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Dear Ms O'Loughlin,

## **PROTECTING AVIATION SAFETY: ESSENTIAL CONDITIONS FOR AUSTRALIAN 5G IMPLEMENTATION**

AusALPA represents more than 7,100 professional pilots within Australia on safety and technical matters. We are the Member Association for Australia and a key member of the International Federation of Airline Pilot Associations (IFALPA) which represents over 100,000 pilots in 100 countries. Our membership places a very strong expectation of rational, risk and evidence-based safety behaviour on our government agencies and processes.

We are particularly concerned about the potential for the unseemly breakdown of government coordination between the Federal Communications Commission (FCC) and the Federal Aviation Administration (FAA) over the 5G rollout in the United States to be replicated in Australia. While we have been assured by CASA that safety will not be compromised, we are not convinced that ACMA has fully acknowledged the risk to safe aircraft operations.

In the US it seems that the lure of multi-billion dollar spectrum auctions as a budget repair tool has overwhelmed the FCC's ability to properly recognise and manage operational risk to the aviation industry or to recognise the potential cost to the economy of disrupting the aviation system. This situation has forced the FAA (and other regulators) to take urgent steps to mitigate the risks, resulting in significant economic disruption to domestic and international air travel. The cumbersome nature of the FAA mitigations, which are not sustainable even in the medium term, has itself introduced operational risks. There are few, if any, of the world's pilots who do not see the FCC as foolishly adopting a risk denial strategy as their *modus operandi* in pursuing the telecommunications 'pot of gold'.

AusALPA and the other aviation stakeholders have already identified limitations in the simplistic modelling and assumptions used by ACMA. These have been highlighted by Boeing's avionics experts during stakeholder discussions. At the minimum, we sense some ambivalence about the very existence of the risks and very little understanding of aviation 'safety of life' certification standards. Aircraft certification is based on a  $10^{-7}$  assurance of no "hazardous" failure or  $10^{-9}$  assurance of no "catastrophic" failure, yet ACMA is casually suggesting that  $10^{-3}$  is acceptable in the same 'safety of life' context.

**ACMA must not go down the same telco-biased path as the FCC – AusALPA asserts that to do so would be entirely counter to Australia's national interest.**



## What is the risk to aviation safety?

While we have not fully quantified the risk or identified the size of the affected aircraft population, the risks are nonetheless real and non-trivial. The most undesirable outcome of radio frequency interference (RFI) is the indication of undetected erroneous height information given by the radio altimeter.

Aircraft radio altimeters are a key component in many aircraft systems. Radio altimeter data feeds many of the complex systems that were developed to improve safety, particularly in challenging weather conditions. Radio altimeter data is a key input to systems such as Terrain Awareness Warning Systems (TAWS), Traffic Alert and Collision Avoidance Systems (TCAS) and Airborne Collision Avoidance Systems (ACAS), Wind Shear detection systems, flight control systems, autoland systems (including auto-throttle and automated landing flare and rollout) and helicopter autohover systems. Erroneous radio altimeter inputs to these systems can result in misleading instrument displays or software protective shutdowns. Unexpected systems behaviour may also cause the pilots to lose situational awareness at critical junctures in the operations. Corrupting the radio altimeter data through RFI compromises the very core of the systems that have allowed us to now classify aviation as an ultra-safe industry.

## It's not about how we got here, it's about how we go forward

Examining the failures that led us to the current situation has already generated a flurry of remediation, however that is just a distraction when it comes to ensuring that we do not make things worse.

Radio altimeters are typically designed for 20 year life cycles and many in service today were designed before 5G became a practical consumer product and when the radio altimeter band of 4.2-4.4GHz was essentially alone in an otherwise quiescent part of the RF spectrum. The consequent lack of standards for co-existence and tight RFI rejection for what are essentially broadband antennae and detection algorithms means that there is a very real possibility that 200MHz buffers cannot eliminate the RFI risk. There is no quick software update or firmware retro-fit to solve the onboard equipment problem.

There is no doubt that there are radio altimeters in service across the Australian aircraft fleet that have inadequate RFI protection when encountering 5G emissions. Consequently, some of our airliners, charter, aeromedical, police and rescue aircraft are vulnerable and may well be affected in critical stages of flight unless we address the problem now.

Critically, this is not an aerodrome-specific problem – **it is an everywhere problem**.

Identifying and replacing all at-risk radio altimeters is one solution. The immediate problems with that option are supply of appropriately protected replacement equipment and funding. Even if that was feasible in Australia, it does nothing to redress the issues facing foreign aircraft using our airports.

While new design performance standards from the RTCA and EUROCAE are expected to be agreed before the end of this year, the timeframe for equipment to be designed and manufactured to those standards is expected to take about six years from now. While some existing systems have been cleared for unrestricted flight operations, those systems are not readily transferable to other aircraft either physically or electronically due to system compatibility issues.

Even when supply becomes sustainable, the thorny issue of who pays for the acquisitions and fitment of the new equipment remains to be resolved.

Our aviation system and the associated safety enhancements are long-established key components of our transportation system, whereas the rollout of the parts of the spectrum

giving rise to the RFI risks has not yet occurred – it seems to us that as the use of the 5G spectrum for personal telecommunications is generating the risk, then the cost of mitigation or preferably elimination should be borne by the users of that part of the spectrum. We expect that funding will be a hotly contested debate that will not be realistically resolved in sufficient time to inform the conditions of sale of the relevant parts of the spectrum.

AusALPA's preferred solution is for ACMA to adopt the approach taken by Innovation, Science and Economic Development Canada (ISED) in recognising and mitigating the risk to aviation.

## The Canadian Approach

As ACMA is aware, ISED issued a decision on 06 August 2021 in relation to the roll-out of 5G operations in the 3450-3650MHz ("3.5GHz") band, which clearly respected the primacy of aviation safety. In pertinent part, the decision included:

Given that radio altimeters are critical in aeronautical services, the amendments proposed to the SRSP were based on protecting the safety of Canadians while still allowing the deployment of 5G operations in the 3500 MHz band.

The main protection measures included:

- exclusion and protection zones to mitigate interference to aircraft around certain airport runways where automated landing is authorized
- a national antenna down-tilt requirement to protect aircraft used in low altitude military operations, search and rescue operations and medical evacuations all over the country

Importantly, the decision is an interim decision:

ISED will continue to study whether allowing antenna up-tilted base stations at a specific power level could be feasible, while still protecting radio altimeters. Based on further investigation, ISED will also consider whether different mitigation measures could be imposed in urban, rural, and remote areas. At this time, ISED considers that the national antenna down-tilt requirement is necessary until more information is available on the types of radio altimeters in use on helicopters in Canada.

and

ISED will continue its internal studies, lab testing of radio altimeters, and discussions with other regulators.

Importantly, the Canadian transmitted power limit is far less than that implemented or proposed in the US.

## Protection of Emergency Services aircraft

AusALPA is concerned that the ACMA-led discussions in which we have participated did not specifically address the issue of protecting Emergency Services aircraft from 5G RFI in areas remote from major airports, in stark contrast to the Canadian approach. Recent natural disasters in various parts of Australia have emphasised the importance of Emergency Services aircraft, particularly in remote and regional areas.

One size does not fit all, since each country has transmission infrastructure specific to geographic and topographic features, and a range of mitigations may be necessary to cater for our national circumstances. However, we cannot emphasise enough that Emergency Services aircraft must be adequately protected before higher band 5G is rolled out.

As we have already noted, this is not airport specific – it is entirely about **operating sites**.

## RFI incident reporting

Much has been made here and elsewhere about the perceived lack of reported RFI incidents. There also has been quite a lot of inappropriate comparisons made between jurisdictions.

There are several reasons why reports are relatively scarce. The most common is that a crew has no way of confirming that an aircraft system disruption or outage is specifically caused by RFI, let alone the precise nature of the source of RFI. Even where some form of data logging is available, only the event is captured and any later diagnosis is fundamentally constrained by the persistence of the fault or by the statistical population of a repetitive geo-located event. Detecting a spurious data event is much more difficult, particularly if the affected system is not being relied on at the time – the loss of Turkish Airlines Flight 1951 on 25 February 2009 due to spurious radio altimeter data is a classic example of the human factors considerations.

Nonetheless, it is not true to say that RFI with radio altimeters is unreported. As ACMA is undoubtedly aware, IP06 of the 11<sup>th</sup> Working Group meeting of ICAO's Frequency Spectrum Management Panel (FSMP) reported on 20 recorded flight anomalies related to two airports where the RFI was from 3G/4G bands well away from frequencies being considered here and included a causal statement:

RF susceptibility when RadAlt is exposed to a crowded spectrum environment (> 2300 cases since 2017)

The other issue is the critical error of conflating a perceived lack of evidence with demonstrated evidence of the absence of risk. For example, a lack of RFI-specific reports from a jurisdiction that requires antenna down-tilt and a radiated power limit of 631W is not relevant to an environment with no antenna tilt limitations and a radiated power of 3000W.

## Radiated power

AusALPA strongly believes that we need to take a pre-emptive conservative approach to the implementation of 5G in the 3.4-4.0GHz band. We must start in the right place because, once the auctions are complete and the spectrum is allocated, it will be politically impossible to wind back licence conditions should the risks materialise into adverse outcomes.

The information before the ICAO FSMP mentioned above highlights that we already have identified issues with 3G/4G installations around airports. In our view, the Canadian ISED approach is where we must start, implementing exclusion and protection zones around airports (including known heliports) and a national antennae down-tilt mandate.

A common feature of best managed jurisdictions is the limiting of base station radiated power, as is proposed in the draft area-wide licence conditions. While we do not know what prompted the US telcos to want 3KW of radiated power compared with the 631W of other apparently successful international roll-outs, such power levels clearly increase the known risks dramatically.

AusALPA consider radiated power levels such as those implemented in the US to be a completely misguided and unacceptable experiment with aviation safety. We strongly believe that the initial roll-out of 5G in the 3.4-4.0GHz band in Australia should be limited initially to that permitted by Canada, given the geographic similarities.

As the aviation industry defines and designs its way out of the current inadequate RFI protections standards for radio altimeters, we expect the path towards revised limits and requirements will evolve and become clearer.

While the combination of low radiated power and down-tilted antennae serves to reduce the risk to Emergency Services aircraft in regional and remote areas, one further option we suggest should be considered is the option for telcos to reduce radiated power for selected base stations where they are proximate to the site of emergency operations that involve aircraft, in particular helicopters. Similar schemes currently exist to stop wind turbines from operating in the vicinity of aerial firefighting activities.

## Conclusions

AusALPA asserts that there is sufficient evidence to identify a real risk to the safe operation of aircraft due to RFI affecting radio altimeters, a key component of many safety-critical aircraft systems.

There is already a demonstrated risk with 3G/4G transmissions that will be exacerbated with 5G operations in the spectrum much closer to the allocated band for radio altimeters.

While the effects of 5G RFI are currently being urgently researched to better define the risks, it is inarguable that the RFI protection standards for many radio altimeters in service are inadequate and not fit for purpose. We must pre-emptively act to prevent 5G implementation in the 3.4-4.0GHz bands of the spectrum from crystallising that vulnerability into hazardous or catastrophic 'safety of life' outcomes for Australian aviation operations.

Australia's Emergency Services aviation operations must also be protected against the identified risks. The solution must cover the airports and heliports from which those operations originate as well as the regional and remote areas where they operate.

Mitigation and/or elimination of the risks requires appropriate exclusion zones, protection zones, antennae down-tilt requirements and radiated power limits. These licence conditions must be imposed before the spectrum is allocated.

## Recommendations

AusALPA strongly recommends that ACMA should follow the lead of the Canadian ISSED and impose exclusion zones, protection zones and antennae down-tilt requirements for base stations, as well as limiting radiated power.

Yours sincerely,



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