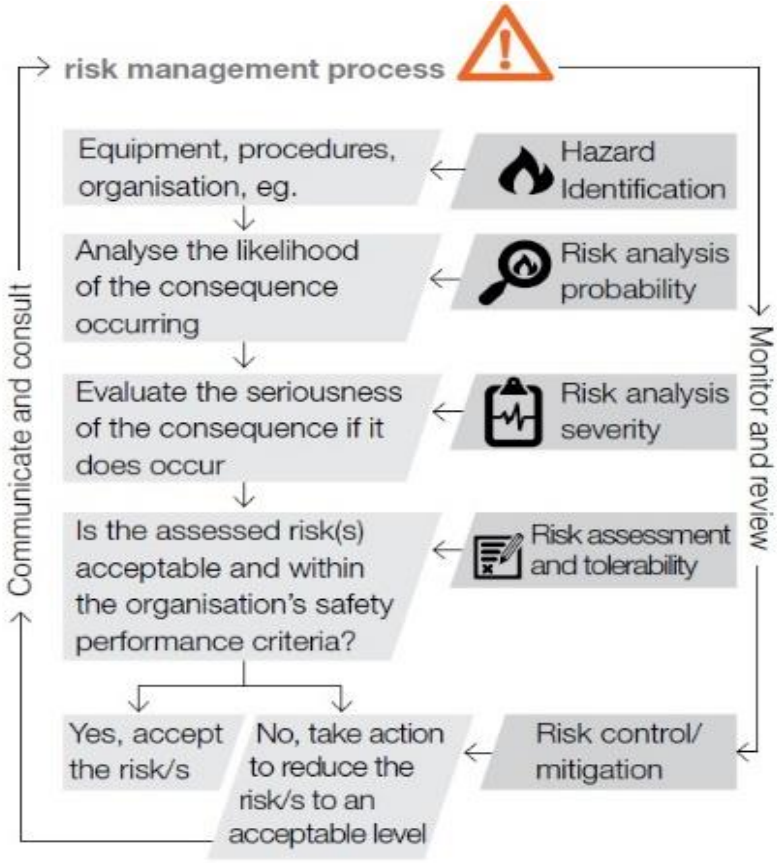

Figure 1: Risk assessment process

Step 1: Identify the hazards

The operator has significant experience in helicopter mustering operations and has sought the advice of experienced pilots to identify the main hazards associated with the intended operation and has identified the following hazards:

- undetected aircraft unserviceability
- lack of pilot experience or recency
- fatigue
- pressure to complete the task
- adverse weather conditions.

Step 2: Decide what might be harmed and the cause of the harm

The next step in the process is to determine the harm that may flow from each of the hazards should they emerge as an operational factor. A table to correlate the hazard with the possible harm such as the one below could be used.

Table 1: Hazard and possible harm

Hazard	Possible harm
Undetected aircraft unserviceability	Mechanical failure in flight
Lack of pilot experience or recency	Handling errors or undesired aircraft state
Fatigue	Handling errors or undesired aircraft state Degraded decision-making
Pressure to complete the task	Shortcuts in procedures
Adverse weather conditions	Reduced performance margins Reduced margin for error near ground Exceeding aircraft limits Increased handling errors or potential for departure from controlled flight

Step 3: Determine the likelihood of an event

The likelihood is the chance or probability of each of the hazards causing harm in the proposed operation. This determination may be based on the operator's previous experience, intelligence from other operators and input from qualified pilots. One possible matrix that can be used contains word pictures to identify and assign a value to the relative ranking of the likelihood of an event. A matrix for this is located on page 6 of the CASA SMS-3 booklet and this is reproduced at Table 2.

Table 2: Likelihood matrix

Likelihood	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that this event will occur	1

Determining the likelihood matrix enables another column to be added to Table 1, based on the circumstances expected to be encountered during the operation. For the purposes of this example (see table 3 below), it is assumed that each hazard in the table will generate an occurrence (the harm) at least occasionally, so all are rated 4.

Table 3: Hazard/harm/likelihood

Hazard	Possible harm	Likelihood
Undetected aircraft unserviceability	Mechanical failure in flight	4
Lack of pilot experience or recency	Handling errors Departure from controlled flight	4
Fatigue	Handling errors or undesired aircraft states Degraded decision-making	4
Pressure to complete the task	Shortcuts in procedures	4
Adverse weather conditions	Reduced performance margins Reduced margin for error near ground Exceeding aircraft limits Increased handling errors or potential for departure from controlled flight	4

Step 3: Determine the severity of a possible future occurrence

If it were to happen, ranking the severity or consequence of a possible occurrence is required so that an unacceptable risk can be identified. One way is to use a matrix that describes the consequences of the possible harms. A matrix for this is also located on page 6 of the CASA SMS-3 booklet and this is reproduced at Table 4.

Table 4: Consequence matrix

Value	Severity/ Consequence	Meaning
A	Catastrophic	» multiple deaths » equipment destroyed
B	Hazardous	» 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 » Serious injury » Major equipment damage
C	Moderate	» A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency » Serious incident » Injury to persons
D	Minor	» Nuisance » Operating limitations » Use of emergency procedures » Minor incident
E	Negligible	» Few consequences

Step 4: Determine the overall safety risk level

By combining the consequence and likelihood, a risk severity score can be determined. When the table is expanded to include two additional columns covering consequence and risk severity score, the table might look like the example at Table 5.

Table 5: Sample likelihood and consequence related to a hazard

Hazard	Possible harm	Likelihood	Consequence	Total risk severity score
Undetected aircraft unserviceability	Mechanical failure in flight	4	B	4B
Lack of pilot experience or recency.	Handling errors Departure from controlled flight.	4	B	4B
Fatigue.	Handling errors or undesired aircraft states Degraded decision-making.	4	B	4B
Pressure to complete the task.	Shortcuts in procedures.	4	B	4B
Adverse weather conditions.	• Reduced performance margins. • Reduced margin for error near ground. • Exceeding aircraft limits.	4	B	4B

In the above example the information indicates that an undetected aircraft unserviceability could lead to a mechanical failure in flight. This type of event happens "occasionally" and the outcome is "hazardous" to the flight crew. Hence, the total risk severity score which is the combined elements of its likelihood and consequence is 4B. This is also the case for the other hazards identified.

Step 5: Evaluate and determine if the overall risk is acceptable

ICAO publish a safety risk assessment matrix that can be used to determine what combinations of risk probability (what this Annex calls likelihood) and risk severity (what this Annex calls risk severity score) can be considered acceptable.

The matrix is located on page 7 of the CASA SMS-3 booklet and is reproduced at Figure 2.

Risk probablility		Risk severity				
		A	B	C	D	E
		Catastrophic	Hazardous	Moderate	Minor	Negligible
5	Frequent	5A	5B	5C	5D	5E
4	Occasional	4A	4B	4C	4D	4E
3	Remote	3A	3B	3C	3D	3E
2	Improbable	2A	2B	2C	2D	2E
1	Extremely improbable	1A	1B	1C	1D	1E

Figure 2: Risk severity score matrix

It will be noted that the sample risk examined in Table 3 is 4B which is in the red area meaning it is unacceptable. Paragraph 13.02(a) of the Part 138 MOS requires operations to be conducted without unacceptable safety risks. In this example risk mitigation is required to reduce the level of risk.

Step 6: Mitigate the risk if required

Once an initial risk severity score has been determined, there may be a need to develop risk mitigators/control measures, with the aim of reducing the risk severity score to less than unacceptable. Since the risk severity score is composed of two elements (the likelihood and the consequence) risk controls can be implemented that affect either, or both, of these elements.

From the data in table 2, some sample risk controls are now entered into a continuance of the existing tables.

Note: The risk controls mentioned below are designed to reduce the likelihood of the risk occurring, none of them will reduce the consequences of the risk if it does occur.

Table 6: Examples of risk controls reducing the total risk scores

Risk	1st score	Risk control	Final score
An undetected aircraft unserviceability may result in a mechanical failure in flight.	4B	The operator ensures the pilots attend a safety course on the aircraft that covers detailed aircraft pre-flight examination.	4C
Lack of pilot experience or recency may result in handling errors or departure from controlled flight.	4B	The operator implements specific minimum hours in low level operations before approving pilots to conduct the proposed mustering operation.	3B
Fatigue may result in handling errors, undesired aircraft states or degraded decision-making.	4B	The operator implements limits on pilot flight hours considering heat, low level flight, and pilot experience.	4C
Pressure to complete the task encourages shortcuts in procedures.	4B	Station staff are briefed on pilot and aircraft limits and briefed on the dangers of placing undue pressure on the pilot.	4C
Adverse weather conditions may reduce performance margins which may result in handling errors or departure from controlled flight.	4B	The operator implements limits on operations above 40 degrees Celsius OAT and on days when moderate to severe turbulence is possible.	3B

As Low as Reasonably Practicable (ALARP) concept

With the proposed risk controls considered and presuming that they are as effective as proposed, the operator must determine if the residual risk level is acceptable both in terms of flight risk to the pilot and the aircraft, and if the risk is acceptable and justifiable from a safety perspective. For example, a mustering operation that is quantified as an unacceptable risk cannot be acceptable to a pilot and operator. In this case the operator would be required to implement additional controls to reduce the risk to an acceptable level.

The diagram in Figure 3 illustrates the word pictures applicable to the ALARP principle (CASA SMS-3 Booklet page 10).

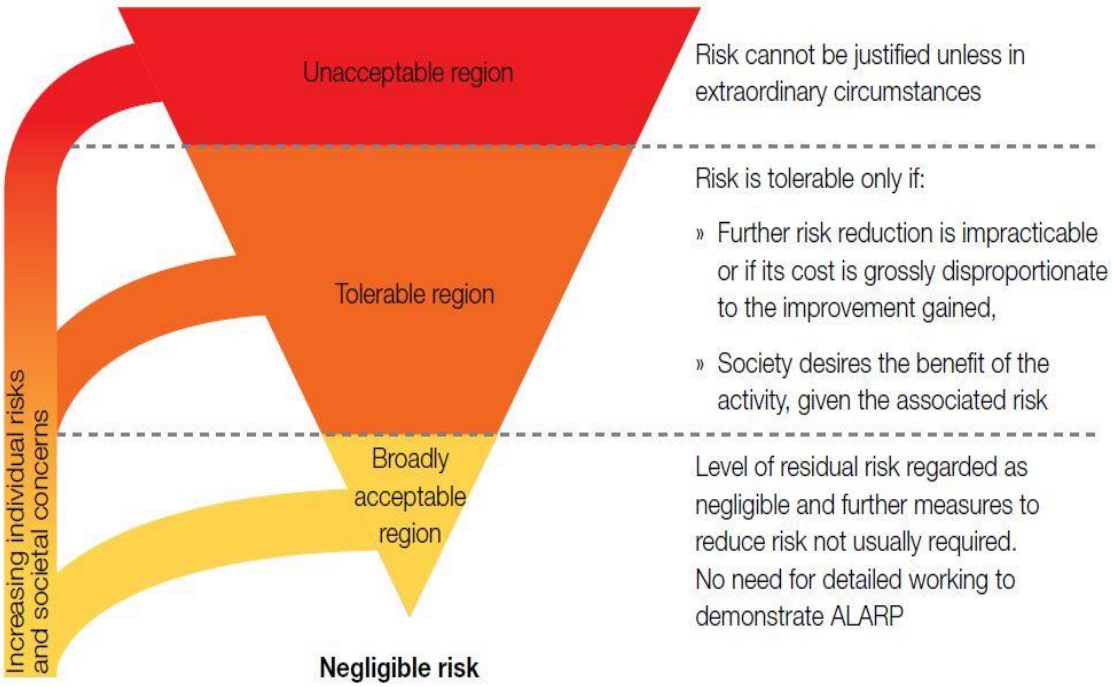

Figure 3: The ALARP principle

Step 7: Pilot actions

Before flight and while conducting the operation, the pilot must apply all previously determined risk controls to ensure the flight is carried out safely. They must consider the following:

- the operation and its particular characteristics
- the location of the operation and its particular characteristics
- the aircraft to be used in the operation, its particular characteristics, and its performance class (if applicable)
- their qualifications and experience
- the hazards, external to the aircraft, that may be met in the course of the operation.

The pilot must be satisfied that the operation can be conducted without any unacceptable safety risk for themselves, persons and property on the ground; and can be conducted so that it is not likely to have an adverse effect of the safety of air navigation.

If any matters require additional risk controls the pilot must employ them to mitigate the risks. The pilot must consider all information relevant to the operation and act to manage and mitigate any safety risks.

Flight risk assessment tools

A number of aircraft manufacturers and software developers have worked with industry participants to provide a number of useful safety apps to all pilots and operators free of a charge. These apps considerably simplify the risk assessment process outlined above.

These apps are designed to help pilots to understand and mitigate the risks they might face during a flight. The goal is to reduce the number of accidents that occur due to operational factors. These apps have been designed especially with individual pilots and smaller operators in mind and are customisable to the operation.

See sections 4.2.8 through 4.2.11 of this AC for details on the free apps.