Australian Airline Pilots' Association
Member of IFALPA

Suite 6.01, Level 6
243-249 Coward Street
Mascot NSW 2010

T. +61 2 8307 7777
F. +61 2 8307 7799
E. office@ausalpa.org.au

By Email

17 March 2022

Ms Pip Spence
Director of Aviation Safety
Civil Aviation Safety Authority
GPO Box 2005
CANBERRA ACT 2601

Email: ceo@casa.gov.au

Dear Pip,

NORMALISING TAILWIND OPERATIONS
POLITICS THREATENING AVIATION SAFETY

As you are aware, 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.

AusALPA is very concerned with the political processes being undertaken by Airservices (AsA) and Brisbane Airport Corporation (BAC) to appease a small but vocal segment of the local community who, after being lulled into a false environmental perception by the lack of aviation activity during the majority of the COVID-19 pandemic, are concerned by the impact of a resumption of flights on their property values as well as the impact on their quality of life.

Despite decades of public consultation over the Brisbane Airport Master Plan and the new parallel runway, it appears that many feel that they were misled by BAC, aided and abetted by AsA, that the new runway operations would be predominantly conducted over Moreton Bay. That advice was provided in the ambitious anticipation of CASA's acceptance of their 10 knot tailwind proposal.

The proposed increase in the tailwind limit to 7 knots is unarguably a political "rescue mission" for BAC and AsA simply because **there is no safety benefit** in increasing the maximum allowable tailwind permitted to retain a runway in use solely for noise abatement considerations.

Even though CASA will be the decision maker, the process is being conducted by two bodies, AsA and BAC, who have no liability in any practical or legal sense if there is a serious incident or accident during the proposed tailwind operations.

In the event of go-arounds, the noise footprint of which is a quantum increase above that of approaches, we have no doubt that any adverse feedback will be channelled directly at the pilots and the airlines, the additional operating costs will be borne by the travelling public and the only pain suffered by AsA and BAC as the proponents will be some increased activity in their noise complaint mailboxes.

AusALPA is particularly concerned that CASA will be the subject of intense political pressure, particularly in the current election cycle, and that the safety case process (regardless of the quality of the end product) will provide an attractive way out for CASA to compromise on international safety standards to deflect that political pressure.

We were most gratified that CASA's recent response to this issue dated 20 July 2021 has been to uphold the ICAO standard of a maximum of 5 knots (including gusts) of tailwind when determining runway configuration for noise abatement. We fully support both the history and the analysis set out in that letter, presuming that the "new or different data" to which your letter refers means technical data rather than just a collection of 'stakeholder workshop' opinions.

However, since that laudable CASA response, we have heard on more than one occasion in the various Brisbane discussions that CASA has already indicated that it will accept an increase from 5 to 7 knots of tailwind.

That rumour in itself is disturbing, eclipsed only by the widespread ignorance of the physics of wind and the operational consequences for pilots that we have observed during our participation in the "safety case" process that is searching in all of the wrong areas for "new or different data". That ignorance, unfortunately shown by most of the participants of those discussions, has skewed many attitudes away from the actual problems and the associated risks of adverse outcomes. Most stakeholders have treated this issue as an air traffic management (ATM) problem and selected their representatives accordingly, almost guaranteeing that aerodynamics, performance, operational procedures and human factors concerns are largely left off the table.

For the absence of doubt, **AusALPA wishes to reinforce with you that this is an aviation safety issue that has implications for ATM – not the reverse, as is the current focus.**

Our representatives have spent an inordinate amount of time in briefing the risk consultants who, despite being open and willing to accept input, have little familiarity with the key technical issues of operating aircraft in the lowest levels of the atmosphere. How well they are able to grasp the complexities is yet to be determined, but we doubt that AsA as their client has either the resources or the inclination to fully scrutinise that potential weakness in the "safety case".

It is clear from the July 2021 letter that CASA has appropriately considered the history of increased tailwind proposals in the global context. However, the proponents are seeking to overturn the input from ICAO technical resources and those of the Contracting States who participated in the various reviews. AusALPA does not believe that the challenge to the standards is being based on aircraft certification, performance, flight standards or operational management experience. We further believe that the apparent support from some large operators is driven not by any safety analysis but rather by the fear that a curfew will be imposed, as if there are only two alternatives.

We will set out the detailed technical arguments separately below. While in the normal course of events we would expect the length and content of this letter may demand too much of your personal time, AusALPA hopes that you at least familiarise yourself with the main arguments to ensure that the safety advice you receive is sufficiently informed, robust and defensible for you as the ultimately accountable person to make the best decision. It is our strong view that this decision will have long term ramifications for aviation safety at Australian aerodromes.

By way of an informal executive summary, our conclusions are:

> AusALPA does not believe that there is any safety-related reason to abandon the ICAO selection of runway in use criteria or to increase the limit.

The inaccuracy and filtering of the source wind data, the very unpredictability of the future wind structure and the reliance on ATC to act appropriately and in a timely manner on the available wind data results in sufficient uncertainty that adequate buffers must be maintained from certification limits. The AsA proposal does not maintain safety.

AusALPA strongly recommends that the change in criterion from 5 knots including gusts to 7 kts including gusts should not be approved.

WHAT ARE OUR CONCERNS?

Wind near the runway surface

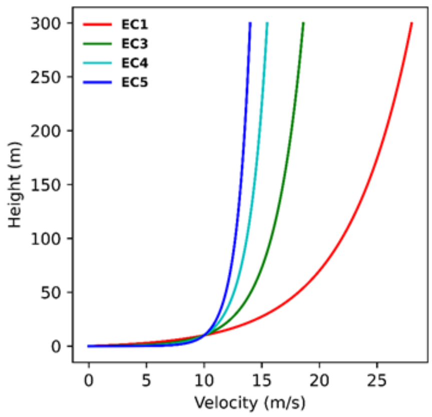
We are most concerned by the apparently widespread misconception that the wind is a unidirectional laminar flow with minor fluctuations, easily measurable and quite predictable. While there are many circumstances where we statistically manipulate wind records to look that way, such as in ensuring the structural integrity of buildings, in real-time aircraft operations, the wind is none of those things.

The wind near the ground is affected by many things, including surface roughness, terrain and larger scale meteorological effects. The actual wind we take-off and land in is stochastic, acts in 4 dimensions, often changes faster than humans can recognise and respond and is relatively unpredictable. It is those very characteristics that require seemingly larger buffers to critical limiting speeds than the average person otherwise might expect.

Atmospheric boundary layer models

There are a number of statistical models of atmospheric boundary layer (ABL) winds that are used for a range of aircraft certification requirements or, more commonly, in building codes such as Australian/New Zealand Standard AS/NZS 1170.2:2021 *Structural design actions, Part 2: Wind actions*. While those ABL wind profiles are generally used to estimate extreme values, they are most useful in this context to illustrate the effects of surface roughness on the variability of wind speed with height as well as on gust factors and turbulence intensity.

For example, the following figure[1] demonstrates the difference in mean wind speed expected with height from over a city (EC1) through to over a coastal plain (EC5), based on long term wind speed records:



1 See Figure 6 from https://www.simscale.com/docs/analysis-types/pedestrian-wind-comfort-analysis/wind-conditions/atmospheric-boundary-layer/

In real life, most approaches pass over more than one terrain category and inversion layers and sea breezes may cause a complete reversal of wind speed with height, resulting in disappearing headwinds or increasing tailwinds on take-off and approach. Nonetheless, these profiles clearly illustrate the fallacy of picking spot winds on descent at say 500 feet as some sort of predictor of the expected surface wind later in the approach.

Despite common usage, spot winds on descent can never be mitigators of risk on the runway and, more often than not, are unwelcome distractions requested at operationally inappropriate times.

These same terrain categories are also variables in the modelling of gust factors and turbulence intensity.

A typical gust factor for an aerodrome might be around 1.5, meaning that the mean wind (recorded as the arithmetic mean of the wind speed over the previous 10 minutes) would typically be associated with gusts (recorded as the highest 3 second gust speed recorded during the previous 10 minutes) that are 1.5 times greater in magnitude. The gust factor is, among other things, an important human factors reality check, since we are constantly exposed to reports, forecasts and observations predominantly of the mean wind and most non-aviators are biased toward filtering wind considerations to minimise or even ignore gusts.

It is also important to remember that all long-term modelling suppresses a lot of natural variability. A brief scan of some BoM observations at Brisbane over the last month have shown actual gust factors to be as high as 1.9 around mean winds of about 7-10 knots. It is noteworthy that the published observations are not continuous and cover a relatively small part of each reported observation period.

Turbulence intensity as modelled is based on a uniform surface roughness and cannot take into account localised effects due to treelines and aerodrome buildings. While moderate turbulence is typically generated at coastal aerodromes at winds higher than about 25 knots, it is noteworthy that long-term modelled turbulence intensities typically increase 10-14% at 3 metres compared to those measured at standard anemometer height of 10 metres.

Changes in wind direction are not modelled in microscale in the various ABL profiles. This is simply because structural design is mostly focused on catering for extremes of wind strength and for critical directions, rather than the mid or lower range considerations important to us in this aviation context. Suffice it to say, changes in wind direction due to gusts of 30 degrees or more are not uncommon but often go unreported. As we will demonstrate, the consequences of the wind changing direction are often greater than changes in just the wind speed.

Wind measurement and recording

The mechanical devices used to measure wind have limitations that affect their ability to accurately capture the actual wind speed. This issue is discussed extensively in the *Extreme Windspeed Baseline Climate Investigation Project Final Report* for the Department of Climate Change and Energy Efficiency dated 24 Apr 11.

AusALPA has previously interceded with CASA in regards to crosswind limits in the same runway in use context. A key document in that event, also considered later by ICAO in the 2014 debate, was NLR-TP-2001-217 *Safety aspects of aircraft operations in crosswind* published by the National Aerospace Laboratory of the Netherlands in May 2001. Section 3 of that document is titled *Wind climate and measurement of wind conditions* and we strongly recommend that your relevant staff should study it closely as it links the technical issues with the ICAO Annex 3 reporting requirements to flight crew and ATC.

For our present purposes, we believe that it is sufficient just to illustrate the problems of wind measurement and reporting to ATC with a figure from Section 3:

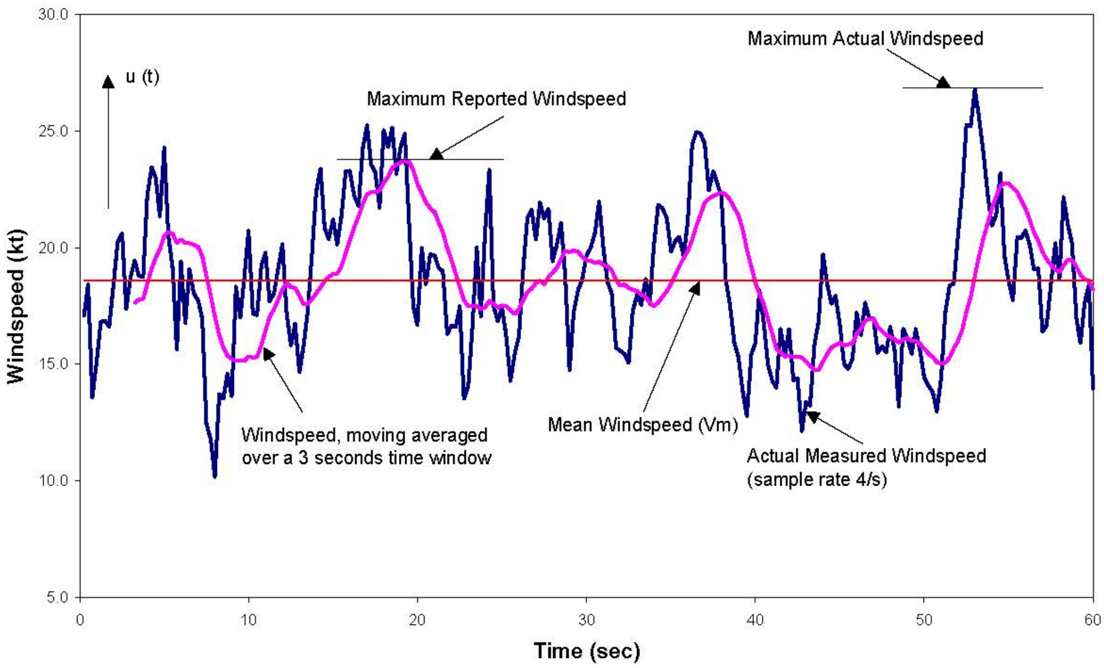


Figure 4: Wind speed versus time.

In summary, what ATC sees on the tower instrumentation is not what a pilot has to live with! Furthermore, it is important to note that, while the wind data invariably reports gusts as additive to a mean wind, they are equally likely to be diminutive – together, the total change in wind components may result in a very short-lived but significant wind shear.

<u>Tailwind and crosswind</u>

Another significant misconception is the source of tailwinds and crosswinds. We often encounter people whose mental filter leaves them thinking of tailwind or crosswind as mutually exclusive winds, rather than components of the wind calculated using the runway alignment as the frame of reference. This often leads to a failure to properly consider the speed and directional effects of gusts on the tailwind and crosswind components.

To demonstrate these effects, consider the situation where the wind, including gusts, just meets the current MOS Part 172 limits. Using a conservative gust factor of 1.4, we can calculate a theoretical mean wind from which to consider the effects of greater gust factors such as the 1.9 factor we saw in the Brisbane observations, the effects of a 30 azimuth change and the effect of both changes:

	Azimuth	Speed		XW	TW
	104	20.62		20	5
mean=/1.4		14.73		14.29	3.57
x1.9		27.99		27.15	6.78
30 veer	134	20.62		14.82	14.33
mean		14.73		10.59	10.24
x1.9		27.99		20.11	19.45

The amber figures for the azimuth and the wind speed are the trigonometric outcome of maximising both crosswind and tailwind limits. As can be seen, the azimuth change creates a greater problem than a higher gust factor, with the combined variation particularly problematic for aeroplanes certified with a 10 knot tailwind limit, given that a 19.5 knot tailwind component exceeds the certification demonstration requirement of 15 knots (150% of the proposed limit). Variations in the wind of this magnitude are not extreme, but the probability of both variations occurring simultaneously, while not insignificant, is likely to be small.

Increasing the tailwind component limit from 5 knots to 7 knots increases the magnitude of the problem, particularly as the aerodynamic effects are a function of the square of the airspeed and the response time of the engines and controls can be somewhat longer than the gust duration:

	Azimuth	Speed		XW	TW
	109.3	21.2		20	7
mean=/1.4		15.14		14.29	5
x1.9		28.77		27.14	9.5
30 veer	139.3	21.2		13.82	16.07
mean		15.14		9.87	11.48
x1.9		28.77		18.76	21.81

These outcomes are for the limiting case of both limits being challenged at the same time – again not unlikely in probability or extreme in magnitude.

While these tables might project a somewhat static outcome, it must be remembered that gusty winds are both random and cyclic (the 4-dimensional problem) and that a 5 knot tailwind aligned with the runway, rather than a 21 knot quartering tailwind, largely misrepresents the operational risks .

Predictability of wind

Even with constantly recorded wind data and broader synoptic modelling by BoM, nothing can predict the future behaviour of the wind to a level of precision that will prevent a pilot from inadvertently flying into wind conditions that exceed the certified limits for the aeroplane. While we cannot predict the outcome of the exceedance, we can identify that the risk of exceedance is elevated when the existing buffer is reduced. There is no doubt that the risk of an adverse outcome is also elevated from that which currently exists.

Performance margins

Currently, most if not all aeroplane manufacturers provide adjustments to planned approach airspeeds based on the mean winds and gust spread – typically adding half the mean headwind plus all of the gust spread to the nil-wind approach speed. None of our members can recall seeing a V_{APP} adjustment for tailwind gusts, yet the performance and handling consequences are even more demanding.

All of these existing risks are further elevated by foreseeable human factors considerations by both ATC and pilots.

ATC management of displayed wind data

AusALPA has been advised that Brisbane Tower has data displayed from all four runway-related anemometers and that the display provides for the display of “instantaneous” wind as well as mean and peak gusts. It was suggested that ATC monitor the “instantaneous” wind and change the runway configuration strictly upon the observation of a wind value in excess of the Part MOS 172 limit. We are not able to satisfy ourselves that the suggestion is either representative or practical, particularly as the comment was also made about the Brisbane winds being “all over the shop” and highly variable.

In the selection of the runway in use, the human-machine interface is obviously critical and entirely dependent upon what an ATC has displayed in front of them, the refresh rate, the informal reaction rules, the time lost between detection and a pilot receiving a report and how the expected persistence of the reported wind is determined.

AusALPA is very much concerned from a human factors perspective that, even if the wind history is accurately displayed, a busy controller has to divert their attention to and from many competing cues and is most often dealing with multiple aircraft from a sequencing/separation perspective. In those circumstances, human monitoring strategies tend to prioritize only some parts of the available data according to the level of stress that they are under – the priorities are normally rational, but not always – and the operational environment is more about efficiency and operational throughput, with safety largely presumed as inherent in the procedural design or from biased perceptions of “it hasn’t happened before/won’t happen to me”.

We believe that, more likely than not, ATC will favour the 10 minute mean wind data over the 3 second gust data or more “instantaneous” options. A display of the mean wind provides a sense of persistence and the perception of a more solid base for decision-making, despite the NLR figure demonstrating just how far from operational reality the mean wind may be. On the other hand, there is an innate perception that gusts are temporary in nature and a bias against relying on such temporary data as a decision tool.

However, the problem that we see with this likely bias towards using the mean wind is that there is little or no understanding of gust factors and there is no site-specific means for ATC determine an appropriate 10 minute mean wind that will most likely prevent the gust limit being exceeded.

It also became obvious to us during discussions with operating controllers that there is a significantly misplaced reliance on the value of 500 feet wind reports from arriving aircraft. While there may be some merit in using such a report to predict the likelihood of go-arounds from unstable approaches, the unfortunate emphasis appears to be placed more on a presumed relationship between mid-descent winds and those experienced on the runway.

A related human factors bias stems from the mistaken belief that pilots can easily handle any extra tailwind or crosswind, hence reducing the incentives to commence an appropriate change of runway in use. Unfortunately, many pilots may also hold the same mistaken belief without knowing what margins are actually available or how easily they may be compromised, particularly if they operate aeroplanes with higher tailwind limits than 10 knots.

Paradoxically, it is often the case that ATC in the past have censored wind data in the mistaken belief that they are assisting pilots to complete their operations more efficiently. That “assistance” has been encouraged in some circumstances by pilots, with neither party fully understanding the elevated risks in so doing.

Pilot decision-making

AusALPA recognises that many pilots are as unaware of the wind issues we are raising as other stakeholders – **this is a systemic safety issue**.

There are many human factors considerations affecting pilot decision-making around taking off or landing with tailwind. There are immediate issues surrounding post COVID-

19 recency, training and operators' different workplace approaches to recovering to more normal operations. Most pilots are very aware of the noise politics and, longer term, the threat of imposing curfews, with the associated operational limitations and long term economic damage.

While operators always state that "safety is our highest priority", the reality is that the highest priority is more like "sufficient safety to generate maximum profits". Pilots are subject to many workplace pressures to depart on time, arrive on time and to burn minimum fuel in the process. Fatigue can often be present. In the end, those pressures lead to decisions that may be uncomfortable and pushing personal (and professional) limits in order to achieve self-imposed or operator specified efficiency criteria, including "I'm not going to be the one causing a change of runway".

While we do our best to highlight to our members the risks involved in allowing such pressures to affect our decision-making, those pressures remain and seem to be even greater post COVID-19. Importantly, the aviation system must provide some inherent protections against poor decision-making and lack of knowledge, not to condone those deficiencies but rather to acknowledge their persistence.

To be very clear, **AusALPA does not accept the reduction of safety buffers simply for the convenience of ATC or the indeterminable benefit of a small group of private landholders.**

Normalising tailwind operations

In 2012, Boeing published an article *Reducing Runway Landing Overruns*[2] which included the following:

> Event data, analyzed collectively from 2003 to 2010, shows the factors contributing to landing overruns occur at these frequencies:
>
> - 68 percent occurred after stable approaches.
> - 55 percent touched down within the touchdown zone.
> - 90 percent landed on an other-than- dry runway.
> - **42 percent landed with a tailwind of 5 knots or greater.** [emphasis added]

It makes no sense to us that, with existing tailwind controls still not fully effective in maintaining sufficient margins to ensure compliance for 10 knot tailwind limited aeroplanes, CASA would reduce the operational buffers even further. Given that we believe that human factors influences mean that ATC are more likely than not to treat the limit as a mean wind limit rather than a gust limit, increasing the tailwind limit to 7 knots substantially increases the likelihood that gusts will exceed the limits for aeroplanes certified for 10 knots of tailwind. That remains the case if the limiting wind veers, even if the crosswind limit is reduced to 15 knots as a "mitigator".

During the "safety case" discussions, AusALPA suggested that AsA were attempting to normalise tailwind operations, certainly for noise abatement if not for convenience in order to delay or avoid runway changes. We made it very clear that such normalisation is not in the interest of aviation safety.

The AsA response was that the increased tailwind limit was only being sought for Brisbane. It was also suggested that CASA had indicated that any approval would be limited to Brisbane. The irony of that stance is that it underlines that the proposal (and its apparently

---

2 Jenkins M and Aaron R, 2012, Reducing Runway Landing Overruns, *Boeing Aero Quarterly*, QTR_03, pp 15-19

foregone approval) is entirely a localised political decision dressed up in a mantle of safety considerations.

If CASA was to abandon existing ICAO standards and to renege on the recent confirmation of those standards by approving an increased limit on the basis of a "safety case" paid for by AsA, then there is no consistent regulatory basis available to CASA to deny that increased limit for every other controlled aerodrome in Australia.

That will further reduce the historical emphasis on landing or taking off on the most into-wind runway and normalise tailwind landings. The pressure on pilots to accept the higher risk would be enormous.

Strict liability provisions relating to pilot take-off and landing decisions

AusALPA was reminded yet again during the "safety case" discussions of the ability of stakeholders to advocate bad policy on the basis that any attendant risks were mitigated by the duty of the pilot to operate safely at all times and that legal liability falls mostly, if not entirely, on the pilot. Typically, this takes the form of "well, the pilot could have gone around", "they could have requested a change of runway" or "they could have held or diverted", regardless of the prevailing circumstances. This bad policy shield is regularly invoked by CASA (particularly relating to aerodrome standards and risks), AsA and operators as absolution from the human factors environment for which they are almost entirely responsible.

The now-repealed CAR 92 targeted the person who physically causes an aircraft to take off from or to land an aircraft on a place. That was mapped across to CASR 91.410, where the liability was extended to the operator. Apart from compliance with runway standards, the key relevant provision is that:

> …the aircraft can land at, or take off from, the place safely having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions).

While it is a legal curiosity that CASR 121.205, while overriding CASR 91.410, does not contain a similar explicit safety requirement, our members consider operating safely within known risks to be an overriding responsibility. Our associated concern relates to CASR 91.095 *Compliance with flight manual etc.* and related provisions not mentioned in CASR 91.035, such as CASR 121.055 and CASR 153.040.

The various formulations of the legal provisions invariably rely on the laziness of 'strict liability' provisions, for which the only available defence is "mistake of fact"[3]. The key elements of that defence are that, at an appropriate time, the person considered whether or not facts existed and is under a mistaken but reasonable belief about those facts, and had those facts existed, the conduct would not have constituted an offence.

In either case, should CASA approve an increase in the tailwind limit and the associated reduction in safety buffers, AusALPA is of the view that such an increase would, except in obviously egregious circumstance, remove any likely criminal liability for exceeding the flight manual tailwind limits or any related incidents as a consequence of the pilot not knowing with any certainty what the wind was at the point of lift-off or touchdown.

Conclusions

AusALPA does not believe that there is any safety-related reason to abandon the ICAO selection of runway in use criteria or to increase the limit.

---

[3] See Division 9 of Part 2.3 of Chapter 2 of the Criminal Code 1995

The inaccuracy and filtering of the source wind data, the very unpredictability of the future wind structure and the reliance on ATC to act appropriately and in a timely manner on the available wind data results in sufficient uncertainty that adequate buffers must be maintained from certification limits. The AsA proposal does not maintain safety.

Recommendation

The change in criterion from 5 knots including gusts to 7 kts including gusts should not be approved.

Yours sincerely,

Captain Tony Lucas
President AusALPA
President AIPA

Captain Louise Pole
Vice President AusALPA
President AFAP

Tel: 61 – 2 – 8307 7777
Fax: 61 – 2 – 8307 7799

Email: office@ausalpa.org.au
government.regulatory@aipa.org.au
technical@afap.org.au