

Planning for success in agricultural aviation

Omaka Aerodrome, Blenheim

4 May 2012

A day to show NZPI Conference delegates the capability of the agricultural aviation industry in New Zealand, the challenges faced by the industry and the industry response.

Sustainable Farming Fund
Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

NZAAA
Aviation in Agriculture

WELCOME

Welcome to this special aviation-focused demonstration day organised by the MAF Sustainable Farming Fund Project, "Environmental best practice in agricultural and associated rural aviation".

Today is about enabling you to experience first-hand the capability of the agricultural aviation industry in New Zealand, sharing information about the challenges faced by the industry and the industry response.

The day's programme will include a series of short presentations, static displays and demonstrations related to the handling and application of fertiliser, agrichemicals and vertebrate toxic agents (VTA's) to demonstrate how the industry goes about meeting environmental and safety standards.

We trust you will take this opportunity to learn more about agricultural aviation technology and its relevance and application to policy and regulation.

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Supporting sponsors

We acknowledge the sponsorship and support of the following companies and organisations:

- The New Zealand Fertiliser Quality Council
- Marlborough Helicopters Ltd (MHL)

DEMONSTRATION DAY PROGRAMME

"MHL" = Marlborough Helicopters Ltd office and Hangar at the end of Aerodrome Rd

Time	Topic	Place
9:00am	Welcome, morning tea, introductions and safety briefing	MHL
9:15 – 10:00am	Background	MHL
10:00 – 11:30am	***Demonstration*** – Fertiliser spread pattern testing • Equipment inspection • 2 passes over collection system, helicopter with urea and fixed wing with lime • Analysis of results, discussion, Fertmark and Spreadmark	Outside MHL Aerodrome MHL
11:30am - 12:00pm	GPS and the introduction to task verification	MHL Hangar
12:00 – 2:00pm	Lunch and viewing Aviation Heritage Centre	
2:00 – 3:00pm	***Demonstration*** – Liquids pattern testing • Equipment inspection • Nozzles and spray quality • 2 passes over collection system, field inspection and data analysis	Outside MHL Hangar Aerodrome
3:00 – 3:30pm	***Demonstration*** – VTA • Equipment inspection • 1 demonstration pass	Outside MHL Hangar Aerodrome
3:30 – 4:00pm	Open forum, analysis of results for both liquids and VTA, discussions and questions, concluding remarks, afternoon tea	MHL Hangar

BACKGROUND

"Agricultural aviation" refers to the use of aircraft in the application of agrichemicals and fertilisers for agricultural operations, including forestry and horticulture, and the application of vertebrate toxic agents (VTAs) for pest eradication operations in native forests for conservation values and extensive farm operations for TB vector and rabbit control.

Agricultural aircraft are also used in fire-fighting operations and urban pest management operations, such as the Painted Apple Moth eradication programme in Auckland.

Industry information

Governing and regulation

- New Zealand Agricultural Aviation Association (NZAAA) is a division of the Aviation Industry Association (AIA).
- The industry operates its own independently audited quality and safety management system, AIRCARE™. More information about AIRCARE can be found at http://www.aia.org.nz/AIRCARE.html
- Civil Aviation Rule Part 137 governs agricultural aircraft operations. Operators must hold a CAA Part 137 certificate and are subject to audit every year by the Civil Aviation Authority.

Industry size

- There are 107 Part 137 certificate holders (operators).
- 80 fixed wing aircraft and about 200 helicopters on the New Zealand register are involved in agricultural work.

Industry Capability

- Total hours flown 2005 – 2010 (rounded figures)

Aircraft type	2005	2006	2007	2008	2009	2010
Helicopter	37,500	29,500	30,500	35,500	29,400	33,300
Fixed wing	45,500	37,000	34,500	29,500	21,100	24700
Totals	**83,000**	**66,500**	**65,000**	**65,000**	**50,500**	**58,000**

Agricultural work in NZ (all figures rounded)

Year	Aircraft	Bait (tonne)	Fertiliser ('000 t)	Spray ('000 litres)
2010	Fixed wing	475	439	4900*
	Heli	1,000	39	60,300
2009	Fixed wing	600	380	6,700*
	Heli	1,850	26	54,400
2008	Fixed wing	1,700	482	6,600
	Heli	1,800	35	55,500
2007	Fixed wing	500	567	2,000
	Heli	1,450	27	40,000
2006	Fixed wing	70	577	2,500
	Heli	1,250	28	41,000
2005	Fixed wing	300	704	5,500
	Heli	2,300	28	51,500

Observations:

- Total bait application (tones) trending down because of lower application rates per hectare.
- Helicopters now fly more hours on agricultural work than fixed wing aeroplanes.
- For helicopter spraying, 70 – 80% of the total is agrichemical and about 15% is for fine particle suspension.
- Data for ferliser applied includes lime.

Compliance

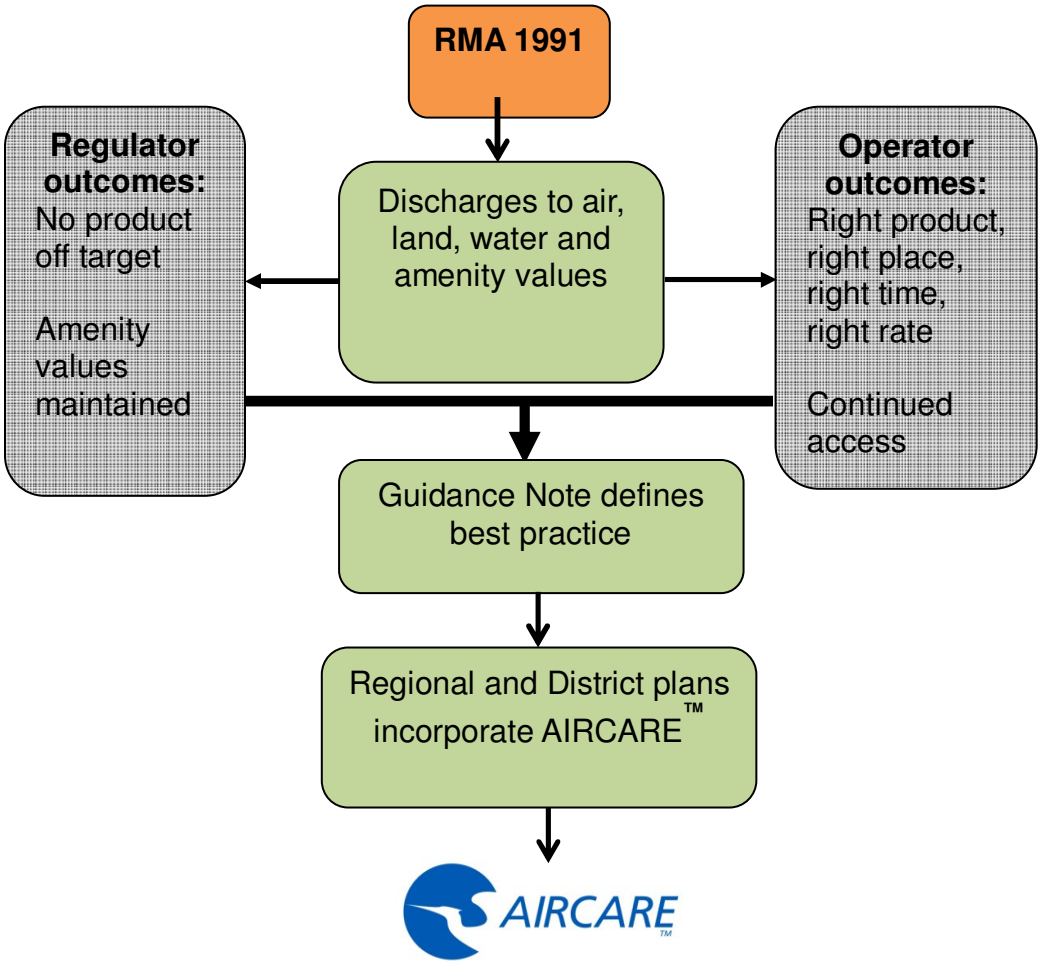
Compliance costs and requirements for a "typical" small operator range between $50,000 – $60,000 per year, representing 5-10% of turnover.

Compliance cost summary – typical small operator (1-2 aircraft)

Category	$k	%
RMA	21	40
CAA	13	24
Other	14	26
HSE	3	6
LTSA	1	2
HSNO	1	2
Total	**59**	100

Sustainable Farming Fund Project: "Environmental best practice in agricultural and associated rural aviation"

The NZ Agricultural Aviation Association and NZ Helicopter Association are running a project, "Environmental best practice in agricultural and associated rural aviation", to address environmental and compliance issues faced by pilots and aerial operators. The project aims to deal with the operation of aircraft in respect to discharges to land, air and water and amenity values. So, it's about addressing the adverse effects of the application of spray, fertiliser and baits (VTAs) and of aircraft noise. The following diagram provides a project overview.



Industry value

In NZ the aviation industry has recognised its value to the NZ economy and believes that the most effective way to ensure its sustainability is to have all operators in the industry perform to best practice standards. Agricultural aviation alone is worth some $2 billion to NZ in terms of export income that would be lost if the industry was closed down. In the UK in the 1980's the aerial application industry was effectively regulated out of existence and in Europe last year aerial spraying was banned altogether - unless strict operating standards are met.

In NZ this threat was recognised 25 years ago and the GROWSAFE® Certification programme was launched as a vehicle to train people to manage agrichemicals in a responsible manner. GROWSAFE® celebrates its 20th birthday this year and currently most Regional Councils require pilots to hold a GROWSAFE® Certificate.

Certification and Accreditation

Does certification always ensure that the pilot is operating in accordance with the GROWSAFE® Code of Practice (NZS8409:2004) every time they go to work?

Clearly the answer is 'no'.

All it shows is that the pilot has the *knowledge* to operate in accordance with the Code.

Enter **AIRCARE™**

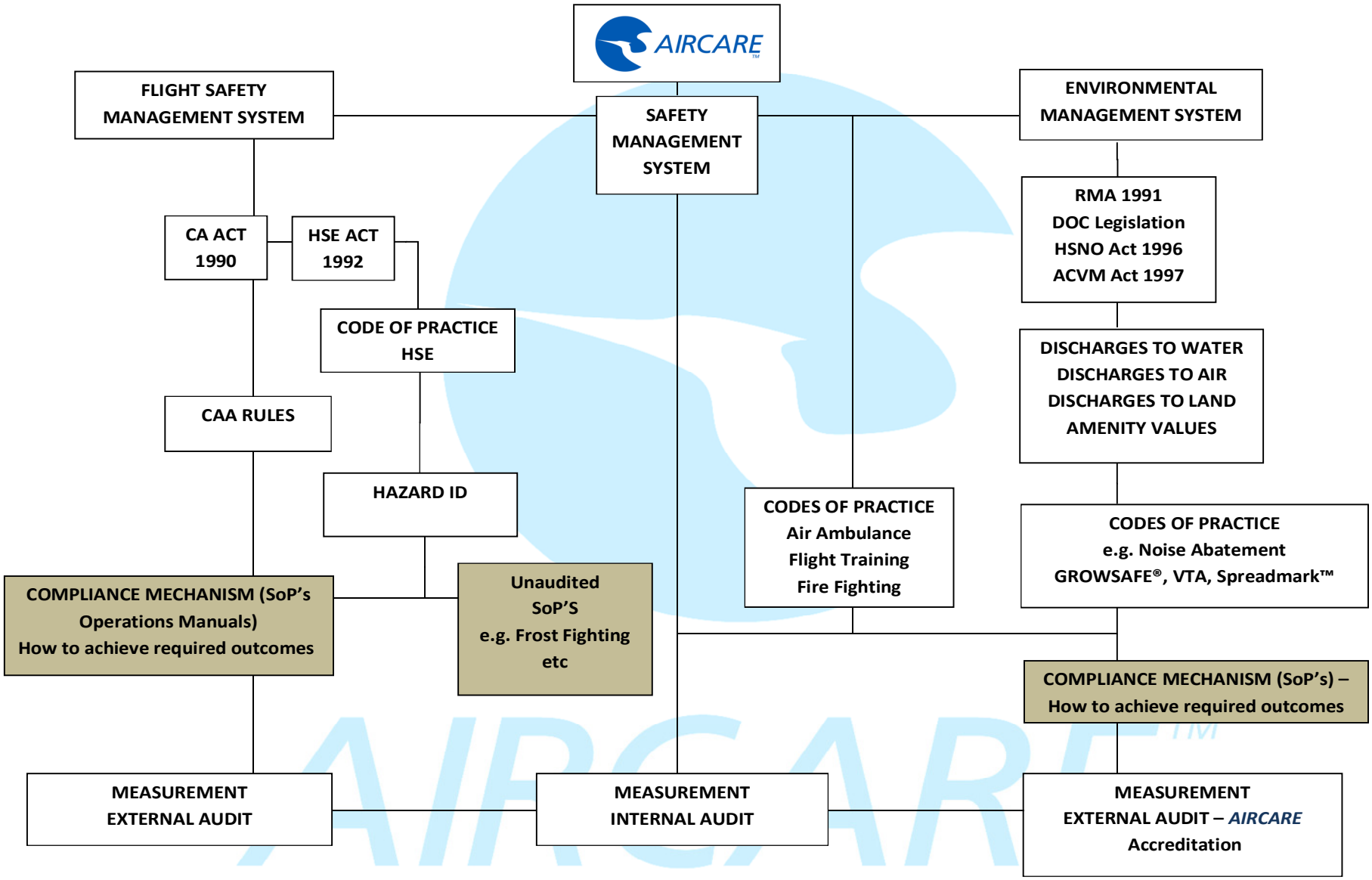
AIRCARE™ is an integrated accreditation programme that requires operators to apply the same robust risk management processes to environmental safety that they have adopted for flight safety. It assures *quality service* to customers. The AIRCARE™ Environmental Programme requires compliance with the following standards:

- NZS8409:2004 Management of Agrichemicals (GROWSAFE®)
- SPREADMARK™ Code of Practice - Aerial
- AIRCARE™ Code of Practice – Vertebrate Toxic Agents
- AIRCARE™ Code of Practice - Noise Abatement

The AIRCARE™ Programme has three components:

- Pilots have to be competent. In this context they are required to hold GROWSAFE® and AIRCARE™ Noise Abatement Certificates. (As far as it is known, NZ is the first country in the world to offer a formal qualification in noise abatement.)
- The organisation has to run a safety management system that in addition to bringing flight safety benefits must also be able to demonstrate that the pilots are operating in accordance with the codes of practice every time they go to work.
- The programme is independently audited.

The aviation industry would welcome Regional Councils requiring AIRCARE™ Accreditation as a *permitted activity* condition to discharge VTA, fertilisers and spray by air. Such a requirement would give regulators an assurance that best practice was being followed.


AIRCARE
FLIGHT SAFETY MANAGEMENT SYSTEM
SAFETY MANAGEMENT SYSTEM
ENVIRONMENTAL MANAGEMENT SYSTEM
CA ACT 1990
HSE ACT 1992
CODE OF PRACTICE HSE
CAA RULES
HAZARD ID
RMA 1991
DOC Legislation
HSNO Act 1996
ACVM Act 1997
DISCHARGES TO WATER
DISCHARGES TO AIR
DISCHARGES TO LAND
AMENITY VALUES
CODES OF PRACTICE
Air Ambulance
Flight Training
Fire Fighting
CODES OF PRACTICE
e.g. Noise Abatement
GROWSAFE®, VTA, Spreadmark™
COMPLIANCE MECHANISM (SoP's Operations Manuals)
How to achieve required outcomes
Unaudited SoP'S
e.g. Frost Fighting etc
COMPLIANCE MECHANISM (SoP's) – How to achieve required outcomes
MEASUREMENT EXTERNAL AUDIT
MEASUREMENT INTERNAL AUDIT
MEASUREMENT EXTERNAL AUDIT – AIRCARE Accreditation

VERIFICATION OF TASK

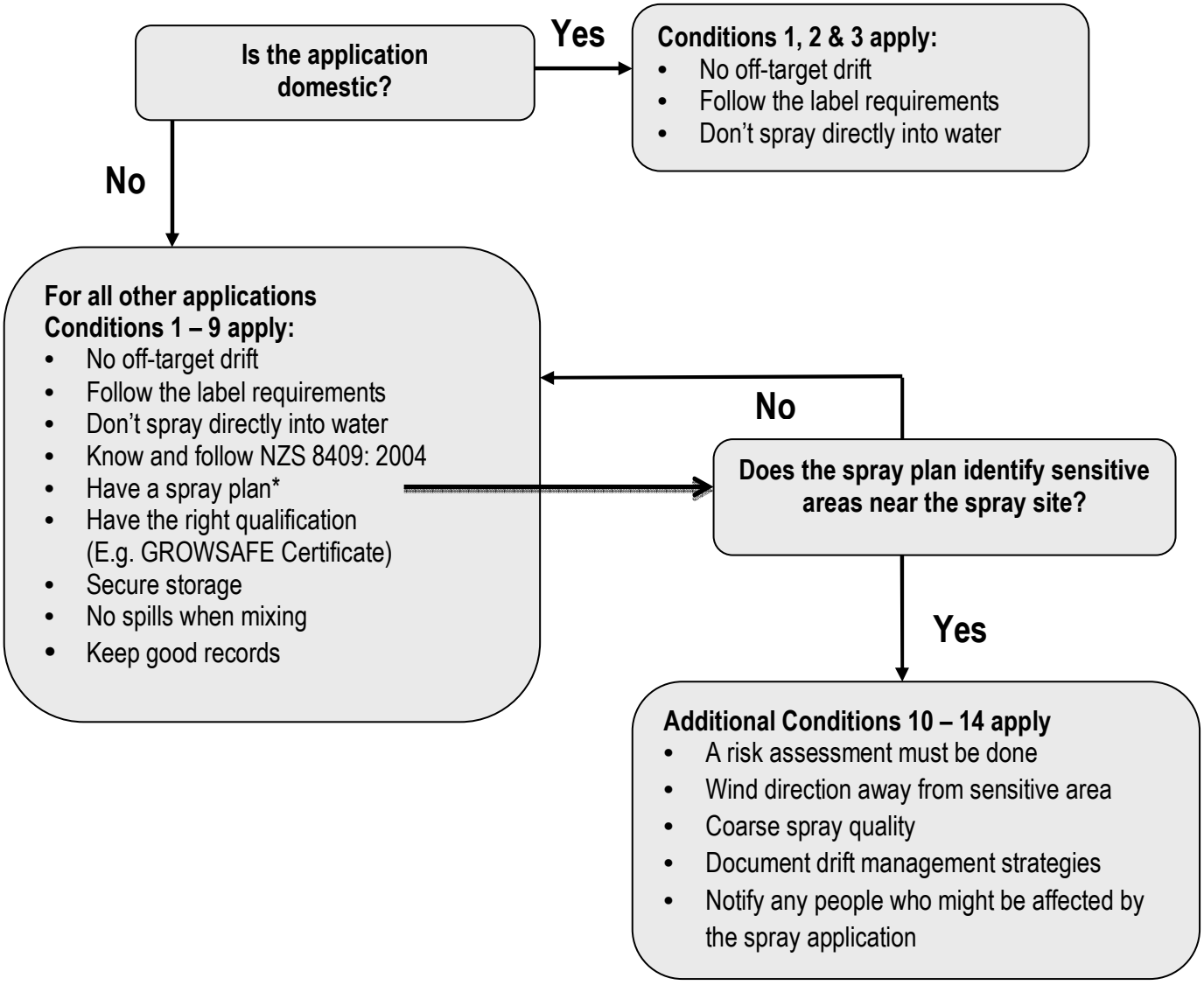
An important component of discharging substances from air is about *verification of the task* – that is being able to provide evidence about what was done, where and when. There needs to be a form of recording of such information.

GPS (Global Positioning System) is one way of recording such information. The demonstration will show how GPS works and the type of records it can provide.

How can verification of task be brought into a regional plan?

Application of agrichemicals: A risk-based approach for a permitted activity rule

If you are applying agrichemicals, follow the chart to determine what requirements you need to meet.



The approach is dependent on a definition of "sensitive area" as this is critical to determining whether conditions 10-14 will need to be undertaken. Examples of sensitive areas include:

- Dwelling houses
- Educational facilities
- Amenity areas and public places
- Domestic and community water supplies
- Water bodies and associated riparian vegetation
- Non target plants and/or crops which are sensitive to agrichemicals
- Organically certified properties e.g. Bio-Gro
- Wetlands, indigenous flora and fauna habitat areas and reserves.

The question for any applicator is having identified if a sensitive area exists:

- What mitigating steps are available to eliminate risk or minimise from any agrichemicals
- How is the relevant information identified, collected and stored in such a way that the information would be available and useful in the event of any drift incident or dispute that may need to be resolved: that is - how would the task be verified.

DEMONSTRATION INFORMATION

The physical form of the product being applied, regardless of whether it is solid (e.g fertiliser or bait) or liquid for spray application greatly influences the precision and evenness of the result achieved on the crop or on the ground. The main features are:

- Product type (liquid, suspension, solid)
- Mean particle/drop size
- Particle/drop size range
- Consistency (batch-to-batch for solids and adjuvant/chemical concentrations for sprays or other products mixed on site)
- Particle shape and smoothness (solids)
- Particle/droplet integrity (ie. will it break up).

Samples of materials applied will be available for inspection today during the demonstrations, including 1080 bait (non-toxic), urea, DAP and super phosphate. Displays will include a demonstration of fertiliser particle size assessment using a sieve box.

Spray application equipment

The spray nozzle and droplet production is the heart of any spray application equipment. There will be a display to show how different nozzle production systems work, including:

- Accuflo
- Flat fan
- Disc and core
- CP nozzle
- Air aspirating
- Micronair (fitted to helicopter)
- TVB (fitted to helicopter).

The key point is a specification of what the task requires, which includes the type of agrichemical being applied, the nature of the target crop and risks associated with the application site. With this information appropriate nozzle selection can be made. The performance of spray nozzles is now being described as spray quality. The product label will describe the spray quality needed.

Ground support

With aerial application of fertiliser, agrichemicals or VTA two major issues in relation to impacts on human health and the environment are non-point source e.g. spray drift, and point source e.g. from mixing and loading operations.

Safe and effective aerial application requires appropriate ground support systems and equipment. Displays include:

- Agrichemicals - Spray application mixing and loading equipment
- VTA - Bait handling and loading
- Fertiliser - Solids handling and loading.

Pattern testing

Evenness of application on the specified target for both liquids and solids can only be determined by testing a single pass of the aircraft to establish the swath pattern. Such testing is done under controlled conditions using collectors appropriate for the task.

For solids (fertiliser) application the Spreadmark Code of Practice is followed:
http://www.fertqual.co.nz/files/downloads/aerialapp01.pdf

Figure 1: Good spread pattern

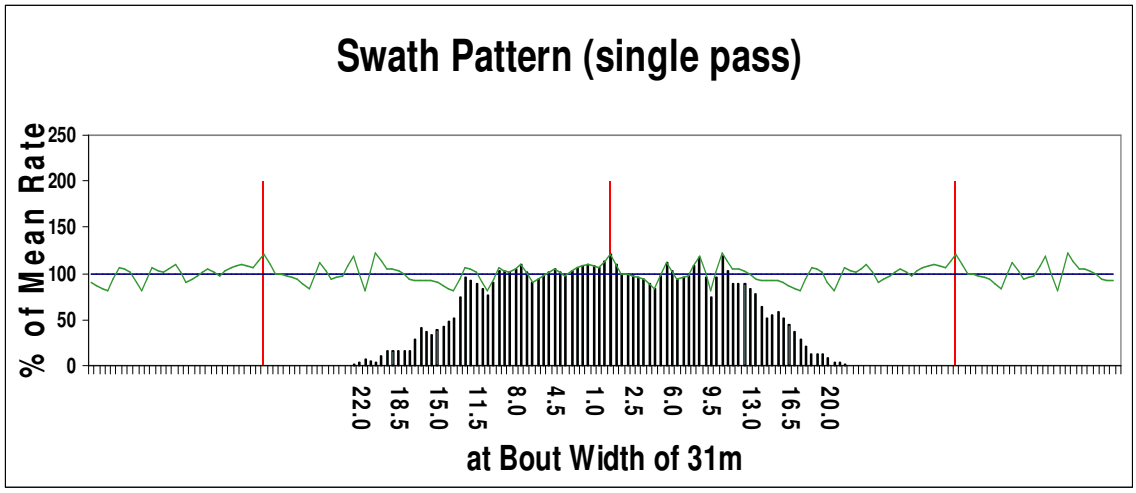


Fig 1 shows a good spread pattern of an aircraft for round and round (R&R) travel applying urea – the black vertical lines show the amount of solid particles collected in each tray. The total swath width is about 44m.

The effective swath width (bout width) is determined according to the evenness of application required.

Figure 2 Swath width (bout width) vs CV%

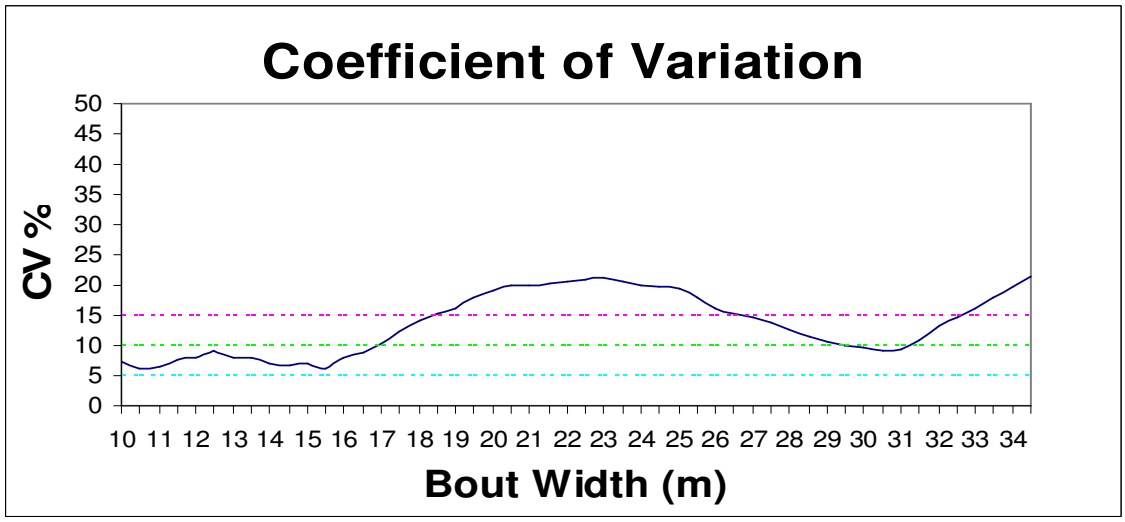


Fig 2 shows how CV% rises for a swath pattern of the shape shown in Fig 1. The higher the CV% value the poorer the overall distribution. In this example a bout width (effective swath width) of 31m as shown by the red lines will give an evenness of application of 10 (CV %) which means it is very even spreading. Under Spreadmark, the maximum permissible CV % for a nitrogen based fertiliser is a pattern test is 15%

Spray application (liquids): For spray application a different collection system is used. Common options include cards, paper tape or a string system. Both the paper tape system and the string system will be demonstrated. The string system is best for trapping very small droplets and so is often used for drift measurements.

Bait application: Because application rates are so low (down to 1 kg per ha or less) collecting the baits in the same trays as for fertilisers does not work. Instead 10m x 10m grids are laid out across the flight path and the number of baits counted in each grid can be used to calculate effective application rate.

Note: I ha = 10 000 m^2 and I kg/ha = 1000gm per ha. Cereal baits are usually about 10 gm which means 100 baits per ha or 1 bait every 100m^2. A 10 x 10 m grid = 100 m^2 so you would expect to find on average 1 bait in that grid.

Spray quality and ASAE S-572 Spray Classification by Droplet Size

This standard defines droplet spectrum categories for the classification of spray tips, relative to specified reference fan tips discharging spray into static air or so that no stream of air enhances atomization. The purpose of classification is to provide the tip user with droplet size information, primarily to indicate off-site spray drift potential, and secondarily, for application efficiency.

As a general rule a spray quality no finer than "coarse" will virtually eliminate spray drift in most situations.

Classification categories[1], symbols and corresponding color codes are as follows:

Classification Category (Spray Quality)	Symbol	Colour Code (Nozzles)	Approximate VMD[2] (micron)
Very Fine	**VF**	**Red**	< 100
Fine	**F**	**Orange**	100 – 175
Medium	**M**	**Yellow**	175 – 250
Coarse	**C**	**Blue**	250 – 375
Very coarse	**VC**	**Green**	375 – 450
Extremely coarse	**XC**	**White**	>450

[1] Developed by the Pest Control and Fertilizer Application Committee; approved by the Power and Machinery Division Standards Committee; adopted by ASAE PM41.
[2] VMD = volume median diameter. Half the volume of spray is in droplets smaller than the VMD and half the volume is in droplets bigger than the VMD

Droplet sizes are usually expressed in microns (micrometers). One micron equals one thousandth of a millimeter. Other than the effects of the specific material being sprayed, the four major factors effecting droplet size for hydraulic nozzles are: tip style, capacity, spraying pressure and spray pattern type.