6MINUTE

CASA Ref:

TO: Office of Airspace Regulation

THROUGH:

CC:

FROM: Walter Schöning

Aerodromes that require attention as listed in the Quarterly Risk Review

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1. **<u>Executive Summary:</u>** The Quarterly Risk Indicator report (QRIR) was developed as a means of complying with the Government's intent for CASA to complete regular reviews as outlined in the Australian Airspace Policy Statement 2015 (AAPS). The QRIR is the first phase in the review of aerodrome related airspace, completed following the OAR's Airspace Risk and Safety Management Manual (ARASMM)[1] processes. The purpose of this minute is to summarise the results of the Quarterly Risk Review for the period ending 30 September 2018 and list the aerodromes where the risk score was altered, and the movement fluctuation is more than 10%. Consideration was given to movement numbers, passenger numbers, surveillance coverage, and Air Traffic Control services availability, the analysis of serious incidents and percentages of IFR traffic. If the pre-risk assessment score was 8 or below no immediate further action was required. However, all aerodromes are monitored on a quarterly basis and special attention was given to aerodromes with more than 10,000 movements and some were brought to CASA's attention because of special activities as mining etc. It is further important to note that it takes approximately four months to collate all the relevant data.

    a. There are currently several aerodromes that have a post risk assessment rating of 8 or higher. Aerodromes with risk scores of 7 or lower do not require any further action but are regular monitored. The aerodromes listed below should further be scrutinised in a screener meeting to be held at the end of January or the beginning of February.

s 22 [redacted]

s 22

[redacted]

s 22

[redacted]

s 22

[redacted]

s 22

[redacted]

6. **Tasmania aerodromes with lowered risk scores**

   a. **Class D**

      i. **Hobart - YMHB:**

The aerodrome breaches the AAPS 2018 passenger threshold for Class D aerodromes. A proposed Hobart airspace change is being consulted with the community. It is anticipated that the ACP will be submitted prior to 28 February 2019 and implemented by November 2019. New SIDS/STARS also being considered to address noise/environmental issues. No serious incidents were recorded for this aerodrome therefore the risk score was lowered by a factor of 2 to a final score of 8.

s 22

[redacted]

s 22 [redacted]

b. The following Class D aerodromes have a final risk score of 8 and depending on the scrutiny meeting to be held later this month January/February 2019 need be monitored closely:

s 22 [redacted]

ii. Hobart: s 22 [redacted]

s 22 [redacted]

d. The following aerodromes breach the AAPS 2018 threshold:

The following Aerodromes breach the AAPS 2018 Thresholds				
Aerodrome	**Airspace Class**	**Air Transport**	**Passengers**	**Final Risk Score**
s 22 [redacted]				
Hobart	D		X	8
s 22 [redacted]				

s 22

[redacted]

1. Purpose:

The purpose of this document is to propose an aviation risk appreciation methodology for aviation operators, service providers and regulators to assess the level of risk in the airspace above aerodromes.

The methodology is risk-based and is applied to Australian aerodromes with approximately 10,000 or more movements per annum. A few exceptions are included such as mining related aerodromes with less than 10,000 movements per annum.

Aerodromes are categorised in terms of the air traffic services and class of terminal area airspace. Aerodromes either have no air traffic control services (Class G), or they have air traffic control services - Class D and Class C airspace.

Four primary risk indicators have been identified:

- Movement numbers;
- Passenger numbers;
- Numbers of aviation safety occurrence reports (ASIR) per movement; and
- Ratio of the numbers of IFR category to VFR category aircraft.

Each of the risk indicators are collated for all Aerodromes under consideration. As the numbers of movements, passengers, aviation safety occurrences and VFR aircraft increase, the sum of each of the indicators singly and in combination can be considered to reflect an appreciation of the frequency and diversity of the aviation operational risks at the locality. Every risk indicator is factored appropriately in accordance with its size or degree of recurrence as appropriate. The appreciation methodology is based on Dawes and Meehl's theory (Thinking Fast and Slow by Daniel Kahneman).

2. Discussion:

The aim of the aviation risk appreciation methodology is to propose a simple and effective way of appreciating risk in the terminal airspace of aerodromes. This methodology is based on the same principles as the Apgar score which is used to evaluate a newborn infant's physical health. The Apgar system is based on assigning a value (0, 1, or 2) to each of five criteria, namely complexion, pulse rate, reflex, activity and respiratory effort.

The Apgar score was developed as a quick and effective methodology for midwives and paediatricians assessing the physical condition of a newborn infant. A baby with a score of 8 and above is likely to be healthy and in good shape. No immediate intervention is required. However, a baby with a score of 4 would be under duress and needs immediate intervention. This method ensures that an infant's vital danger signs are not missed and has resulted in reduced infant mortality (Thinking Fast and Slow by Daniel Kahneman) According to Kahneman, Dawes observed that complex statistical algorithms, based on multiple regressions, do often worse than a simple methodology grounded on basic statistics and equally weighted formulas. The indicators should be independent from one another and easily passed by following a basic process.

The following four primary indicators were identified:

- Movement numbers;
- Passenger numbers;
- Numbers of aviation safety occurrence reports per movement; and
- Ratio of the numbers of IFR category to VFR category aircraft.

2.1. Movement and Passenger Numbers:

Movement numbers are important statistic parameters. No movements would translate into no aircraft landing or taking off, therefore no conflicts or aircraft collisions. The more aircraft take-off or land, the greater the risk of a conflict or mid-air collision. It is consequently sound to assume that the risk to persons in the air increases with an increase in movement numbers.

Therefore operators, regulators and service providers are expected to ensure that fare paying passengers are not exposed to risks above an "Acceptable Level of Safety (ALoS)

It is important to note that the Australian Government in the Australian Airspace Policy Statement (2012) considers the safety of passenger transport services as the first priority in airspace administration and expects the regulator to respond quickly to emerging changes in risk levels.

In 2012 the Australian Government defined the following criteria to initiate investigations to determine if airspace classifications should change:

Description	**Class B**	**Class C**	**Class D**
Service provided	ATC	ATC	ATC
Total annual aircraft movements	750,000	400,000	80,000
Total annual PTO aircraft movements	250,000	30,000	15,000
Total annual PTO passengers	25 million	1 million	350,000

Table 1: Australian Airspace Policy Statement Parameters also called Trigger data

Using these criteria as a basis, a weighting system was developed which allocates values between 0 and 3 according to thresholds shown in table 2.

AAPS Rating

Risk Appreciation Factor	Passenger Numbers and Movement
0	< 3 % of the AAPS 2012 Threshold
1	Between 3 % and 50 % of the AAPS 2012.
2	Between 50 % and 90 % of the AAPS 2012.
3	Between 90 % and 100 % or more, above the AAPS 2012.

Table 2: Traffic movements and passengers

Occurrence **Reports per Movement**

Aviation Occurrence reports are collected by ATSB and Airservices Australia and the Bureau of Infrastructure, Transport and Regional Economics (BITRE) and are completed by pilots or ATC filling in a form that details an aviation safety occurrence or safety-related unusual event. The purpose of the report is to document exact details of the occurrence while they are fresh in the minds of those who participated in or who witnessed the event. This information may become significant in future analysis of the airspace if the occurrences are deemed airspace risk-related. Before the data of these events are entered into the database they are analysed and cleansed. In some cases, interviews are held with the parties involved in the event. The occurrence reports from ATSB (but not those from Airservices Australia (CIRRIS)) are grouped into the following categories shown below in order of highest to lowest risk severity category:

- Accident
- Serious Incident
- Incident

Airspace risk-related aviation occurrence reports are collated, and any duplicates and non-airspace related occurrences are removed. Typical removed occurrences include:

- Bird strikes;
- Runway incursions;
- All taxi incidences;

The collated aviation risk related occurrences are used as measures and standardised to report "Occurrence Reports per movement". The values attributed are shown in Table 3.

Occurrence Reports per Movement	
Risk Appreciation Factor	**Occurrence Reports per Movement**
0	No Occurrence Reports were recorded.

1	< 0.00005 (5.00 E-05) Incident Reports per movement.
2	< 0.0005 (5.00 E-04) Incident Reports per movement.
3	> 0.0005 (5.00 E-04).

Table 3: Occurrence Reports per Movement

Aviation occurrences classified as "Serious Incidents", by the ATSB, are weighted heavier than those classified as "Incidents" and are counted twice. If more than one incident was classified as a "Serious Incident" this should raise behaviour-based safety concerns and additional information should be requested for this locality. If more than one "Serious Incident" is raised at an aerodrome this should lead to further investigation.

2.2. Traffic Mix

A further factor of importance was the ratio between IFR and VFR operations at an aerodrome.

In a briefing paper presented by CASA to the Department of Transport & Regional Services in 2003, CASA observed in Class G aerodromes that 20,000 annual movements with significant VFR traffic (20% of total movements) attributes intolerable levels of risk to fare paying passengers in IFR aircraft. In contrast at 5% the VFR traffic poses virtually no risk to IFR aircraft at all.

This observation is partly explained in the paper by the fact that VFR pilots were likely to have less strict radio discipline than IFR pilots, who would rarely fail to make well-formulated and pertinent radio calls. Therefore, an IFR aircraft would be known to the airspace system, where VFR traffic would be a greater threat as being unknown to the system.

A further consideration is that when IFR aircraft fly in Class G airspace, numerous procedures are in place (more reliable radio call, Traffic Collision Avoidance System), which ensure that IFR aircraft are self-segregated and a conflict between two aircraft of this category is remote.

IFR traffic generally also spends a reduced proportion of its overall flight time in Class G airspace and enters (and leaves) Class G airspace from controlled airspace only for a relatively brief period to land or depart. In addition, IFR aircraft would receive separation from other aircraft by provision of ATC services in controlled airspace and information from ATC in uncontrolled airspace when heading towards (or away from) the same destination.

When IFR traffic exits controlled airspace, they tend to already have knowledge of other IFR traffic in the airspace ahead. IFR aircraft also have access to alerted see-and-avoid through ATCs knowledge of both IFR aircraft and VFR aircraft, supplemented by aircraft advisory broadcasts, radar in the J-curve and ADS-B where implemented. Although IFR pilots have to self-separate in Class G airspace, and they have a higher cockpit workload and restricted visibility, they also have good communication and standardised procedures and it is assumed that they would know of each other and learn about VFR aircraft by either ATC advice, and/or sighting and/or radio communication once approaching an aerodrome.

Therefore once 95% of the traffic is IFR the risk level decreases again. A scaling between 0 and 3 is used to indicate this level of risk as shown in Table 4.

IFR, VFR Ratio	
Risk Appreciation Factor	VFR Percentage of total Movements
0	No VFR Movements (= 0).
1	VFR < 5 % of total movements and IFR 95 % of total movements.
2	VFR Between 5 % and 20 % of total movements.
3	VFR > 20 % of total movements.

Table 4: IFR, VFR ratios.

3. <u>Risk Appreciation</u>

In an article by Robyn M Dawes of the University of Oregon titled *the Robust Beauty of Improper Linear Models in Decision Making* he states that complex statistical algorithms add little value. Kahneman in his book *Thinking, Fast and slow* observes that equal weights to all predictors are often superior, because they are not affected by accidents of sampling. The surprising success of equal weighting of variables in algorithms allows for the development of useful, simple and more reliable formula. Kahneman concludes that this logic can be applied in many areas ranging from selection of stock for investment purposes by portfolio managers to the classification of a newborn baby's health in the medical field.

On this basis, an additive risk appreciation system was developed wherein values attributed to each of the 4 primary variables identified are added. The total value / number is represented in the table below and represents a 'risk classification'. Risk Classification table 5 was created keeping in mind a 6 by 6 risk matrix system.

The total will be between 0 and 12 for risk classifications.

Total Risk Score	
11 and 12	[illegible]
9 and 10	High Risk (Above Scrutiny Line)

7 and 8	Medium Risk (Upper ALoS)
5 and 6	Low Risk (Lower ALoS)
3 and 4	Very Low Risk (Trivial Risk)
0 and 2	Extreme Low Risk

Table 5: Risk Classification

The above risk classifications shown in Table 5 were developed by testing various values and determining numeric intervals. The categories identified are based on the following:

- Values between 0 and 4 represent a risk level below the Acceptable Level of Safety (ALoS) region;
- Values between 5 and 8 are within the ALoS region where 8 is approaching the scrutiny line;
- Values calculated as 9 are at the scrutiny line; and
- Values above 10 indicate extreme risk and should be unacceptable to CASA and action is required.

4. Recommendation and Conclusion

4.1. Similar methodologies have been used in medicine, recruitment and engineering.

4.2. The methodology has been tested and is risk based.

4.3. It is recommended that a similar system as outlined above is applied for assessing the high-level risk at aerodromes.

5. References:

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