SECTOR RISK PROFILE
AGRICULTURAL AVIATION
COMPANION REPORT

DEVELOPED BY: Aerosafe Risk Management

June 2013

ABOUT SECTOR RISK PROFILES (SRP)

A Sector Risk Profile (SRP) presents a strategic picture of the key risk issues that face a specific sector of the aviation industry at a given point in time. An SRP contains the definition of the context of the sector and the context of the risk profile, identifies key strategic and operational risks, their associated impacts and a resultant risk rating and then presents proposed high level treatments, the associated residual risk and the risk ranking. An SRP provides the platform for the agricultural aviation sector to develop detailed risk reduction plans, outline the agreed risk reduction measures, as well as timelines for implementation and accountability.

ABOUT AEROSAFE RISK MANAGEMENT

The Aerosafe Group is a global safety and risk management company, which provides services, support and tailored products in the fields of governance, risk management and safety management systems to companies around the world. With over fifteen years in operation, Aerosafe offices are located in Australia, North America, India, China and New Zealand. The integrated business model allows Aerosafe to support its global client base across the aviation, defence, regulatory and transport sectors. Recognised as international experts in these sectors, Aerosafe has been invited to set standards with government regulators, industry groups and companies alike.

Aerosafe represents the leading edge of governance, risk management and safety management system consulting internationally. Through cutting edge methodology and practice, the company provides services, support and tailored solutions through its consulting, training and risk network divisions. In recent years, Aerosafe has developed the methodology and expertise to lead the industry in Strategic and Industry Risk Profiling.

AEROSAFE RISK MANAGEMENT

AEROSAFE RISK MANAGEMENT
Level 7. Wellington Chambers.
154 Featherston Street. Wellington 6011
Phone +64 4 496 5206 www.aerosafe.com.au

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PROJECT CONTACT DETAILS AND ACKNOWLEDGEMENTS:

PROJECT CONTACT:

Kimberley Turner – *Chief Executive Officer, Aerosafe Risk Management*
Level 1, 40 Lord St, Botany, NSW 2019

STAFF ACKNOWLEDGEMENTS:

Civil Aviation Authority of New Zealand
John Kay – *General Manager Policy and System Interventions (Project Sponsor)*
Jack Stanton – *Intelligence, Risk and Safety Analysis Manager (Project Manager)*
Michael Campbell – *Team Leader Safety Data Management (Project Team Member)*
Steve Kern – *Manager Helicopter and Agricultural Operations*

New Zealand Agricultural Aviation Association
Graeme Martin – *General Manager, Aginformation Ballance Agri-Nutrients Ltd*
Irene King – *Chief Executive, Aviation Industry Association*

AEROSAFE RISK MANAGEMENT

CAA CIVIL AVIATION AUTHORITY OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

AEROSAFE
RISK MANAGEMENT

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SECTOR RISK PROFILE CONTEXT

1.0 INTRODUCTION TO THE COMPANION REPORT

The Agricultural Aviation Sector Risk Profile (SRP) Companion Report is provided as a supplementary report to the SRP report. Its purpose is to document the full contextual analysis that was completed as part of the development of the (SRPSRP). In the SRP report a summary of the context is provided in Section 2. This companion report provides the expanded contextual view that underpins the profile.

2.0 NEW ZEALAND AGRICULTURE: A SHORT OVERVIEW

Agriculture plays a fundamental role in the New Zealand economy and is currently at its highest level in a number of years.[1] Agriculture, forestry production and processing make up more than 5% of NZ Gross Domestic Product(in the December 2012 quarter), and a total of $8,791 million (in 2012). The top 2 exports of NZ as at Feb 2012 was milk powder, butter and cheese $12 097 million, followed by Meat and edible offal at $5482 million[2] . The productivity of the agricultural industry is also increasing, surpassing the wider economy's annual compound growth.[3]

Nearly 14 million hectares of the total New Zealand land area (26.7 million hectares) is used for pastoral agriculture, arable and fodder cropping, or production forestry.[4] The greatest area of arable land is under grazed, permanent pasture. The fertiliser industry is one of a number of service industries that underpin the agricultural and forestry industries. Fertilisers are necessary for maintaining the productivity of the land, and in some cases without it, the land would become unusable for industry.

The way that New Zealand's agricultural land is utilised is changing, incorporating significant increases in dairy farming (for example there was 6.5 million cattle in 2012, an increase of 23% since 2007). In turn, beef and wool production has decreased (for example sheep numbers were 31.2 million in 2012, a reduction of 7.3 million from 2007). This change has a flow on effect, reducing the type of farming operations that traditionally supported agricultural aviation operators' services. Dairy farm operations are comparatively smaller in nature and utilise more specific application techniques, refining the required aerial operations.

3.0 NEW ZEALAND AGRICULTURAL AVIATION HISTORICAL BACKGROUND

Early trials of aerial application of seed and later fertiliser, a process called top dressing, commenced in New Zealand in 1947[5]. This addressed the problem of servicing the country's mountainous terrain, greatly improving agricultural productivity, as well as reducing soil erosion. By 1958 there were 73 commercial top dressing operators in New Zealand.[6] In 2012, almost 130,000 hours per year were flown aircraft engaged in agricultural activities; 43,909 were conducted by aeroplanes, and the remaining 75,654 by helicopters.[7]

Early aircraft were modified fixed wing aeroplanes, with many ex-military aircraft such as de Havilland Tiger Moths and Piper Cubs being converted to include hoppers (storage containers used to dispense granular material), installed inside aeroplanes. The (then named) Civil Aviation Department detailed 23 specifications for aerial topdressing aircraft, such as climb rates, ground handling and the ability to operate from short airstrips. The American based Fletcher Aviation Corporation presented the Fletcher FU 24 aircraft in 1953 which was quickly taken up by many in the industry. The FU24 series and subsequent versions, such as the Cresco, remain the most commonly used agricultural aircraft in New Zealand, comprising more than 70% of the aeroplanes operating in the period 1970 to 2007.[8]

Agricultural aviation activities have expanded to include aerial application of lime, minerals, and specialised trace elements, animal control and data capture. Global Positioning Systems (GPS) now guides aerial application to improve accuracy, and agricultural helicopter now outnumber aeroplanes, providing additional flexibility in the operating environment. For example, in 2012, approximately 4.7 million tonnes of fertiliser was applied by fixed wing operators, and 7.7 million tonnes by helicopter operators.[9]

The NZ Agricultural Aviation Association (NZAAA), now a division of the Aviation Industry Association (AIA), was established in 1949 and has a charter to represent the sector with the aim to providing an 'environment where its members can prosper in safety'.[10]

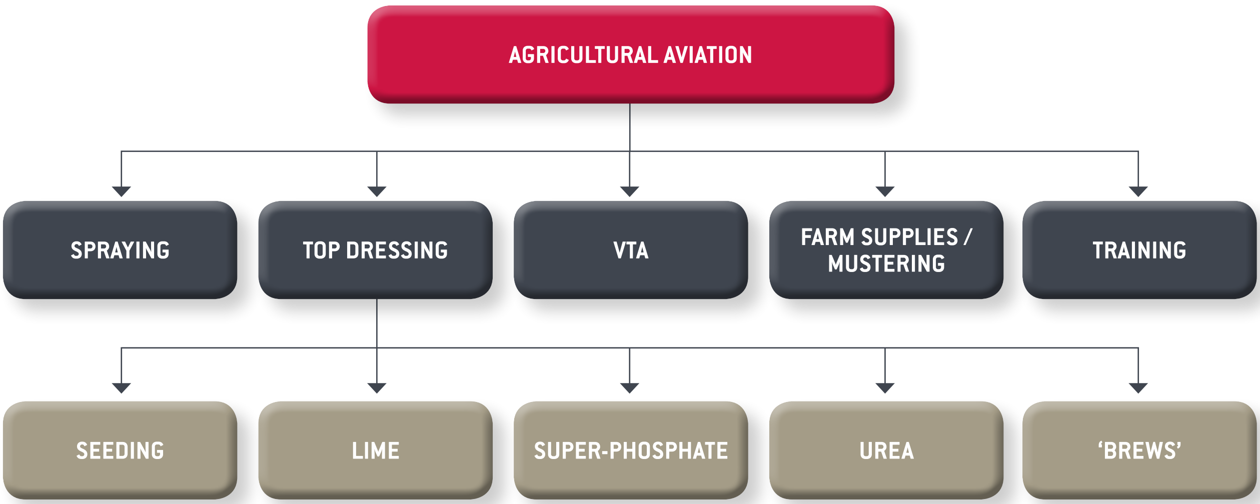
4.0 THE AGRICULTURAL AVIATION SECTOR: A DEFINITION IN THE CONTEXT OF THE SRP

In general, agricultural aviation activities include the use of aircraft for dispensing activities,[11] dropping or delivering farm supplies and materials in rural areas, surveying agricultural forest or water areas, feeding or transferring livestock on farms in rural areas[12], or reconnaissance of the proposed treatment area for the above activities. Specifically, agricultural aviation operations include the use of an aircraft for the purpose of:

- Dispensing substances such as agricultural chemicals (agrichemicals) or others for the purpose of plant nourishment, soil treatment, propagation of plant life, pest control or other impacts on agriculture and forestry
- Delivery of farm supplies on farms in rural areas
- Surveying agricultural, forest or water areas
- Feeding or transferring livestock on farms in rural areas
- Reconnaissance activities for any of the above operations (CAR Part 1).[13]

For the purposes of the SRPSRP, Figure 1 illustrates how the activities of agricultural aviation operations have been defined. Each of these activities has been described in more detail within Section 1.6.

FIGURE 1 *Definition of New Zealand agricultural aviation activities*



5.0 REGULATORY CONTEXT

Agricultural aviation is subject to a number of different regulatory requirements including Civil Aviation legislation as well as environmental and health and safety requirements.

5.0.1 AVIATION REGULATORY CONTEXT

Agricultural aircraft operations in New Zealand are conducted in accordance with the Civil Aviation Act 1990 specifically Civil Aviation Regulation (CAR) Part 137, the scope of which includes agricultural aircraft operations and training, as well as certification and aircraft instrument requirements. Many operators who hold an agricultural aircraft operator certificate (AAOC) hold other certificates issued by CAA; such as training, aircraft maintenance, manufacture and air operations.

A large proportion of agricultural helicopter operators hold a Part 119/135 Air Operator Certificate (AOC) allowing full utilisation of the helicopter's multi-role capability to conduct passenger transport flights. Part 119 mandates the organisations use of a management system. The use of a management system which covers safety/quality assurance places these operators in positions of organisational strength. Operations under Part 137 are not similarly adjoined to the Quality Management System requirements of Part 119.

The CAA performs its functions of oversight and surveillance through the conduct of routine inspections education and research initiatives. The inspection frequency is partially influenced by the organisation's risk profile score, as determined by the CAA. Other forms of surveillance include spot-checks, reviews of available occurrence reports, special purpose audits and safety investigations.

In 2007 the CAA responded to concerns over the efficacy of Part 137 (Lewis Report 2005) and commenced development of a more detailed, prescriptive approach to the rule set in terms of certification standards, and to correct deficiencies or anomalies in the existing rule. Surveillance activities (including accident investigation findings) highlighted rule deficiencies such as overload weight determinations, calculation of hopper contents, seating restraints, management of fatigue and the definition of some agricultural aircraft activities.

In 2008 the CAA conducted a detailed Review of Agricultural Aircraft Safety[14] which identified numerous inconsistencies across the agricultural aviation sector apparent at the time. A major conclusion of this review was to rewrite Part 137, addressing the findings and recommendations. Deficiencies in the rule would be remedied to provide uniformity and improvement in operating standards and the requirement for the operator to document management systems and operating procedures would significantly improve the CAA's ability to monitor operator compliance and determine safety risk.[15]

Rule development progressed with the initial support of a majority of the Industry and the declared support of the NZAAA. The CAA published the Proposed Rule[16] and subsequently support for the initiative was withdrawn by the AAA. This was the result of concerns about the content of the proposed Rule and the potential costs of compliance. The rule amendment was shelved in 2012.

5.0.2 FUNDING

The government believes that aviation organisations should meet the full cost of regulating these operations. The civil aviation sector derives benefits from the CAA's services and therefore the sector should meet the related costs – both under the CAA's funding principles and also under the charging guidelines set by Treasury and the Office of the Auditor-General.[17]

5.0.3 CAA AUDITING ACTIVITY

The CAA undertakes a range of surveillance activities, including spot checks, documentation audits and routine inspections of Part 137 organisations. Inspections are conducted through a 'user-pay' system, with the operator paying a set rate per hour for the surveillance conducted by the CAA. In 2007 the CAA adopted a risk-based approach to surveillance, whereby inspection depth and frequency was determined (in part) on the risk index for each operator, as determined by CAA staff.

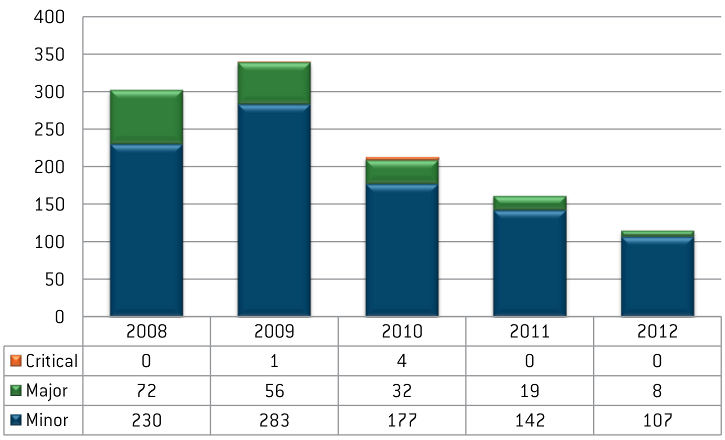
In 2009, 153 Inspections of 104 Part 137 certificate holders were completed, which then declined by 52% over the next 3 years. This is reflected in the declining number of audit findings (see Figure 2) and corresponding cause descriptors shown in Figures 8 and 9. During this period some organisations underwent re-certification which impacted the Inspections completion figures.

The number of Inspection surveillance activities, shown in Figure 2 varied significantly in the period of study, declining nearly 50% between 2010 and 2012. Generally the finding types are 'minor', as shown in Figure 3, with an apparently decreasing number of 'major' findings. It is not clear if there is a direct relationship between the number and type of Inspections conducted and the reduced frequency of 'major' findings. The limited number of 'critical' findings, which indicate a non-compliance or finding which has the potential the cause loss of life or limb, demonstrates that non-compliances with severe consequences are not frequently identified in the industry.

FIGURE 2 *Number of Inspections conducted on agricultural aviation operators by CAA (2008 – 2012)*

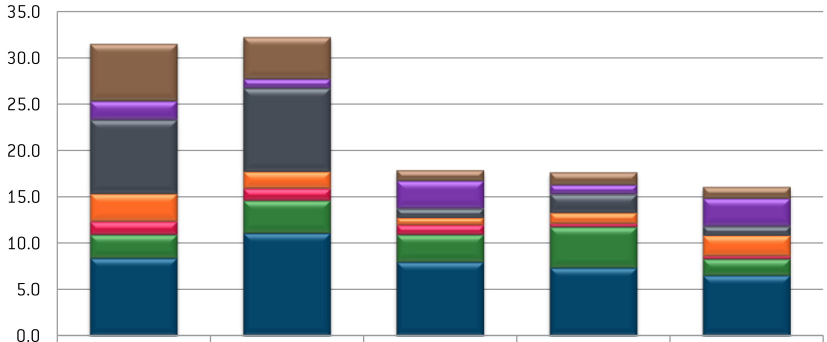
	2008	2009	2010	2011	2012
Number of Inspections conducted (all types)[18]	141	153	153	109	80

FIGURE 3 *CAA 'Finding Types' assigned to agricultural aviation operators (2008 – 2012)*



The majority of findings were categorised as 'organisational factors' and, as shown in Figure 4, related to inadequate checking, controlling and monitoring. This type of finding manifested primarily in incomplete documentation and lack of effective documentation and record management (for example logbook records). Instances determined to be caused by 'lack of knowledge' often related to maintenance and aircraft modifications or conversions, particularly the conduct of inspections.

FIGURE 4 *CAA finding rate of 'Cause Descriptors' assigned to agricultural aviation operators (2008 – 2012) per 10 Inspections*



	2008	2009	2010	2011	2012
Inadequate checking	6.2	4.5	1.2	1.4	1.3
Risk misinterpretation	2	1	3	1	3
Poor decisions	8	9	1	2	1
Lack of knowledge	3.0	1.8	0.8	1.2	2.2
Inadequate procedures	1.4	1.3	1.0	0.4	0.3
All other cause descriptions	2.6	3.5	2.9	4.4	1.8
Inadequate control and monitoring	8.4	11.0	8.0	7.3	6.5

5.0.4 OTHER GENERAL REGULATORY CONSIDERATIONS

On 5 May 2003, the CAA was designated to administer the provisions of the Health and Safety in Employment Act 1992 with respect of the aviation sector. The Prime Ministerial Designation requires the CAA to administer the Health and Safety in Employment Act 1992 for the aviation sector, specifically for aircraft while in operation and a stand-alone department was formed within the CAA for its administration. The scope of the designation covers the administration of the Act for work on board aircraft and for aircraft as places of work while 'in operation'. Specifically, the scope incorporates the period when the aircraft is taxiing, taking off, in flight, and landing.[19]

In the agricultural aviation context, a Standard was jointly produced by the CAA, AAA, Federated farmers and the Department of Labour. This standard called Safety Guidelines: Farm Airstrips and Associated Fertiliser Cartage, Storage and Application espouses a fundamental approach to the management of risks within the workplace in this industry.[20] The purpose of this document is to provide guidance to ensure the quality of the fertiliser available is 'fit for purpose and provides information about farm airstrips and the farmer's role in providing an adequate and reasonable strip, and an appropriate fertiliser storage facility'.

Approved codes of practice are guidelines which have been approved by the Minister of Labour. Because of their approved status, they provide industry agreed methods of compliance with regard to practicable steps to take in the management of specific hazards. In enforcement situations, they may be offered as evidence of the availability of practicable steps.

To a large extent agricultural aviation activity can fall under the provisions of the Resource Management Act (RMA) 1991.[21] The purpose of this Act is to promote the sustainable management of natural and physical resources. The RMA is then exercises by Regional Councils in differing ways (e.g, some require letters of consent for the conduct of certain types of aerial spraying). Where it interfaces with agricultural aviation the RMA is managed by 12 separate 'Regional Councils' within New Zealand which are tasked with the management of air, water and soil under the Act as well as soil and biodiversity conservation and water quality.

The Hazardous Substances and New Organisms (Low Risk Genetic Modification) Regulations 2003 also pertains to agricultural aviation operations. It was enacted to reform the management of hazardous substances and new organisms. There is a strong relationship between the HSNO Act and the Health and Safety in Employment (H&SE) Act 1992 because hazardous substances are often found in workplaces[22].

6.0 AIRCRAFT AND PILOT CONTEXT

6.0.1 AIRCRAFT

A. Aeroplanes

Types of aeroplanes used in agricultural operations are relatively few, although a number of FU24 series aircraft have been modified to have more engine power, creating more variants. The Air Tractor, Gippsland GA200 and a few other types comprise the remainder of the aeroplanes in use.

The modification of aeroplanes for agricultural operation, particularly increased weight and turbine conversion, has changed the overall performance. The basis for performance calculations, and particularly the application of Part 137 Appendix B for increased payloads above that of the MCTOW, has been impacted by this shifting aeroplane capability, and can result in an exceedence in the manufacturers' MTOW

The conversion of a number of fixed wing aircraft from piston to turbine aircraft led to the airframes operating under more power and carrying greater weights, with the cost of these conversions ranging from $250 000 to $500 000 NZ dollars. Operators bore this expense for increased productivity, better aircraft performance and for reasons of maintenance, as these engines have a longer service life and are easy to maintain and source replacement parts for.[23] It is important to note that these turbine engines were not made for the airframes that they were being placed in and there was no study undertaken to establish the possible effects that this powerful engine could have on the existing and ageing airframe it would be occupying. This has subsequently led to an increase in aircraft defect rates on modified aircraft. The number of such modifications has reduced in recent times however the fleet still operates with 21 Fletcher aircraft which have been modified. These modifications were with 14 Walters, 7 PT6 and 1 TPE331 type engines.[24]

There is a decline in the number of aeroplanes available to conduct aerial operations. The existing fleet is ageing due to the financial viability regarding replacement aeroplanes, which is exacerbated by the lack of new and suitable aeroplanes being manufactured or certified.

B. Helicopters

A specific range of helicopters service agricultural operations, with the Robinson R44, Eurocopter AS350 and Bell 206 dominating the fleet. There are more modern helicopters which are available for use, which are better suited to the more specialised and targeted applications required under modern farming needs. The growing popularity and versatility of helicopters creates an environment of pressure for the fixed wing operators who, in some areas, are unable to compete financially and operationally.

Modifications to role equipment used and equipment on the helicopter occur in New Zealand in order to maintain competitive advantage. Anecdotally, some modifications are un-approved due a reluctance to undertake the certification process through the CAA.

FIGURE 5 *Agricultural aviation aircraft types in New Zealand*

AIRCRAFT TYPE	MANUFACTURER	VARIANT	NUMBER OPERATING	DESCRIPTION
AEROPLANES				
180J	Cessna	Piston	1	
A185F	Cessna	Piston	1	
AT-402B	Air Tractor	Turbine	4	
AT-502B	Air Tractor	Turbine	1	
DHC-2 Beaver	De Havilland Canada	Piston	1	
GA200	Gippsland	Piston	6	

AIRCRAFT TYPE	MANUFACTURER	VARIANT	NUMBER OPERATING	DESCRIPTION
AEROPLANES CONTINUED				
G-164B	Gippsland	Piston	1	
FU24	NZ Aerospace	Piston	1	
FU24-950	NZ Aerospace	Piston	8	
FU24-950	NZ Aerospace	Turbine	11	Modified Engines
FU24-950M	NZ Aerospace	Piston	7	
FU24-950M	NZ Aerospace	Turbine	6	Modified Engines
FU24-954	NZ Aerospace	Piston	5	
FU24-954	NZ Aerospace	Turbine	4	Modified Engines
750XL	Pacific Aerospace	Turbine	1	
Cresco 08-600	Pacific Aerospace	Turbine	22	
Z-137T	Zlin	Turbine	1	
HELICOPTER				
R44	Robinson	Piston	51	
AS 350	Aerospatiale	Turbine	23	
SA 315	Aerospatiale	Turbine	1	
AS 355	Aerospatiale	Turbine	1	
407	Bell	Turbine	1	
206	Bell	Turbine	35	
UH-1	Bell	Turbine	7	
UH-12	Hiller	Piston	1	
269	Hughes	Piston	19	
369	Hughes	Turbine	33	
BK 117	Kawasaki	Turbine	1	
500	McDonnell Douglas	Turbine	8	
R22	Robinson	Piston	17	
R66	Robinson	Turbine	1	

6.0.2 PILOTS

Pilots conducting Part 137 operations hold Agricultural and Chemical Ratings. However, CAA rules require that these ratings are entered into the pilot logbook rather than license. Consequently CAA does not have specific data on the number, location, age or experience of the agricultural aviation pilot fraternity, nor the individual hours flown per year.

Agricultural pilots in New Zealand must hold at least a private pilot's licence and have logged a minimum of 200 hours total time with at least 100 of these hours on the category of aircraft they will operate – fixed wing or helicopter. To conduct agricultural operations for hire or reward a pilot must be the holder of a commercial pilot licence. An agricultural pilot rating requires 75 hours specialised agricultural flight training. The first 1000 hours of productive flying, as a Grade 2 agricultural pilot, must be attained under the supervision of a qualified Grade 1 agricultural pilot. Once 1000 hours productive agricultural flying is achieved, the pilot becomes an unrestricted Grade 1. Then, each year pilots undertake a competency assessment with an instructor or Flight Examiner.

The current demographics of agricultural pilots is such that the existing fixed wing pilot pool is predominantly pilots who are very experienced and approaching retirement age. Helicopter operators have an increasing number of pilots entering the industry with a lower average age and experience than the fixed wing pilot population.

7.0 OPERATIONAL CONTEXT

Agricultural aircraft operations in New Zealand are conducted using both aeroplanes and helicopters. Each category has operating characteristics and economies that make it better suited to particular tasks and so we see a mix of the two aircraft categories working in concert. Within each category there is diversity in types that also are better suited to various tasks.

7.0.1 OVERVIEW OF ACTIVITIES UNDERTAKEN

In the 1960's and 70's all operations including topdressing, spraying, VTA and transfer of livestock/ mustering were conducted by aeroplanes, which continued till the mid 90's. Over time, the use of helicopters for agricultural operations has become increasingly popular in NZ. The helicopters' flight characteristics have proven to be more suitable for the range of activities, particularly the application of product onto smaller or more targeted treatment areas requiring greater manoeuvring ability and application of product (fertiliser of spray) where no or unsuitable airstrip infrastructure exists within an economical flying distance.

Aeroplanes remain suited to the broadcast application of larger treatment areas, applying traditional products such as lime and superphosphate. Figure 6 is an overview of activities undertaken.

FIGURE 6 *Description of agricultural aviation activities in New Zealand*

NAME	DESCRIPTION	AIRCRAFT TYPE(S) USED	PRODUCT USED	PRODUCT USED
Spraying	Application of agrichemicals – mainly herbicides and desiccants for the control of weeds in forestry, pasture or marginal land, and to a lesser degree, insecticides for the control of insect pests. Occasional application of soil and plant nutrients by the methods also (eg Lime emulsion)	Almost exclusively helicopter. Some specialist aeroplane operations still exist	Herbicides, pesticides, desiccants (or some fertilisers) in liquid or slurry form	**HECTARES** F/wing 51,595 Helicopter 905,852
Top dressing (seeding)	Aerial distribution of grass (or other) seed for propagation or land stabilisation. Often mixed and applied coincident with topdressing products	Helicopter or aeroplanes	Grass or other seeds	**TONNES** F/wing 284 Helicopter 356
Top dressing (lime)	Aerial distribution of crushed lime rock in flowable form	Mainly aeroplanes	Crushed lime rock	**1000 TONNES** F/wing 177,080 Helicopter 1,589
Top dressing (super phosphate)	Aerial distribution of solid fertilisers and trace elements in a flowable medium or granulated form to agricultural land for soil improvement or plant propagation	Predominantly aeroplanes. But helicopter application also	Superphosphate	**1000 TONNES** F/wing 340,273 Helicopter 5,154
Top dressing (Urea)	Aerial distribution of nitrogen rich plant nutrient as a flowable medium onto pasture and forestry	Helicopter and aeroplanes	Urea	**1000 TONNES** F/wing 26,582.1 Helicopter 25,853.2
Top dressing (brews)	Specialist mixes of trace elements determined to be deficient in the soil	Helicopter or aeroplanes		**1000 TONNES** F/wing 105 Helicopter 1193
VTA	Aerial distribution of Vertebrate Toxic Agents in a pelletised form or 'laced bait' for control of rodents and possums	Predominantly helicopter. Some aeroplanes	1080 Sodium Fluoro acetate	**1000 TONNES** F/wing 58 Helicopter 1172
Farm supplies / mustering	Mustering/transferring livestock and or delivery of farm supplies, predominantly fencing material, animal feed supplements or erosion control	Almost exclusively helicopter as external load	N/A	F/wing Nil reported Helicopter 434 hrs
Training	Specialist helicopter or aeroplanestraining for the issue of an agricultural pilot rating conducted in accordance with Part 61	Helicopter and aeroplanes	N/A	F/wing Nil reported Helicopter 185 hrs[25]

7.0.2 OPERATOR 'COST OF COMPLIANCE'

It is difficult to precisely calculate the cost of compliance for small operators. However, Industry have estimated the total cost of compliance for small agricultural operators to be in the vicinity of NZ$58,000.00 per annum for helicopter operators and NZ$51,000 for aeroplanes operators, of which $19,000 and $13,000 respectively are attributed to CAA costs.[26] There is a general industry sentiment, evidenced by survey and interviews, that the overall cost of compliance for smaller operators is prohibitive.

7.0.3 VOLUME AND FREQUENCY OF ACTIVITY

The following trends were noted through the review of agricultural operational return data (Figures 7 through to 9):

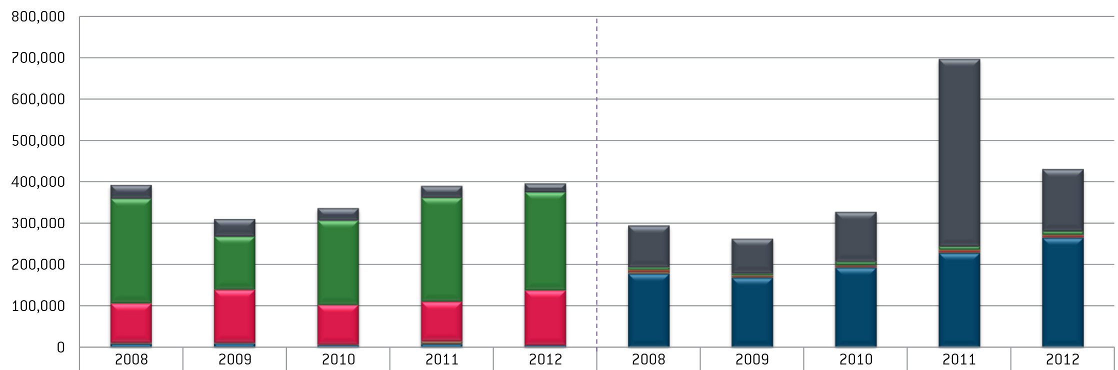
A. **Fixed wing**

- Between 2009 and 2012 there was a relatively stable trend in the number of loads carried (e.g, an average of approximately 350,000 per year). This is less than helicopter load carriage overall
- Super-phosphate is predominantly spread by fixed wing aircraft, and there has been a gradual increase in the amount used
- Between 2009 and 2012, the carriage of urea has gradually declined, although urea was a small proportion of the top dressing activities
- Fixed wing delivered most super-phosphate and lime over this period with stable loads over 2011 and 2012.

B. **Helicopters**

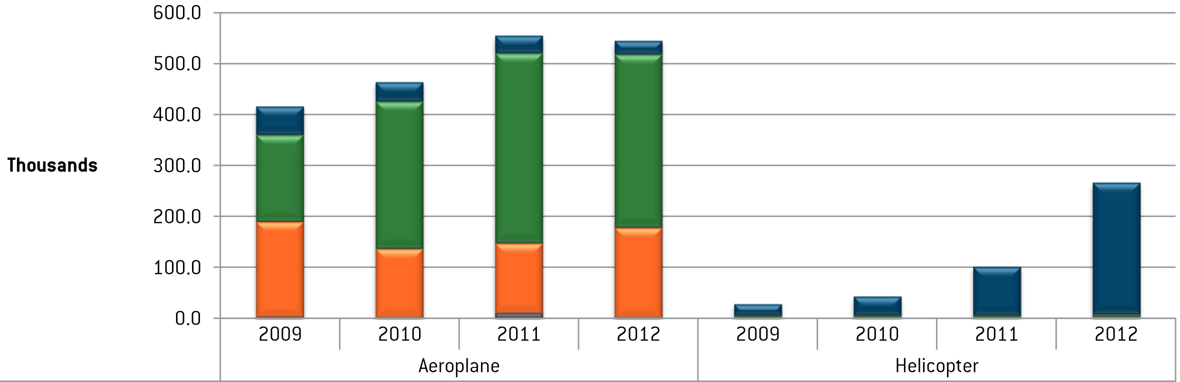
- Between 2009 and 2012, the number of loads carried by helicopters has continued to steadily grow, also noting a significant spike in activity seen in 2011 also (approx. 700,000 loads). In 2012 the CAA recorded approximately 420,000 loads conducted by helicopters)
- Helicopters delivered nearly all urea since 2009 with a very large increase in 2012.

FIGURE 7 *Number of loads taken by both aeroplanes and helicopter aircraft (2009-2012) –Source: CAA Agricultural aviation operator 'returns'*



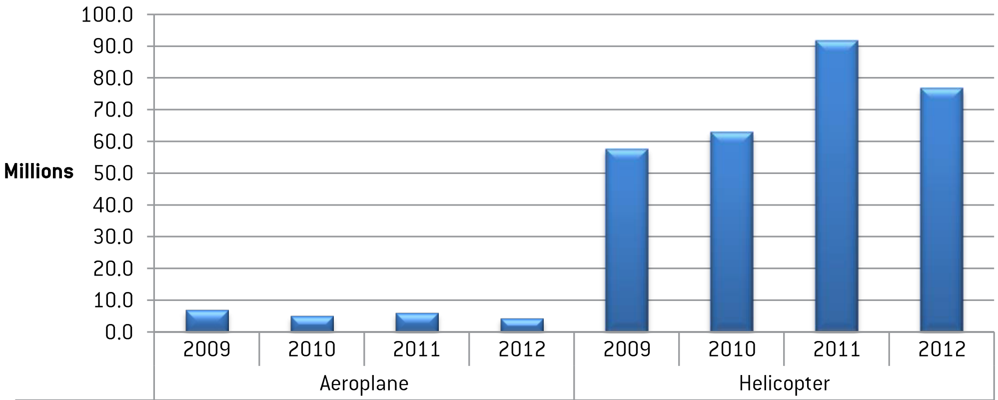
	Fixed wing 2008	Fixed wing 2009	Fixed wing 2010	Fixed wing 2011	Fixed wing 2012	Rotary Wing 2008	Rotary Wing 2009	Rotary Wing 2010	Rotary Wing 2011	Rotary Wing 2012
Top dressing: Urea	33288.0	42166.0	30012.0	28280.0	20934.0	100786.5	83655.8	121042.7	452378.3	150183.7
Top dressing: Super-phosphate	251980.0	128331.4	202784.7	250340.0	236280.0	6149.5	5224.0	7791.7	8518.4	8899.8
Top dressing: Seeding	602.0	248.0	157.0	170.0	540.0	2512.4	1267.9	1732.7	2434.9	2171.4
Top dressing: Lime	94696.0	127633.0	96133.0	95500.0	132249.0	1675.6	855.5	1590.4	2335.6	2806.8
Top dressing: Brews	2709	1849	977	6420	124	5659	3604	3174	2720	2355
Spray or VTA	9610	10375	6619	9382	6090	178020	168643	192929	228128	264380

FIGURE 8 *Number of tonnes or litres taken by both aeroplanes and helicopter aircraft during top dressing activities, i.e. excluding 'spraying or VTA (2009-2012) – Source: CAA Agricultural aviation operator 'returns'*



	Aeroplane 2009	Aeroplane 2010	Aeroplane 2011	Aeroplane 2012	Helicopter 2009	Helicopter 2010	Helicopter 2011	Helicopter 2012
Top dressing: Urea	56039.4	37812.3	34448.3	26582.1	22286.5	37261.8	95581.1	258532.3
Top dressing: Super-phosphate	170609.5	289148.3	373185.1	340273.4	3660.3	3357.3	3380.6	5154.1
Top dressing: Seeding	103.8	42.9	84.7	284.0	211.4	363.2	890.2	356.3
Top dressing: Lime	187276.0	135395.0	137400.5	177080.7	376.3	799.6	915.9	1589.5
Top dressing: Brews	1763.4	769.3	9200.6	105.5	1998.5	1466.9	1039.4	1193.4

FIGURE 9 *Number of tonnes or litres taken by both aeroplanes and helicopter aircraft during spraying or VTA (2009-2012) – Source: CAA Agricultural aviation operator 'returns'*



	Aeroplane 2009	Aeroplane 2010	Aeroplane 2011	Aeroplane 2012	Helicopter 2009	Helicopter 2010	Helicopter 2011	Helicopter 2012
Spray or VTA	6873259.0	4954332.5	5977672.0	4236381.4	57634108.	62983345.	91860241.	76758954.

7.0.4 NUMBER AND NATURE OF OPERATORS

There are presently 104 agricultural aviation certificate holders in New Zealand, 22 of which operate fixed wing aeroplanes only, and another 3 operators using a mix of fixed wing and helicopters. There is estimated to be a total of 81 fixed wing aeroplanes and 199 rotary aircraft being operated. [27] See Figure 10 for an overview of operator locations, sizes, and types of agricultural aviation aircraft.

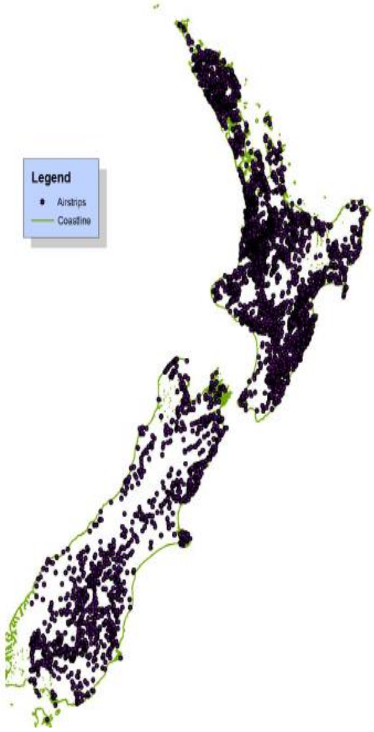
Apart from several substantially sized fixed wing organisations, most remaining fixed wing agricultural operators utilise 1 or 2 aircraft. This organisational model is subject to greater commercial pressure due to competition from similar operators. Some of the larger fixed wing operators who are under corporate ownership with greater resources and personnel have voluntarily implemented these systems which may reduce the safety risk to their operation.

FIGURE 10 *Location of Part 137 operators throughout New Zealand and the nature and number of aircraft operated – Source: Civil Aviation Authority*

7.0.5 AIRSTRIPS AND SUPPORTING INFRASTRUCTURE

There are approximately 3670 airstrips (see Figure 11) in New Zealand which support the agricultural industry, a number of which would not meet the CAA published Guidelines.[28] A high proportion of the owners of these airstrips cannot afford the financial investment that would be required to upgrade their airstrips and adequately manage them. Airstrips have prescribed guidelines which include optimum width, length, surface, position and slope of the airstrip. Airstrip conditions that do not meet the guidelines will adversely affect or restrict the type of aircraft which can safely utilise it. Effective and continuous maintenance of these airstrips is also of key importance for safe operations. Hazards on or around the airstrip contribute significantly to accidents and incidents.

FIGURE 11 *Airstrip coverage in New Zealand – Source: 'An Economic Analysis of the Topdressing Industry', Grafton, Yule and Lockhart'*



The fertiliser must be stored at the airstrip in such a way that it maintains its integrity for free flowability, which is essential to ensure the safe dispersal of the load from the air and also for the ability to safely jettison the load in case of emergency as required by CAR 137.103(a)(2). Weather proof storage facilities that have unobstructed access are vital safety considerations with respect to fertiliser flowability and truck manoeuvring ability.

The fertiliser must be stored so that it maintains its integrity for free flowability, which is essential to ensure the safe dispersal of the load from the air, and also for the ability to safely jettison the load in case of emergency. Weather proof storage facilities that have unobstructed access are vital to assure fertiliser flowability and truck manoeuvring ability. Loader/drivers are utilised to ensure the safe delivery of product to the aircraft. These loader/drivers roles include; assessing the product for free flowing characteristics, establishing the suitability/ weight and mass measurements of the product and passing these on to the pilot.

8.0 SAFETY CONTEXT

There is a widespread belief that agricultural aviation, by its nature, is 'riskier' than other forms of aviation due to the nature of the activities undertaken; very low level flying, high workload, subject to the negative effects from weather, terrain and obstacles, etc.

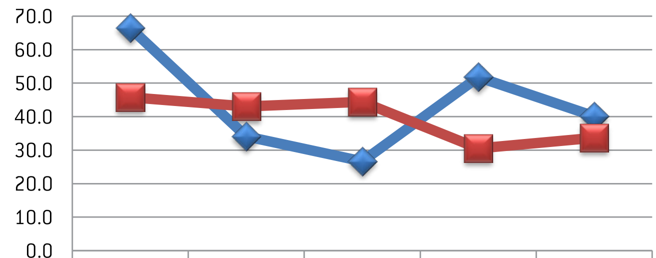
The CAA state the safety performance of the agricultural aviation sector has been resistant to improvement, despite CAANZ and industry research and initiatives . This has included the conduct of the Agricultural Aircraft Safety Review in 2008 and the introduction of the industry-initiated voluntary safety and compliance programme AIRCARE in 2011.

8.0.1 ACCIDENT AND INCIDENT RATES

The safety performance of the agricultural aviation sector is markedly worse than comparable sectors. In 2008, the accident rate was at approximately 66 per 100,000 flying hours for aeroplanes, and approximately 46 per 100 000 hours for helicopters. In 2012 this had dropped to 40 and 34 per 100 0000 hours respectively, but this is still considered high.

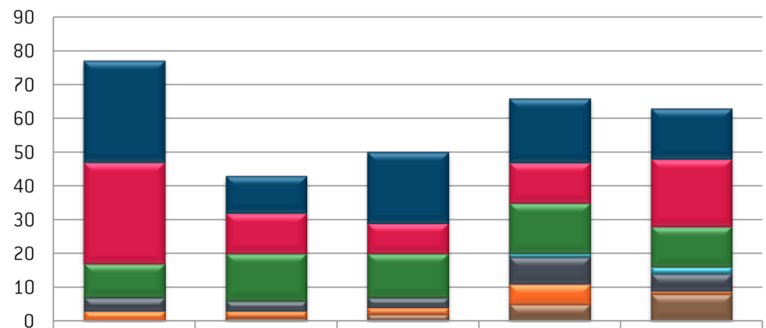
In terms of the incidents reported to CAANZ, in 2012 the rate was 40.1 per 100 000 flying hours for agricultural aircraft, compared to 33.7 per 100 000 flying hours for helicopters (see Figure 12).

FIGURE 12 *Number of reported occurrences by aircraft type per 100 000 flight hours (2008-2012) – Source: CAA safety reporting database*



	2008	2009	2010	2011	2012
Fixed Wing	66.4	34.1	26.7	51.8	40.1
Rotary Wing	45.8	43.0	44.4	30.5	33.7

FIGURE 13 *Number of reported occurrences by 'Occurrence type' (2008-2012) – Source: CAA safety reporting database*

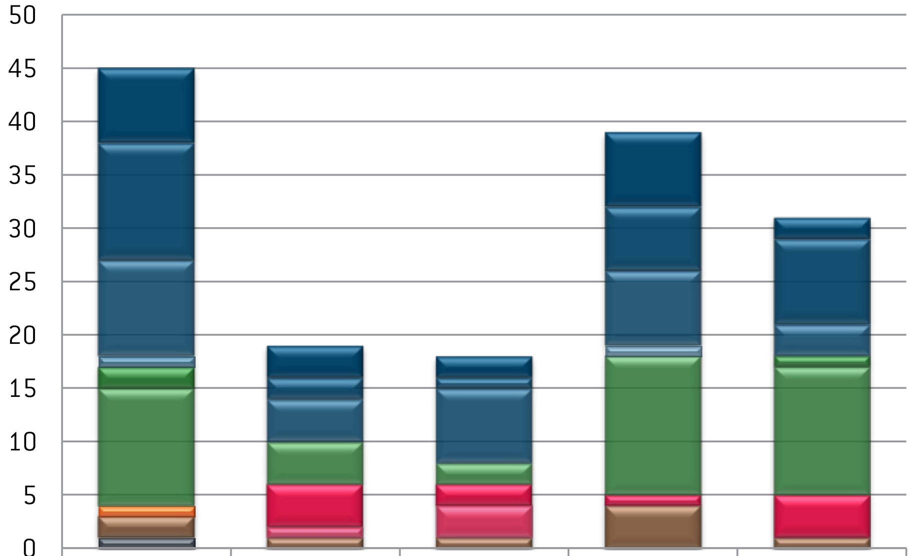


	2008	2009	2010	2011	2012
Incident	30	11	21	19	15
Accident	30	12	9	12	20
Defect	10	14	13	15	12
Aerodrome Incident	0	0	0	1	2
Bird Strike	4	3	3	8	5
Airspace Incident	3	2	2	6	1
Aviation Related Concern	0	1	2	5	8

The majority of reports are considered 'incidents'. However, the number of 'accidents' (as evidenced in Figure 12) is relatively high. For example, in occurrences reported to CAA between 1990 and 2009, landing gear issues accounted for over 16% of all occurrences, and represented the single biggest proportion, followed by controls (14%) and operational error (13%).[30]

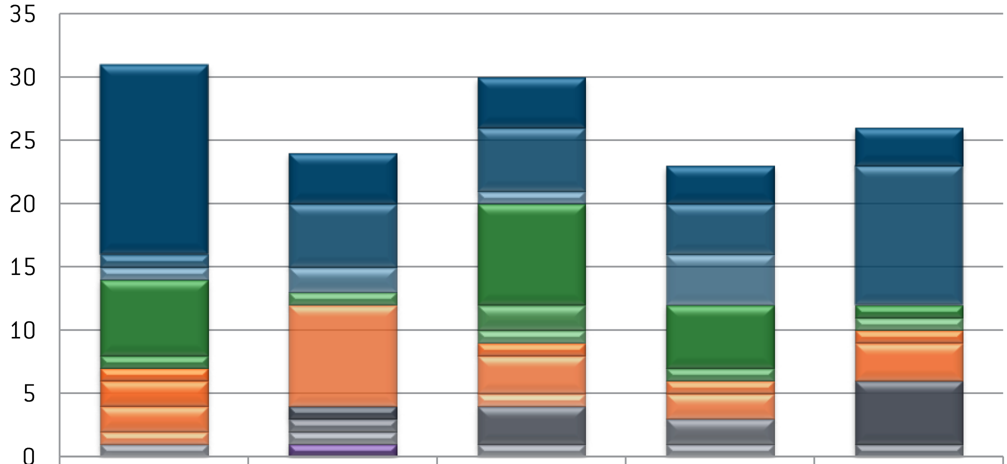
Figures 14 and 15 outline the number of reports received for each type of aeroplane and helicopter. The majority of fixed wing reports occurred within the 'Fletcher' family of aircraft, which is partially as a result of this being the most commonly-operated aircraft. The 'Robinson' fleet of helicopters reported the majority of occurrences, including those associated with not becoming airborne (sometimes due to overloading). Please note that it was not possible to develop normalised data (that's based on the number of each aircraft type) for this report, due to lack of data. As outlined in Figure 16, reports with active errors classified as 'structural / mechanical' reports have continued to rise, as did reports classified as 'actions inconsistent with procedures' (until 2012).

FIGURE 14 *Number of aeroplane reported occurrences by aircraft model (2008-2012) – Source: CAA safety reporting database*



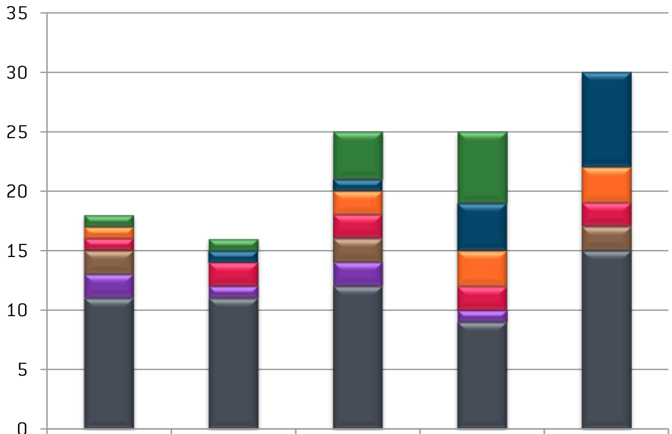
	2008	2009	2010	2011	2012
Fletcher 24-950M	7	3	2	7	2
Fletcher FU-24954	11	2	1	6	8
NZ Aerospace FU24-950	9	4	7	7	3
NZ Aerospace FU24A-950	1	0	0	0	0
NZ Aerospace FU24A-954	0	0	0	1	0
Pacific Aerospace 750XL	2	0	0	0	1
Pacific Aerospace Cresco 08-600	11	4	2	13	12
Air Tractor 402B	0	4	2	1	4
Air Tractor AT502B	0	1	3	0	0
Cessna 172M	1	0	0	0	0
Gippsland GA200C	2	1	1	4	1
Zlin Z-137T	1	0	0	0	0

FIGURE 15 *Number of helicopter reported occurrences by aircraft model (2008-2012) –Source: CAA safety reporting database*



	2008	2009	2010	2011	2012
Robinson R44	15	4	4	3	3
Robinson R44II	1	5	5	4	11
Robinson R22 Beta	1	2	1	4	0
Bell 206B	6	0	8	5	1
Bell 206L	1	0	0	0	0
Bell 206L-3	0	1	2	1	0
Bell UH1B	0	0	1	0	1
Hughes 369HS	1	0	0	0	0
Hughes 369F	2	0	1	0	1
Hughes 369D	2	0	0	1	3
Hughes 269C	1	8	3	2	0
Hughes 269B	0	0	1	0	0
Aerospatiale AS 315B	0	1	0	0	0
Aerospatiale AS 350B	0	0	0	0	5
Aerospatiale AS 350B3	0	0	3	0	0
Aerospatiale AS 350BA	0	1	0	2	1
Aerospatiale AS 350B2	1	1	1	1	0
Hillier UH12E	0	1	0	0	0

FIGURE 16 *Top 'Causal Factors' selected for safety reports that were processed (2008-2012) – Source: CAA safety reporting database*

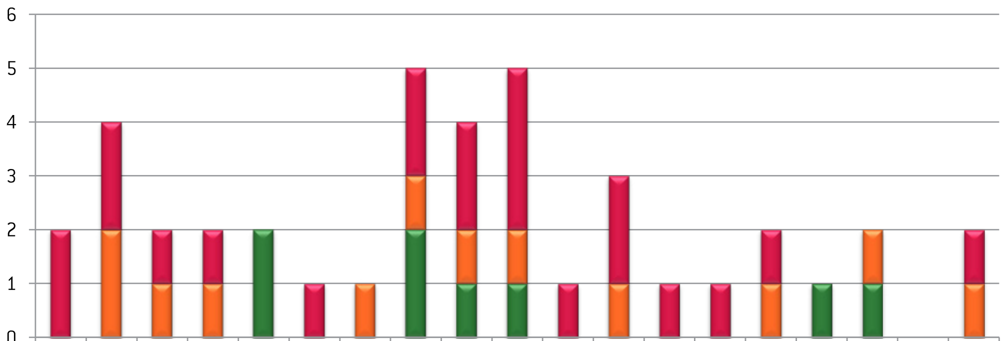


	2008	2009	2010	2011	2012
Actions inconsistent with procedures	1	1	4	6	0
Primarily 'structural / mechanical'	0	1	1	4	8
Inadequate checking	1	0	2	3	3
Poor procedure action	1	2	2	2	2
State change not detected 'information'	2	0	2	0	2
Inappropriate 'procedures'	2	1	2	1	0
All other descriptors	11	11	12	9	15

8.0.2 FATALITIES AND INJURIES

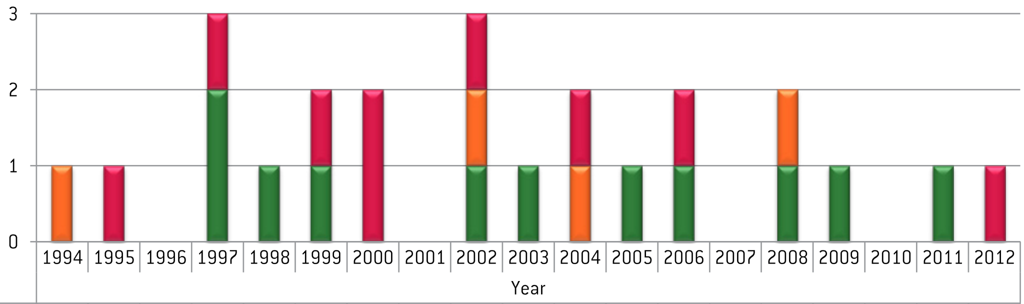
Since the 1950's approximately 140 fatalities have occurred in agricultural aviation. Between 2003 and 2012 there were 19 fatalities, 12 serious injuries and 8 minor injuries in aeroplane occurrences, and 9 fatalities, 4 serious injuries and 11 minor injuries as part of helicopter occurrences[31]. See Figure 17 and 18 for a breakdown of fatalities, serious and minor injuries since 1994 in both aeroplanes and helicopters.

FIGURE 17 *Numbers of aeroplane fatalities, serious injuries and minor injuries (1994-2012) – Source: CAA*



Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Fatalities - Fixed wing	2	2	1	1	0	1	0	2	2	3	1	2	1	1	1	0	0	0	1
Serious Injuries - Fixed wing	0	2	1	1	0	0	1	1	1	1	0	1	0	0	1	0	1	0	1
Minor Injuries - Fixed Wing	0	0	0	0	2	0	0	2	1	1	0	0	0	0	0	1	1	0	0

FIGURE 18 *Numbers of helicopter fatalities, serious injuries and minor injuries (1994-2012) – Source: CAA*



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Fatalities - Helicopter	0	1	0	1	0	1	2	0	1	0	1	0	1	0	0	0	0	0	1
Serious Injuries - Helicopter	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0
Minor Injuries - Helicopter	0	0	0	2	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0

8.0.3 SIGNIFICANT INVESTIGATIONS

On Friday 31st March 2006 a Fletcher FU24-950 aircraft, ZK-EGP crashed whilst conducting top-dressing operations in steep hilly terrain. The investigation report[32] found that the aircraft likely suffered a hung load of lime, which would have impaired the aircrafts climb performance. The report noted the steep terrain and high tree line in the aircrafts path, as well as suggesting that distraction and fatigue may have been contributing factors. Importantly it was identified that the standard sight window on the Fletcher aircraft was an impractical method for pilots to monitor the hopper contents during flight, particularly with lime. Safety actions that resulted included the recommendation that review of Part 137 Appendix D4 take place regarding accurate determination of the weight of hopper loads at all stages of flight. In addition it was proposed that the CAA should consider introducing flight, duty and rest periods for the agricultural aviation industry to manage pilot fatigue.

On 14 December 2008 a Pacific Aerospace Cresco crashed whilst conducting topdressing operations, fatally injuring the pilot after striking a fence on take-off. The investigation found (along with other contributing factors) that the aircraft was overloaded and the fertiliser that was not "free flowing" caused jettisoning difficulty. The aircraft was able to be overloaded (which conflicted with the aircrafts flight manual) because of the CAR Part 137 allowances. Safety actions taken in response to this report included a review of CAR Part 137.[33]

8.0.4 SAFETY PERCEPTIONS

Evidence sourced through surveys and stakeholder engagement has indicated a lack of reporting from smaller operators. There were 906 reported occurrences for all agricultural aeroplanes between 1990 and 2009, including higher reports of performance, landing gear and control related accidents and types.[34]

The Review of Agricultural Aircraft Safety[35] identified that safety performance decreased significantly following the introduction of rule part 137 which is particularly obvious with the landing gear related incidents above.

There have been numerous investigations into agricultural aviation accidents conducted by the Transport Accident Investigation Commission (TAIC), with varying safety issues identified. It is usual for immediate safety actions to be taken as a result of these investigations, which enhance safety.

On 22nd November 2005 a Fletcher FU24-950 suffered a vertical fin failure causing the aircraft to become uncontrollable and crash into trees killing the pilot and passenger. The accident investigation report[36] revealed a number of findings which included that the aircraft had previously been modified from a piston engine to a turbine engine and re-certified. The structural integrity of the fin was found to have been compromised by fatigue cracks which lead to the failure of the fin. These cracks had gone unnoticed and may have been intensified by the additional extra power made available by the turbine engine. This called into question the integrity of all agricultural airframes that had undergone engine modifications. It was established that no revised continued airworthiness maintenance programme was put in place after the engine conversion, which may have contributed to the accident. Immediate safety actions were taken as a response to these findings and an Agricultural Aircraft Safety Review was conducted by the CAA with review findings released in 2008.

A pilot and operator survey received from 79 of pilots and operators revealed that the surveyed participants had issues with the safety of the agricultural aviation sector. These included high responses regarding the condition and lack of maintenance on airstrips and the ageing aircraft and ageing pilots in the fixed wing sector. Additionally there was a high response concerning the number of operators competing for work, creating an environment of undercutting, within which safety margins are reduced. The role of the regulator was questioned as were the practices of overloading aircraft, under-recording of flight hours and the unsafe cutting of corners. Participants highlighted the lack of available training aircraft and expressed serious concerns about pilot training and pilot fatigue.

There are many statistics available regarding the social cost per flight hour of agricultural aviation accidents. The social cost is defined as "the annual cost of machines damaged plus the assumed costs of injury and the statistical value of human life, divided by the number of hours flown by the industry sector."[37] The CAA states that the social cost for agricultural operations is approximately $200 per hour (1997-2007[38]) which far exceeds the CAA targeted $14 per hour. However the perceived risk of the Agricultural Aviation Sector may be softened by the reduced loss of life compared to an airliner (that is 1 pilot lost compared to 5 crew and 200 people in one accident). The loss of an agricultural airplane with a single pilot or additional passenger maintains a high cost to the families of those persons, the loss to the operator and farmer, the adverse effect on the public perception of agricultural aircraft safety and indeed the public's perception of overall aviation safety.

9.0 ECONOMIC CONTEXT

Agriculture is very important to New Zealand's economy with primary industries (agriculture, fishing, forestry and mining) producing approximately 12% of the Gross Domestic Product. Historically the sector has declined and risen since 1985 when the NZ dollar was floated and fertiliser subsidies and tax concessions were phased out. Agriculture continues to be a core part of the economy. The services that agricultural aviation organisations provide to this industry are key to the sustainable future of the agricultural products and therefore the continuance of agriculture to the overall economic future of New Zealand.

The relatively high number of agricultural aviation operators throughout New Zealand appears to be threatening the sustainability of some, who are not as competitive as required. Evidence from statistics, surveys and interviews of stakeholders suggests that there is an oversupply of smaller operators whose pricing models are promoting unsustainable competition. In addition, with the introduction of the 2 large co-operatives, their capacity for very competitive pricing to undercut other local operators are creating additional financial pressure and the associated safety concerns that arise from smaller operators trying to cut corners to compete.

The traditional model for the pricing of application includes quoting a rate per tonne of product applied. Several participants identified an alternative but equal pricing model which quotes an application price per hectare treated (or equivalent) which would involve smaller, possibly more palatable, numbers. Rate increases would also be quoted in smaller dollar terms. This would align with the model used by ground spreaders of fertiliser product on flat country which would enable comparative costing more easily for the farmers.

10.0 GEOGRAPHICAL AND ENVIRONMENTAL CONTEXT

The nature of the geography of New Zealand makes for challenging conditions for any aviation organisation. The 2 larger islands and multitude of smaller islands are located in the South Pacific Ocean, with an area of approximately 270 000 square kilometres. There are numerous mountains with the Southern Alps stretching down the length of the south island and the north island home to numerous extinct and active volcanos. Temperatures vary dramatically with very temperate conditions in the south extending to sub-tropical conditions in the north. The Alps in the west attract more moisture then the eastern regions where dryer pastures may be found.

The climactic conditions are shaped by the mountainous environment, the oceanic environment and intense westerly winds associated with large oceanic weather systems. The variety of weather impacts directly on the primary agricultural activities. This weather is inextricably linked with the agricultural aviation industry. Varying weather results in runs of 'windows of opportunity', when conditions are conducive for safe operations. Favourable conditions are sporadic, and operators must be ready to provide fully serviceable aircraft and available crew at short notice. After periods of unfavourable weather and 'downtime' with an associated loss of productivity, there is a great deal of pressure on operators to service the backlog of work. This is of the highest priority to clients and operators cannot always meet these expectations.

Droughts and floods influence the farming communities which has a flow on negative effect to the aviation community. These geographical and environmental influences directly affect farming returns which, in turn, affects the disposable income available for the maintenance of nutrients and weed eradication (spraying and topdressing).

There are a multitude of environmental risks that require management when aerial spraying crops and agricultural aviation organisations are bound by numerous environmental regulations surrounding the application of agrichemical sprays and powders. Spray drift can occur when droplets vapour or dust associated with agricultural spraying drift away from the target area, and can come into contact with unintended land based recipients or contaminate water ways. The management of discharge of agrichemicals in the air falls under the responsibility of the RMA 1991. There has been a lot of focus on the correct, safe and accurate application of these chemicals within the agricultural aviation industry and pilots have been prosecuted in the past for spray drift contamination. Weather conditions, obstacles, the size of the treatment area, the properties of the chemical and the adverse public perception of aerial spraying place significant pressure on agricultural aviation operators in an already hazardous operating environment.

11.0 SUPPORTING SECTOR CONTEXT

11.0.1 TRAINING

Overall, flight training in New Zealand is a diverse and economically significant sector of the industry. Agricultural aviation training is unique in a number of respects:

- Fixed wing agricultural aircraft are generally single-seat / single control, which do not accommodate the normal pilot / instructor dynamics
- There is no industry-wide oversight of the number of instructors permitted to provide agricultural aviation training. Under Civil Aviation Rules E Category instructors are not subject to the same requirements to hold and retain this qualification as are D, C, B or A category Instructors, including not being required to hold any preceding instructing qualifications or experience, to be under the supervision of a more senior instructor, or to demonstrate ongoing competency of their instructional ability on an annual basis
- Due to the small market for fixed wing agricultural training, there are few specialised dual-control agricultural aircraft. Therefore, some training and competency checks are conducted by 'observation from the ground'
- There is industry-agreed standardised training syllabus; instructors (or companies certificated to provide agricultural training) are required to submit individual training syllabi for the approval of the Director using AC61-15.

The NZAAA has a Code of Practice for Agricultural Pilot Training which supplements the guidance in CAA AC61-15, The Code of Practice was last updated in 2007, as was the AC-615-15However, this is not widely used.

11.0.2 MANUFACTURING AND MAINTENANCE

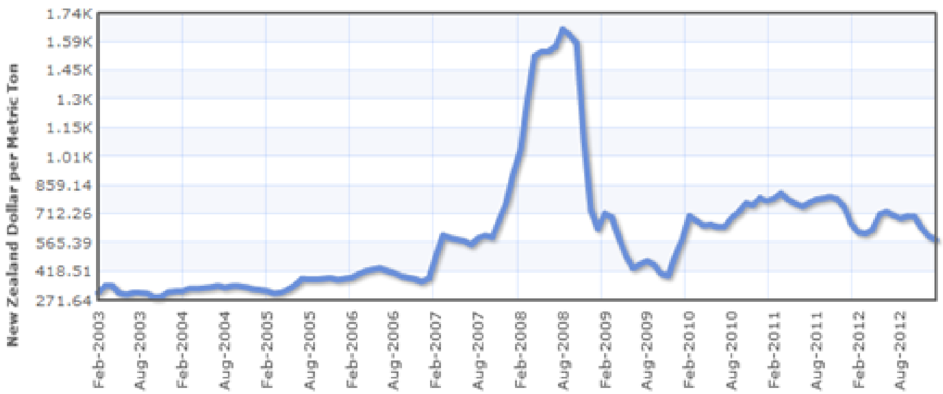
The NZ general aviation aircraft manufacturing, parts and maintenance sectors comprises approximately 184 organisations.[39] This includes 20 manufacturing organisations and a range of 15 to 20 major maintenance companies which service both fixed and helicopter aircraft.[40] For the agricultural aviation industry, the shift to modified aircraft and engines in particular has depended on the skills and availability of parts from these supporting sectors. The two corporately owned operators conduct in-house maintenance, parts and component manufacturer, while a number of other aeroplane and helicopter operators hold approval to conduct aircraft maintenance in-house. Smaller operators will tend to contract out their maintenance.

11.0.3 FERTILISER

In New Zealand over 2 million tonnes of fertiliser are applied annually to pastures, crops and forests by truck or tractor, or by fixed-or helicopter aircraft.[41] In fact, fertiliser use in 2010-2011 increased for the first time in three years to 3million tonnes[42]. About 40% is spread by aircraft onto steep hill-country pastures and production forestry land – the highest proportion in the world. Whereas most hill pastures receive fertiliser every one to three years, forests may be top dressed at 10 year intervals. Two large fertiliser and agrichemical companies, Ravensdown and Balance Agri-nutrients together make up the majority of the fertiliser manufacturing industry in New Zealand. The New Zealand Fertiliser Quality Council (NZFQC) was established by farmers to serve farmers using fertiliser after the New Zealand government stopped fertiliser auditing. Through the Fertmark program, the manufacturing quality of 69 registered products is assured[43]. This presently does not extend to all physical properties of the products for aviation purposes; however it does establish a benchmark around fertiliser reliability and risk to food safety and animal welfare.

The increasing commodity prices across the globe have led to a jump in fertiliser and minerals costs, as shown in the case for DAP fertiliser in Figure 19.

FIGURE 19 *Increasing costs of fertiliser and mineral costs*[44]



In the similar time frame, the monthly lamb price has dropped significantly, see Figure 20. This has increased the financial strain on New Zealand farmers, leading to more planned use of fertiliser and other minerals which are the lifeblood of the agricultural aviation industry. As such, the agricultural aviation industry responds with greater accuracy through GPS aerial application and better control of application to achieve the optimum levels for the land.

FIGURE 20 *Yearly lamb prices- NZD per Pound (2003-2013) – Source: http://www.indexmundi.com/commodities/?commodity=lamb*

Fertiliser and agrichemicals have an impact on the environment, through direct application to waterways, or from nutrient run-off and leaching from enriched soil into waterways, which can cause a rapid increase in algal or weed growth. The RMA 1991 promotes the sustainable management of natural and physical resources, and one of the basic principles is to 'avoid, remedy or mitigate adverse effects on the environment'. This is primarily managed through regional council policies and plans, with national level policy statements and standards developed as necessary.

Agricultural aviation activities such as topdressing will be permitted by a regional council plan, but often with specific conditions such as establishing procedures to prevent the application of fertiliser into water bodies and avoiding a build-up of nutrients in the soil which may leech into waterways. Compliance with the RMA is a shared responsibility between the agricultural aviation operator and the client and adds to the regulatory requirements placed on the operators.

11.0.4 INDUSTRY ASSOCIATIONS

A. **Aviation Industry Association (AIA) and the Agricultural Aviation Association (NZAAA)**

The AIA supports all aspects of aviation with approximately 260 aviation companies in its memberships. It is aimed at taking an entire industry approach to developing and improving aviation. Under the banner of the AIA an accreditation scheme was developed and introduced in 2011, named AIRCARE. AIRCARE is a voluntary code of practice, aimed at the NZ general aviation industry to which agricultural aviation belongs. The programme focuses on flight safety, environmental safety and quality assurance, streamlining a host of compliance requirements.

The NZ Agricultural Aviation Association (NZAAA) is a Division of the Aviation Industry Association (AIA). NZAAA was established "to ensure the sustainability of Agricultural Aviation in NZ by developing and advocating best practice in both flight safety and environmental safety, promoting professionalism and profitable business, facilitating adoption of best practice programmes by members and stakeholders, and engaging in research opportunities.[45]" NZAAA currently represent 62 agricultural aviation operators. From the 102 agricultural aviation certificates currently held, this would suggest that membership represents just over 60% of the sector. The NZAAA website claims that they represent 95% though, as some of the 102 certificate holders are not currently actively undertaking agricultural aviation operations. Currently, there are no other Industry Associations that represent agricultural aviation in New Zealand.

B. **Fertiliser Association**

The Fertiliser Association of New Zealand was founded over 60 years ago with the aim to promote best management practices for managing nutrients. The two major co-operatives manufacture, distribute and market around 98% of all fertilisers sold in New Zealand.[46]

C. **Fertiliser Quality Council**

The Fertiliser Quality Council of New Zealand was formed to provide farmers with quality assurance with the purchase of fertiliser. The initiative named Fertmark is an independently assessed quality assurance programme and Code of Practice.[47] In addition the Council established the Spreadmark programme in 1994 which is a fertiliser placement quality assurance programme. This code addresses the production, security, economic, environmental and social aspects of aerial application of fertiliser.

The Federated Farmers of New Zealand is member based organisation that represents the interests of farmers and promotes the business of farming by encouraging sustainability through best practice.[48]

D. **Federated Farmers**

The Federated Farmers of New Zealand is member based organisation that represents the interests of farmers and promotes the business of farming by encouraging sustainability through best practice.[49]

ANNEX A

REPORT ACRONYMS AND ABBREVIATIONS

AAA	Agricultural Aviation Association
AIA	Aviation Industry Association of New Zealand
AIRCARE	Trademarked program of the AIA
AOC	Air Operator Certificate
AAOC	Agricultural Aircraft Operator Certificate
CAA	Civil Aviation Authority New Zealand
CAR	Civil Aviation Regulation
CASR	Civil Aviation Safety Regulation
FQC	Fertiliser Quality Council
GPS	Global Positioning System
ICAO	International Civil Aviation Organistion
ISO	International Standards Organisation
SRP-AG	Sector Risk Profile – Agricultural Aviation
IWG	Industry Working Group
MCTOW	Maximum Certified Takeoff Weight
NZAAA	New Zealand Agricultural Aviation Association
NZFQC	New Zealand Fertiliser Quality Council
RMA	Resource Management Act 1991
SMS	Safety Management System
QMS	Quality Management System
TAIC	Transport Accident Investigation Commission
VTA	Vertebrae Toxic Agents

ENDNOTES

1. http://www.stats.govt.nz/~/media/Statistics/Browse%20for%20stats/GrossDomesticProduct/HOTPMar12qtr/GrossDomesticProductMar12qtrHOTP.pdf
2. http://www.newzealandnow.govt.nz/investing-in-nz/opportunities-outlook/economic-overview
3. http://www.stats.govt.nz/browse_for_stats/economic_indicators/GDP/GrossDomesticProduct_HOTPMar12qtr/Commentary.aspx
4. http://www.TeAra.govt.nz/en/fertiliser-industry/page-2
5. http://www.teara.govt.nz/en/topdressing/page-4
6. http://www.teara.govt.nz/en/topdressing/page-5
7. CAA agricultural aviation activity returns submitted under CAR12.151
8. Civil Aviation Authority of New Zealand, Agricultural Aircraft Safety Review, 2008, p. 1
9. Zones and Products, Civil Aviation Authority
10. http://www.aia.org.nz/Divisions/NZAAA/Who+We+are.html
11. For plant nourishment, soil treatment, seed propagation or pest control in agriculture, horticulture or forest preservation.
12. At a height of less than 500 feet above terrain.
13. New Zealand Civil Aviation Regulations, Part 1
14. Agricultural Aircraft Safety Review, CAA, December 2008
15. CAA NPRM09-01 Docket 8/CAR/02 Part 137 update 13 May 2010
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20. Farm Airstrips and Associated Fertiliser Cartage, Storage and Application, Department of Labour and CAA 2006
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DEVELOPED BY:

AEROSAFE RISK MANAGEMENT
Level 7, Wellington Chambers,
154 Featherston Street, Wellington 6011
T. +64 4 496 5206 **F.** +64 4 496 5209
www.aerosafe.com.au

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