AAAA Drones Policy

Policy Adopted June 2021

AERIAL APPLICATION ASSOCIATION OF AUSTRALIA LTD.

1. Introduction

The concept of a 'level playing field' is critical to AAAA. There is simply no good reason why drone/UAS/RPAS operations should not be subject to similar licencing, competence, equipment and operational requirements as piloted aircraft.

Drone pesticide licencing must work in a simple manner to attain what is largely a level playing field between all aerial applicators.

AAAA has done its best to help educate State/Territory and Commonwealth regulators and drone operators as to the ongoing unmanaged risks being taken through drone applications. This was previously outlined in the AAAA Policy on Drone Operations 2019 which this policy now replaces.

In 2019 AAAA decided not to accept membership from drone operators to ensure the AAAA remained a body representing and working for professional aerial applicators using piloted fixed and rotary wing aircraft.

In 2021, AAAA decided that, due to a wide range of uncontrolled risks, the lack of maturity of the drone industry and a range of other concerns, it would no longer offer Spraysafe manuals, exams or accreditation to drone operators, but instead refer them to their own industry associations.

After years of trying to support the new drone industry by facilitating training and accreditation that was principally aimed at piloted aircraft operations, AAAA has become increasingly alarmed by:

- the lack of rigour being applied to drone application operations in Australia
- the undue haste to provide licencing provisions without commensurate competence or risk management requirements, and
- the apparent lack of knowledge or maturity demonstrated by many in this sector.

These issues remain serious questions for the drone industry – and for regulators.

It is critical that if any negative outcomes are experienced through drone use, the wider aerial application sector is not 'tarred with the same brush' or otherwise impacted by shortcomings that are unique to the nascent drone sector.

AAAA hopes that the drone industry is able to rapidly mature and make good the many shortcomings that are clear. In particular, AAAA is hopeful the ACUO and /or AAUS can play the same positive role in training and accreditation that AAAA does for our sector. However, in the interim, AAAA must respond to ensure the good work of its members is not undermined by a rapidly evolving sector that is not being regulated in accordance with known risks.

As previously advised, AAAA does not support drone licencing without significantly increased standards, clarity, assessments of performance and accountability.

A level playing field in all aspects is a useful guiding principle.

It is critical that all drone operators check with the relevant regulators in their proposed State/Territory of operation for the current licencing and operating provisions they will be required to comply with **BEFORE COMMENCING OPERATIONS.**

Not only are the regulatory stakes high for this relatively new sector, but the community licence to operate is also a key component in the sustainability and acceptance of the sector.

As with all aerial application, the drone sector will be under significant scrutiny to comply with all relevant regulations and to maintain a high standard of safety and environmental awareness.

2. Safety, Privacy, Security Issues

Safety

One critical – unresolved - safety issue remains at the heart of drone operations – safe airspace separation from other low-level airspace users such as aerial applicators.

This issue continues to be ignored by CASA in favour of a facilitation role regardless of known safety risks and potential consequences.

As drone incidents increase in safety reports to the ATSB – highlighting inherent risks such as ‘loss of link’ and consequent loss of control and crashes – CASA must be brought to account on their confused role in drone policy.

CASA should not be the ‘drone champion’ or ‘world leader’ - especially given CASA’s continually turning a blind eye to clear risks to piloted aircraft – especially when industry has been warning of these risks for many years.

CASA should urgently refocus their attention and resources onto safe drone operations and protecting other airspace users from the obviously significant consequences of a drone strike at low level.

Privacy and Security

Other issues related to drone operations are also important – such as national security and privacy issues – but these are not CASA responsibilities under their legislation and should be managed by the responsible agencies – State and Federal.

Loss of link

Any drone operator should be required have a contingency system in case the drone 'loses the link' between the platform and the controller. In some cases, the drone may automatically return to base, or enter hover and land.

However, loss of link in an aerial application setting is very serious due to the potential uncontrolled release of chemical and necessary low-level of application.

ALL drones used for aerial application should have a system for the immediate and safe shut-off of the spray or application system in case of loss of link, power failure or other emergency.

Guidance and accurate application on/off

A critical issue for drone operators is the ability to accurately turn the application / spray system on only when over the target and to shut it off safely within the target boundary.

In some cases, human markers are used to indicate to the drone controller when the platform is approaching the cut-off point and then reaches it, so that the drone controller can activate the application on/off mode. This generally leaves a problem with the end of the target area being visually assessed for cut-off by the controller, with attendant likely error introduced through parallax.

AAAA sees the reintroduction of human markers into aerial application – including for drone operations - as a significant retrograde step for workplace health and safety.

AAAA hopes that the drone sector can eliminate this practice through the use of technology that will enable automatic on/off by the use of geo-fencing or similar.

Once CASA addresses the operational issues and necessary permissions regarding 'beyond visual line of sight' operations by drones, it is likely that the technology capable of delivering auto on/off will be essential.

Beyond Visual Line of Sight Operations

AAAA is staunchly opposed to drone operations for aerial application being conducted 'beyond visual line of sight' – 'BVLOS' operations – including any drone transiting through known aerial application operational areas.

It is critical during all aerial applications to have a trained set of eyes available to control for unexpected risks including:

- Changing wind speed or direction *at the application site*
- People or vehicles entering the spray area or neighbouring 'safety' areas
- Other aircraft
- Equipment failure – such as blocked nozzles or hoses
- Loss of link consequences

Recommendation

Until the risks identified above are appropriately managed, drones should not be allowed to conduct aerial application.

3. Drone Pilot Competence and Licencing

In keeping with the approach used for piloted aircraft, there are two broad elements of competence that need to be covered for safe drone aerial application:

- competence in operating the platform (CASA licencing) and

- competence in chemical application (EPA / State agricultural chemical control of use agency licencing).

Consequently, AAAA sees it as appropriate that any drone operator must hold both:

- CASA certification/licencing for UAS operations (including low level or aerial application competence), and

- competence in safe chemical control-of use issues including chemical preparation, application, droplet theory, calibration and drift management – something AAAA strongly encourages existing drone industry Associations to establish.

AAAA notes that the national chemical application competencies remain woefully inadequate to produce candidates that are 'fit for purpose' and who have the underpinning knowledge and skills to successfully and safely conduct either ground or aerial applications.

This is why the AAAA Spraysafe program significantly exceeds the requirements of the current national competencies – especially when combined with the required competencies of a CASA issued and examined Commercial Pilots Licence and Aerial Application Rating.

The current required level of competence for aerial application pilots is simply higher than drone operators because aerial application pilots are required to hold a Commercial Pilots Licence and an Aerial Application Rating and are bound by a range of additional CASA regulations that contribute to improved safety (fatigue management, Drug and Alcohol Management Plans etc).

These 'additional' qualifications and competencies contain significant additional elements of risk management, human factors and application-specific training such as meteorology.

This is an area where there is a capability or training gap that warrants additional discussion between regulators and the drone industry

The State agricultural chemical control of use regulators should consider placing conditions on drone licences to ensure equal regulatory coverage with piloted aircraft by specific mention of use of risk management, spray drift management, record keeping etc.

In particular, AAAA believes that aerial application of pesticides should only be allowed to be conducted by a drone operator when working under the direct control of a business as below.

4. UAS Business licencing

In keeping with the approach used for piloted aircraft (except WA), drone application should not be permitted without licencing coverage of the business overseeing the pilot and application.

Consequently, AAAA sees it as appropriate that if a business holds CASA certification/licencing for drone operations, then the State agricultural chemical control of use regulator can use that as a basis for licencing if other conditions of licencing are met, including evidence that the business has in place relevant systems to manage the risks associated with aerial application.

This could be achieved in a number of ways:

- Negotiation of State-by-State licencing conditions covering systems etc and clarifying the application of existing regs to drone ops (eg offences, record keeping etc)

- Use of the previously drafted National Operating Standards for Aerial Application developed through the PISC (COAG) process – covering drift management, spray quality and communications systems requirements.

- Use of a prescribed checklist of ground facilities, equipment, and management systems – equivalent to the AAAA Spraysafe business level accreditation in use in Tasmania and Victoria.

5. Label Compliance, Spray quality and Drift Management

A critical gap remains in the ability of drone operators to provide scientifically valid assessment of their spray quality to ensure what is recommended on label (eg spray quality, water rates, buffers – leading to adequate coverage, efficacy and drift control etc) is able to be delivered in the field.

Every drone operator must assess if **aerial application is permitted** by reviewing the chemical label, and if the particular drone platform and nozzle combination can deliver the **spray quality** required on the label.

There may be a wide range of additional label compliance requirements including:

- spray drift limitations
- temperature limitations
- wind speed limitations (including nil surface temperature inversion operations)
- downwind spray buffer limitations
- crop type / situation and usage pattern limitations by State/Territory
- re-entry period limitations

Piloted aircraft operators are able to use existing verified predictive models to accurately predict spray quality in operational settings for existing fixed wing and rotary wing aircraft types. These include AgDrift / AgDisp / AAAA Nozzle calculator / AAAA Coverage Calculator - that have been developed by the industry over previous decades, along with manufacturers' data and wind-tunnel research outcomes.

These models are used by APVMA – using ‘typical’ operating assumptions on aircraft type etc – to establish relevant buffers and spray quality on chemical labels.

These field-verified predictive models take into account near-wake effects of turbulent airflow on nozzle spray quality and provide confidence to regulators, registrants, operators and pilots that the platform is producing a known spray quality. This work has been backed up by industry testing of nozzles in wind tunnels at representative aircraft speeds and by industry in-field pattern testing of aircraft.

Consequently, it is essential for drone operators to undertake their own due diligence and research to clearly establish the performance of their particular spray platform under varying conditions that are representative of those likely to be encountered in the field.

This is required to establish:

- Compliance with the chemical label – which is likely to include a known spray quality (ie droplet size and distribution produced from a nozzle) under normal operating conditions
- Downwind buffers required to keep any residues below acceptable limits and to avoid damage to the environment or other crops outside the treatment area.
- Optimum spray operational parameters including:

    - spray release height
    - nozzle operating pressures
    - nozzle orientation to the relative airflow (which can significantly impact on droplet size and behavior)
    - airframe, rotor and related aerodynamic effects
    - water rates
    - target coverage and chemical recovery

Placing a nozzle directly under a rotor producing a turbulent airflow at significant speed could theoretically lead to secondary shattering of droplets, with a subsequent ‘fining’ of the spectrum and consequent increase in drift potential. Manufacturers’ data for most common ground nozzles is derived from testing with water+surfactant IN STILL AIR. That means it will not be what is happening under a rotor.

If the label says ‘COARSE’ spray quality for example, then the applicator needs to have confidence – and scientific evidence – that the platform is actually producing ‘COARSE’ in the field.

The platform layout effect on spray quality and drift potential of multiple rotors on drones is also an unknown. With many drones having different set-ups (single rotor to quad or octo-copters are common) and different airframes and nozzle placements (boom or nozzle under rotor for example), accurate individual pattern testing would be a minimum requirement to establish spray quality and other drift management parameters.

The outcome of this complexity is that each individual platform type must prove compliance with the label – potentially through individual compliance testing.

The APVMA should require additional work in this compliance space, or potentially have a separate drone registration process to put data on label, including buffers relevant to drone ops.

AAAA notes there is also an unconfirmed but pervasive assumption that if a chemical is registered for aerial application then it is registered for drone application.

AAAA *does not* accept this assumption and believes formal legal confirmation of drones on label is prudent and required, including development of a national protocol for drone testing and label compliance before use.

6. Drone Application Challenges

Load Capability and Target Coverage

Currently, the load capacity of commercially available application drones is small – with the currently available maximum being approximately 30 litres. This is a common spray volume required on many labels to cover one hectare with MEDIUM to COARSE spray quality and thereby ensure adequate coverage of the target.

However, due to this small load capacity, there is significant commercial pressure to lower application rates by using smaller droplets than required on label – thereby covering more ground per load but maintaining coverage in terms of the number of droplets per square centimetre.

Unfortunately, this can result in label non-compliance, increased drift of smaller droplets with less mass (ie lower sedimentation rates) and poor efficacy of the spray and even – through persistent use – an increase of chemical resistance due to repeat sub-lethal damage to targets.

Translational lift

As most drones are currently rotorcraft, a consideration of translational lift is important in understanding likely airflow around the platform and accompanying issues for spray quality, drift management and release height.

Translational lift is additional lift generated across a lifting surface due to the forward speed of that surface. For example, when a helicopter or rotorcraft moves from a hover in still air to forward flight, the rotors gain additional lift as a result of the increase in relative speed of the airflow.

For spraying purposes, the transition from the hover to forward speed has a significant impact on the vortice ring generated around each rotor. In the case of quad or octo-coptor drone platforms, this could be significant for the entrainment of droplets if the spray is activated in the hover or at low relative forward speed.

Above translational lift, aircraft vortex sheets unroll and a rotor performs in similar manner to a fixed wing aircraft from the perspective of vortices. Below translational lift, rotary platforms create a vortex ring that does not unroll, or only partially unrolls.

If droplets become entrained in the vortice ring – which will not flatten out or unroll and behave as a 'normal' vortice sheet behind the platform until there is significant forward speed – they may be recirculated through the vortice ring or released to the atmosphere at a significantly increased height – potentially leading to a significant increase in chemical spray drift.

'How much drift' is the key question that needs answering. Drones' lower weight may also come into play to mitigate this effect but this is another unknown. CPAS at the University of Queensland may be able to assist with either expertise or establishing a field trial to remove doubt or identify issues.

Spray height

Optimum spray height for chemical release is generally regarded as being approximately 25% of the wing or rotor span of the platform.

This is to ensure the platform is in ground effect and provides a relatively stable spraying platform without unnecessarily intensifying vortices (by flying too low and thereby increasing entrainment of droplets and increasing final release height) or by simply releasing the chemical too high and consequently increasing drift.

The lack of accurate predictive modeling (such as Agdrift or Agdisp) that would be relevant for modelling of drone spray performance is problematical.

However, in-field pattern testing of drone platforms, for example using water sensitive cards or fluorescent dye captured on cotton string, with subsequent analysis by a suitably qualified technician, may provide useful data on optimum spray height for the particular platform, along with a range of other useful information.

Spray equipment

In addition to the essentials, there is additional equipment that drone operators should consider. The essentials include:

- lifting capacity of the spray platform (the drone) and consequently its load and its impact on spray quality, coverage and label compliance
- a pump to provide consistent pressure to the nozzle
- spray lines to get the liquid spray to the nozzle.
- check valves to provide a certain shut-off when the spray system is turned off.
- suck back – in combination with the check valve, this ensures the system does not trail any chemical from the nozzle when it is shut off.
- return lines – at the end of a spray boom, return lines can help ensure constant pressure reaches all the nozzles on a spray boom (especially those furthest from the pump) and can eliminate the 'chattering' of check valves when they are not receiving adequate pressure to function properly.

ENDS