SECURING AN AFFORDABLE AND SUSTAINABLE FIXED WING AGRICULTURAL AVIATION SERVICE IN MARLBOROUGH

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EXECUTIVE SUMMARY

The fortunes of farmers and agricultural aviation operators are inextricably linked. Poor returns for sheep and beef farmers have resulted in a reduced demand for fixed wing agricultural aviation (FWAA) services in Marlborough. As a result both of the locally based operations are struggling for profitability. This presents the real threat that farmers may soon be without a locally based fixed wing service.

With sheep and beef farming in Marlborough becoming increasingly confined to the hill country farmers require a locally based operator to provide cost effective spraying, oversowing, poisoning and specialist fertiliser application services. All are of a timing critical nature. Without these services the ability of farmers to improve the productive and financial performance of their properties will be severely compromised.

The objective of this report has been to identify and investigate the major issues facing fixed wing agricultural aviation in order to ascertain what opportunities exist to help secure affordable and sustainable FWAA services in Marlborough.

The major issues facing the industry are:

1. Poor profitability resulting from an overcapacity and under-utilisation of aircraft and equipment.
2. Inability to account for the costs of ownership such as return on capital and depreciation of aircraft and equipment.
3. A terrible safety record.
4. Ageing pilots and inability to attract new pilots.
5. Difficulty in enabling business succession.
6. Substandard airstrips, access and storage facilities.
7. Lack of farmer awareness of industry issues and the role they can have role in addressing these issues for mutual benefit.
8. Lack of coordination and collaboration between farmers and FWAA operators.

Most of these issues are inter-related however under-utilisation of aircraft and equipment is the most important of all. While increasing utilisation will go a long way to improving the fortunes of aerial operators this in isolation does not address some of the root causes that impact on the industry.

At a national level the amount of product applied aerially and hours flown per plane have halved in the last five years resulting in a massive overcapacity. The average hours flown by all planes certified for agricultural use in New Zealand is now only around 200 hours. 600 hours is considered a benchmark figure for a profitable operation. Under-utilisation of aircraft and equipment means that fixed costs need to be covered by fewer chargeable hours requiring an increase in charge rates. However, by increasing charge rates significantly, operators risk losing work as farmers are a price sensitive market. Therefore the key is to increase the number of hours flown so the fixed cost component of each hour flown can be reduced. This enables a more affordable service to be provided to the farmer whilst maintaining operator profitability.

Marlborough's FWAA operations are also suffering an under-utilisation of aircraft and equipment. Fragmentation of the workload through poor planning and coordination between farmers and operators is a major factor contributing to this under-utilisation.

A root cause in the reduced demand for aerially applied products is due to poor or negative marginal returns of injudicious expenditure on these aerially applied products. FWAA operators and other farm service providers need to focus on recommending and providing products and services that best add value to farmers' business's. It is also important for farmers to research what aerially applied products and services to use and then plan the work so it can be implemented to best effect. By achieving optimal outcomes farmers will be more able and inclined to increase expenditure in aerial services to further improve their profitability. This will increase the demand for FWAA services, improve utilisation of aircraft and equipment and improve profitability.

Diversification into other aerial services such as spraying provides operators the opportunity to increase the number of hours flown. The efficiencies of spraying from fixed wing provide the farmer with a very affordable service (a quarter to half the price of a helicopter) and at the same time delivers much better returns to the operator than standard solids application. However such specialist operations require a skilled pilot and suitable aircraft.

The adoption of new technologies and innovations that provide services that really add value to farmers' business' will also be a key to improving the performance of the FWAA industry.

Choice of aircraft and equipment used has a large bearing on utilisation. Decisions on what aircraft to use should be based on the aerial requirements of farmers. In Marlborough where approximately 7500 tonnes were spread in 2009 a Cresco would be grossly underutilised. A lower capacity aircraft such as a Fatman that is cost effective for its size would be more suitable.

The highly competitive and unprofitable nature of FWAA has had a major bearing on the atrocious safety record of the industry. 140 pilots have been killed ag. aviation in New Zealand since the 1950s and statistics show one in three pilots will be killed in an average 20 year career.

Overloading of aircraft and repowering of planes beyond their design envelope in order to increase efficiencies have seen an escalation in accident rates in FWAA. Poorly designed and maintained airstrips and obstacles near the strip have also contributed to the poor safety record. So too have poor fertiliser storage facilities which can lead to product contamination and flowability issues affecting the pilot's ability to jettison the load in an emergency.

The competitive and stressful environment in which pilots operate has resulted in poor decision making which has also been found to be a causative factor in accidents.

Information provided by the CAA suggests that some aircraft are more airworthy and crashworthy than others. Data on fatalities per hour flown for different ag. type aeroplanes has shown aircraft such as the GA200 Fatman and AirTractor to be much safer than the Fletcher and Cresco. The placement of the hopper in front of the pilot and the tubular construction of the Fatman and AirTractor are likely reasons for this. The Fatman and AirTractor have also been unable to be overloaded to the same extent as the Fletcher and Cresco which will have resulted in a lower accident rate.

In order to enable business succession, particularly that of the owner operator, requires new personnel to enter the industry. However poor profitability, low pay rates and the dreadful safety record make it difficult to attract young pilots. Addressing these issues will be important if the FWAA is to have a sustainable future. Access to dual controlled aircraft and a high level of training will be necessary to produce pilots capable of highly skilled operations such as hill country spraying and to improve pilot safety. Pilot training and succession need to be well planned. In Marlborough the two pilots holding their E category instructor rating are nearing the end of their careers so it is important plans are in place to train successors before the trainers retire.

The choice of aircraft used by operators has a significant impact on the viability and sustainability of an operation. The GA200 Fatman has been identified as the aeroplane that currently best meets the needs of both Marlborough farmer's and operators. It is a multi-role aircraft providing solid and liquid application services both accurately and safely and in a cost effective manner. The multi-role nature of the Fatman also provides avenues for increasing utilisation and generating better margins from specialist work such as spraying while doing so at an affordable price to the farmer. Suitability of capacity, excellent crashworthiness, moderate capital cost, good resale value and long service life are all important aspects the Fatman possesses.

The formation of a farmer coordination organisation could provide a huge opportunity to resolve many of the issues facing the FWAA industry. An organisation to plan and coordinate farmer's FW aerial service requirements with operators could greatly improve utilisation of local aircraft by reducing fragmentation of the work load. Advanced planning will also indicate if outside operators are required to help during peak workloads. This will ensure farmers' needs are continuously meet at an affordable price.

Greater communication and collaboration between farmers and operators can be facilitated through the coordination organisation. This has many potential benefits including the determination of services required by farmers and enabling operators to best match aircraft and equipment to these needs. Change arising from increased farmer awareness of issues, particularly around airstrip and fertiliser storage standards and advanced planning of work will provide mutual benefit for both farmers and operators and can be facilitated by the organisation.

A coordination organisation, through the production of an annual work plan, also has the potential to provide a more stable business environment for operators which would not only help to reduce accident rates but also give a greater degree of bankability to FWAA operations better enabling succession to take place.

Farmers have the best chance of ensuring ongoing affordable local aerial services by collaborating through a unified body. A unified farmer body also has many applications and opportunities that extend beyond the fixed wing agricultural aviation industry. Bulk buying power is one example. These opportunities are worthy of further investigation.

Further research is required as to what the most appropriate structure for a coordination organisation will be but preliminary investigations indicate an Incorporated Society may be the best option. Ideally full farmer support of the organisation is sought so low barriers to participation are required. An organisation with low capital costs and operating expenses covered by a membership fee is attractive.

Finally and to re-emphasise the point if a sustainable fixed wing agricultural aviation service is to be secured in Marlborough, farmers must be provided with services that add value to their business's and not cost. Improved coordination and organisation between both farmers and operators will go a long way to providing an affordable and sustainable fixed wing agricultural aviation service in Marlborough.

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CHAPTER ONE: INTRODUCTION

Marlborough's dry stock farming enterprises have increasingly become confined to the hill country as much of the better finishing land has been converted to viticulture and lifestyle block subdivisions. Farmers need to be able to apply solid and liquid products cost effectively to help improve farm profitability. However, current poor terms of trade and increasing costs especially that of fertiliser have seen many farmers making cuts to their fertiliser budget. This in return has required aerial spreading operators to increase their charge rates to cover overheads from fewer flying hours, making their service less affordable and so the downwards spiral continues. The viability of both hill country farmers and ag. aviation operators are inextricably linked.

The potential rationalisation of the aerial topdressing industry with its surplus capacity presents a real risk to Marlborough farmers that they may soon be without the services of a locally based operator. Whilst services may still be provided by outside operators, the timing critical and specialist services such as oversowing, spraying and high analysis fertiliser/small tonnage jobs may be lost with expensive consequences.

This report investigates the major issues surrounding the ag-aviation industry, and in particular that of the fixed wing operations in Marlborough, in order to identify opportunities to improve the profitability and sustainability of fixed wing operations in Marlborough. Suggested solutions will be provided that can be implemented through a proposed coordination body.

In conjunction with the research and preparation of this paper a steering committee of seven Marlborough farmers has been formed to address the issues presented. A model will be formulated to achieve the objective of securing farmers with a sustainable and affordable agricultural aviation service in Marlborough that meets their various needs.

The steering committee has been granted FITT funding from Beef & Lamb New Zealand, which runs from July2010 to June 2011 to develop the model. As part of the process a series of focus group farmer meetings will be held to inform farmers of the issues surrounding the ag aviation industry and to present the operating model. Professional advice is being sought as to the most appropriate business structure to use.

CHAPTER TWO

2.1 A Background to the Fixed Wing Agricultural Aviation Industry

The agricultural aviation industry has played a huge role in improving the productivity of pastoral farming operations throughout New Zealand and in particular hill country that cannot be serviced from the ground. It is estimated that in 2008 2.3 million hectares of New Zealand pasture land was aerially topdressed. A Meat and Wool New Zealand Economic Service projection indicated that the removal of aerial topdressing for five years would reduce hill country production by 50% or $1.4 billion. Therefore the sustainability of agricultural aviation services is critical to the profitability of hill country farms and the New Zealand economy overall.

However the New Zealand fixed wing agricultural aviation industry is showing symptoms of failure as identified by Lockhart (2009 address at NZAAA annual conference). This is highlighted by a lack of investment in new aircraft and equipment, ageing pilots, poor profitability and cash flow, competition on price, a poor safety record and changing fertiliser practices. Poor standards of airstrips and associated facilities and increasing bureaucracy and compliance costs are also issues.

The lack of profitability in the sheep and beef sector in recent years as well as increases in fertiliser prices has seen a large decline in the application of fertiliser applied by air. This has induced fierce price competition among already cash strapped aerial operators to attract a smaller pool of work. Many operators have been forced to exit the industry with some selling out to either Wanganui Aero-Work (Ravensdown) or the Ballance owned Super Air. The two major fertiliser cooperatives have entered the agricultural aviation industry to ensure that their shareholders have the means of applying product to hill country. They now account for 65% of the aerial spreading market while only owning 25% of the 116 fixed wing topdressing aircraft in the country.

The two fertiliser cooperatives have come under scrutiny from smaller operators for trying to push them out of business with aggressive pricing strategies. The cooperative owned aviation subsidiaries have the benefit of the parent company's financial backing to implement these pricing strategies which the small operators lack.

While this may seem attractive to farmer shareholders in the short term, consolidation of the fixed wing ag. aviation industry still does not address all of the root causes that have undermined the industry. With the removal of small operator competition it is likely that the large cooperatives will take the chance to recalibrate industry pricing upwards (Lockhart 2009). Allegations have been made as to the cross subsidisation of Wanganui Aero-Work (WAW) and Super Air by their parent companies. This raises questions as to whether Cooperative principals are being compromised as some shareholders (hill country farmers) are benefiting at the expense of others e.g. the flat land farmer shareholders who do not require aerial services.

Another concern is that if a fertiliser company has a monopoly on spreading services in a region then it may dictate to farmers that it will only spread its own products. Monopolies also have the tendency to become inefficient in the absence of competition. Such inefficiencies may lead to less affordable services to farmers.

2.2 Agricultural Aviation Services Required By Marlborough Farmers.

Marlborough's sheep and beef farming has become increasingly confined to the hill country as much of the suitable flat land has been converted to higher value land uses such as viticulture. This has resulted in a loss of finishing country in the province. The ability for farmers to improve the productive performance of their hill country in a cost effective manner will be very important if they are to realise the optimal value from their stock and improve farm profitability.

Farmers require an affordable and sustainable agricultural aviation industry to address soil fertility, weed, pest and animal health issues. Aerial sowing of improved pasture species will also be important.

The soil fertility amendments required on Marlborough's hill country are many and varied and in-depth discussion on these matters is beyond the scope of this report. It is essential though, that farmers receive sound advice as to what soil remedies will provide them the best marginal returns. The same applies for other aerially applied products.

Solid application requirements range from broadacre spreading over large areas to single block applications. Application rates depending on products applied can vary too with high rates per hectare for products such as lime to low rates for urea and other nitrogen based fertilisers. Aerial oversowing of seed and poisoning (e.g. rabbits) are also services required by farmers.

Weed infestation is a major problem in Marlborough hill country. Cost effective spraying through fixed wing aircraft may provide the opportunity for farmers to bring weed infested country back into profitable production. Other spraying requirements include that of weeds, pests and diseases of pastures and crops.

Aerial services are also required by other primary producers such as foresters, viticulturists and horticulturists.

Many of the services, such as oversowing, high analysis fertiliser spreading and spraying are timing critical so it is crucial that there is a locally based operation to provide these services on time. Activities such as spraying or oversowing also have a very low tolerance to wind so weather windows in which operations can take place are often small. Therefore these services will be best provided by a locally based operator.

There are increasing rules and regulations imposed by Regional Councils on agricultural aviators and their activities, especially in relation to environmental issues. It is important that aerial operators keep abreast of these issues. Innovation and the development and adoption of new technologies will be important in helping operators and farmers comply with regulations.

GA200 Fatman applying suspension fertiliser in Marlborough. *Photo courtesy of Ray Patchett.*

Truck and tanker used for loading suspension fertiliser into the plane. Photo: courtesy Ray Patchett.

As discussed the fixed wing aerial service requirements of primary producers in Marlborough are many and varied. This will require a multi role operation that can provide both spraying and solid application services at an affordable price. The timing critical nature of many jobs will require a locally based operation to meet Marlborough farmer's needs.

For both farmers and the FWAA industry to have a sustainable future it is imperative that the aerial services provided aren't seen to be a cost but actually add value to a farmer's business.

2.3. Marlborough and its agricultural fixed wing industry.

Marlborough is a challenging region in which to operate an agricultural aviation business. The province is one of the driest in the country and droughts, especially in the last decade have been an all too common occurrence. The affect of drought on farm profitability and cash availability for fertiliser expenditure can have a dramatic impact on the demand for aerial services.

The exposed nature of many of the hill country areas of the province and a predominating northwest wind reduces the number of flyable hours. Both local operators have indicated that weather conditions would limit annual hours flown to 600-700 hours. However the weather conditions around different areas of Marlborough can be quite different on any given day and it is possible to have workable conditions in one area while nowhere else.

The province consists of the Marlborough Sounds to the north, two main river valleys, the Wairau Valley and the Awatere Valley, Ward and then the South east coast from the Ure River down to the Clarence River. As an example the Southeast area can be relatively sheltered from the north-westerly winds while the other areas are experiencing high winds. Conversely during a southerly it may be calm inland while too windy to operate on the coast.

One of the logistical problems faced by operators is the relocation of loaders due to the long river valleys and coastal strip. While it may only take the aeroplane 10 – 20 minutes to fly to the next job it could be a 2-3 hour drive to have the loader on site. Therefore having multiple loaders spread around the province is beneficial in reducing downtime but needs to be balanced by the capital tied up in loaders.

The province consists of many extensive properties, which combined with low rainfall have a low stock carrying capacity per hectare. This makes the typically lower application rates more expensive per tonne to apply than areas with higher stocking rates as it takes longer for the aircraft to spread a given tonnage when sowing at a lower rate. The extensive nature of many of the hill country properties also means that pasture utilisation rates tend to be much lower than on more intensive properties and therefore improved pasture production from fertilising cannot be fully realised which in turn reduces marginal returns on that fertiliser expenditure.

When the marginal rate of return on a particular farm expense is low, or at least lower than other expenditure, then it is likely that this expenditure item will be cut at least in the short term. This is especially so in the cash constrained environment that many Marlborough hill country farmers are in at the moment.

The following table created from data sourced from Beef & Lamb New Zealand shows the profitability and fertiliser expenditure figures of Class 1 (SI High Country) and Class 2 (SI Hill Country) properties over the last ten years as well as the average annual tonnage applied by air.

Table 1. Farm Profitability, Fertiliser Expenditure and Tonnage Applied by Air of South Island Hill and High Country Farms

Year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09 Prov	2009-10 Forec.
Class 1										
Pre tax profit	166,221	81,164	64,819	63,544	74,373	28,081	33,628	-31,974	42,700	19,900
Fert. Exp. $	45,166	44,587	44,057	40,524	44,398	43,880	46,826	66,634	65,843	57,799
Ave. t by air	137	121	110	100	106	82	72	107	40	
Class 2										
Pre tax profit	80,829	110,270	103,625	49,250	73,898	37,777	28,021	-6,042	66,400	40,000
Fert. Exp. $	21,979	26,434	24,573	26,097	31,256	32,628	33,450	35,654	38,257	31,316
Ave. t by air	48	49	52	50	77	99	42	83	43	

From the pre tax profit, tax is still to be paid along with personal living expenses and capital expenditure. Farm profit from 2005-06 onwards has declined markedly and this fits with the data of fewer tonnes of fertiliser applied and hours flown over a similar time. The fertiliser expenditure has stayed relatively constant and reflects the increase in fertiliser cost.

It was interesting to note that from the Meat and Wool Economic Service data for the 08/09 year of the eight Marlborough hill and high country properties (Classes 1 and 2) surveyed only four applied any fertiliser or lime by air. When adding Canterbury properties surveyed to those from Marlborough only 18 properties out of 48 applied any fertiliser or lime by air.

The increase in fertiliser prices in recent years and the spike in 2008 of superphosphate of $510 per tonne (Ravensdown, 2008) saw a dramatic fall off in fertiliser application spread from the air as shown in Table 1.

In Marlborough approximately 7500 tonnes of product was flown on in 2009. This compares with 16-18,000 tonnes, spread by three Fletchers in the mid eighties (Wheelan, A.; Pers. Comm.). Patchett Ag-Air's GA200B Fatman recorded approximately 250 chargeable hours and WAW's Fletcher FU24-400 doing much the same and spreading 3500 tonnes. A WAW Cresco was bought in to spread 1200 tonnes of product onto some larger Awatere runs (Harding,R.; Pers. Comm.). Jim Somerville from Cheviot applied 700 tonnes of product and flew 60 hours and has on average over the last ten years spread 950 tonnes north of the Clarence and flown 80 hours. Both the local operations show a gross underutilisation of their aircraft and equipment which is a common theme throughout the country.

The volatility in work load, due to variability in climatic conditions, fertiliser price, fertiliser product used and farm profitability is very difficult for an ag. aviation operator to manage. What capital investment is required to provide suitable capacity without suffering underutilisation of that equipment? What impact will this volatility have on cashflow and the ability to meet financial obligations?

2.3.1 Marlborough's Locally Based Operators.

Marlborough has traditionally been serviced by two operators based at Omaka, Blenheim, with some outsiders being used to service Southern Marlborough and large properties in the Awatere Valley. One of the outside operators has sold out to WAW and the other continues to service some properties down the Southern east coast. In 2008 one of the locally based operations, Marlborough Aerial Work, took the opportunity to sell its plane and equipment to WAW. WAW has maintained this service at Omaka and the two previous shareholders remain as pilot and loader driver. Andrew Wheelan, the chief pilot, drives the loader and is close to retirement while Richard Smith undertakes most of the flying duties. He is currently flying part time for Sounds Air a local passenger service to supplement the income from the topdressing work.

The other local operator, Patchett Ag Air, owned by Ray Patchett has just sold its loading and spray equipment to another local business, Ridge Air. Ridge Air is an aviation company involved in helicopter operations (including ag.) and fixed wing charters. Ray Patchett still owns his GA200B Fatman and contracts this as an owner/operator to Ridge Air. Patchett had managed to remain in business by diversifying into crop/grape and hill country weed spraying, which is more profitable than spreading of solids. He also developed a remote controlled self loading truck to cut costs and when there was no work he hired the loader with its hiab out to the local lines company. Despite these measures Patchett conceded that the business had downsized to the extent that it had become a hobby. Hence the opportunity to realise some capital as part of an exit strategy while still being able to fly and service local farmers was an offer not to be refused.

2.3 Utilisation of equipment and its impact on profitability.

This chapter discusses one of the main issues faced by the FWAA industry; utilisation of equipment or underutilisation as the case may be. It will be broken down into industry overcapacity and fragmentation of regional workloads, costs of ownership, effects of utilisation on profitability and diversification to increase utilisation. A brief discussion will be given as to possible solutions.

2.3.1 Fixed Wing Agricultural Aviation Industry Overcapacity.

The FWAA industry is suffering from a massive underutilisation of equipment. Currently there are 116 fixed wing agricultural aircraft registered in New Zealand. Table 2 below shows the number of hours flown by fixed wing operators in New Zealand, and the tonnes of fertiliser applied over the last five years.

Table 2. Tonnes spread and hours flown by the FWAA industry in New Zealand.

Year	2005	2006	2007	2008	2009
Hours flown	45500	37000	34500	29500	22500
Solid product applied (tonnes)	704481	577464	567278	484921	372212
Number of planes registered	116	116	116	116	116
Ave. hours flown per plane*	392	319	297	254	194

Data sourced from NZAAA

* Aeroplanes registered for agricultural use have remained at similar numbers over the same period although exact numbers other than for2009 are unknown. To give an indication of hours flown per plane it is assumed that there were 116 planes registered in each of the five years. It is assumed all planes are in operation which may not be the case.

*Productive hours were based on a hobs hour which is recorded from the aircraft is travelling above 30 knots/hour.

As shown in Table 2 the amount of fertiliser applied by air and the hours flown have halved over the last five years. This highlights a massive overcapacity in the industry. Grafton et al (2010) suggest that present requirements for topdressing in New Zealand could be satisfied by as few as 30-40 Cresco aircraft or turbine equivalents.

The Marlborough situation is no different to that faced nationally and discussions with local aerial operators indicate that underutilisation of equipment is at the heart of their poor profitability. Both the local operators used to fly around 600 hours per year (Wheelan, A., Patchett, R pers. comm.) with a peak of around 710-740 hours. Patchett Ag Air recorded 711 productive* hours in 2001 whilst operating with three loaders and covering Nelson as well as Marlborough. In the last three years hours flown are down to 200-300 hours per year.

However pilots mention there are certain times of the year when they often have to turn down or refer work on as they can't get the job done when the farmer requires it. This has seen farmers use outside operators so their product is applied at the desired time. The fragmentation of the workload compounds the underutilisation problems faced by the local operators. This indicates there is opportunity to increase utilisation through the coordination of work with farmers and their service providers. There are products whose application are not timing critical (e.g. lime). Through coordination these products could be spread at quieter times of the year. By taking a collaborative approach farmers and local operators can both stand to benefit through an increase in aircraft utilisation.

2.3.2 Costs of ownership – depreciation and return on capital.

In the paper titled "An economic analysis of aerial topdressing in New Zealand" Grafton et al developed a financial model which compares the operating costs of the Fletcher FU 24 and Cresco, the two most common aeroplanes used for topdressing in New Zealand. The model assumes each aircraft operates for 600 hours per year. The Cresco is a newer plane and has a payload of approximately 2 tonnes and sows around 20 tonnes per hour while the old faithful, the Fletcher has a payload of 1.2 tonnes sows about 12 tonnes per hour.

The analysis showed that the operating costs were cheaper from the Cresco ($47.90/t) than the Fletcher ($58.83/t). However once depreciation and the cost of capital were considered this reversed with application costs being $85.40 and $64.29 for the Cresco and Fletcher respectively.

The model showed that the best returns were achieved by applying fertiliser from obsolete equipment. When overhauls are due on aircraft operators have found it cheaper to overhaul existing aircraft and possibly repower their Fletchers with turbine engines to increase power and load carrying performance, rather than invest in new aircraft. Lockhart (2009) also suggests that the non-cash benefits of aircraft depreciation are being consumed rather than saved for replacing old equipment. This is symptomatic of an unprofitable industry and is problematic when the day finally comes to replace old aircraft.

This presents the issue of whether the current model of using obsolete equipment is sustainable in the long-term? There may also be safety implications associated with such a model. A question that needs addressing is; what is an appropriate service life for an aircraft involved in agricultural operations? This will require a case by case analysis of aircraft and their past and intended future use. Different aircraft constructions (e.g. monocoque versus tubular) will also have a bearing on airframe life (Patchett, R. Pers. Comm.).

Grafton et al (2010)have used the straight line depreciation method (12.5%pa) for agricultural aircraft in their analysis to demonstrate the point that depreciation costs are a real factor which need to be included in pricing models. Such analysis sees an aircraft written off (on book value at least) after eight years but in a practical sense this may not be the case. There will be a salvageable value at this time that should also be accounted for.

The use of a sinking fund would seem an appropriate measure for operators to use in their financial planning. Each year, money is put into the sinking fund so when it comes to replace equipment the finance required has been saved for over a number of years. The money can be invested in a low risk investment (perhaps not a finance company) to provide a return that will at least cover inflation.

For example consider a GA200 Fatman with a purchase price of NZ$520,000 that is sold after 8 years and has a salvageable value of $280,000. This gives a replacement cost of $240,000. Multiplying $240,000 x sinking fund factor of 0.104722* = $25133.28 per year (adapted from Lincoln University Financial Budget Manual 2008). This is the figure that should be allowed for each year with regard to saving for a replacement aircraft. This is considerably less than the $65000 per year ($520,000/8 years) from 12.5% SL depreciation and zero resale value.

*using 5% interest and an 8 year period gives a sinking fund factor of 0.104722

The operator needs to be mindful that if the book value of equipment is lower than the resale value then tax on the profit from sale will be incurred.

The importance of resale value is evident and should be considered by operators when purchasing aircraft and equipment. If it is feasible to safely operate and maintain an aircraft for 20 years then this would further decrease the annual savings to be contributed to the sinking fund.

The determination for how long an aircraft can stand up to the rigours of ag. work will need to be decided on a case by case basis.

As discussed the costs of ownership have a large bearing on charge out rates and for an operation to be truly sustainable these costs must be taken into account. This is demonstrated in Table 3. Lockhart (2009, Failure or Future) suggests that operators need to increase their prices by at least

20-25% immediately to account for the cost of ownership. Whether the market can bare this is questionable. In any case addressing the issues of under-utilisation in the first instance is of prime importance.

When deciding on the appropriate capital cost structure of a business it is important that the operator has a good understanding of what the expected utilisation of the equipment will be. This is easier said than done in the FWAA industry, where workload volatility is high.

2.3.3 The effects of utilisation on profitability.

The current profitability of aerial topdressing seems to have hit rock bottom. Graeme Martin, Super Air's commercial manager, provided the following comparison; in the early 2000's it cost 3 lambs to purchase a tonne of superphosphate and one lamb to spread it. It now costs 7 lambs to buy the fertiliser but still only one lamb to spread it.

The reduction in average flying hours per plane as described earlier in this chapter means that the fixed operating costs need to be covered by fewer flying hours which would require a large increase in charge out rates. This is demonstrated in Table 3 below. However operators have been unable to pass these costs on to the struggling sheep and beef sector for fear of pricing themselves out of the market. Hence the dire situation the FWAA industry is in today.

The following table shows both the fixed and variable costs for a new GA200 Fatman ($520,000) operating with two loaders ($200,000 each). The cost of ownership includes replacing gear and return on capital. Equipment is replaced after eight years use. A sinking fund to allow for asset replacement is used. The operation also requires a 15% return on capital invested. The number of hours and the corresponding hourly charge rates that are required to cover these costs are shown.

Table 3. Costs of operating a GA200B Fatman and two loaders.

Hours flown/year	**200**	**300**	**400**	**500**	**600**	**1000**
Fixed costs/hour	415	277	208	166	138	83
Variable costs/hour	536	536	536	536	536	536
Cost of ownership	919	613	460	368	306	184
Total Cost/hour	**1870**	**1425**	**1203**	**1070**	**981**	**803**

For further workings refer to appendix A.

Table 4 (Grafton et al, 2010) shows how many hours must be flown to achieve a certain application cost per tonne to break even. The analysis clearly shows the impact utilisation has on the cost of services to farmers. Without good utilisation of aircraft (600+ hours/year) both an affordable service to the farmer and a profitable FWAA operation are not possible unless terms of trade for farmers improve dramatically.

Table 4. Variance price analysis for breakeven hours. (NZ$)

	Cresco			Fletcher		
$/tonne	Monthly hours	Annual hours	Revenue required per annum ($)	Monthly hours	Annual hours	Revenue required per anum
60	97	1,164	1,396,800	64	768	552,960
65	82	982	1,276,600	50	600	468,000
70	71	850	1,190,000	39	465	390,242
75	62	744	1,116,000	32	388	349,165
80	56	672	1,075,200	28	333	319,719
85	50	600	1,020,000	24	292	297,576

Source: Grafton et al (2010); An economic analysis of aerial topdressing in New Zealand

Wanganui Aero Work Cresco *Photo Courtesy of Rick Harding, WAW.*

2.3.4 Diversification – a means of increasing equipment utilisation.

According to Lockhart (2009) the future of owner/operator businesses appears limited in the face of fierce competition from both the large coops and other operators. There may be a future though for operations that can diversify into specialised fields such as spraying. Such operations can command a higher hourly rate.

In Marlborough a lot of hill country is infested with woody weeds and bracken fern. With no control of these weeds large tracts of hill country will soon be rendered unproductive. This land is often not fertilised as it would not provide a positive return. There is opportunity for both the farmer and operators if this land can be sprayed to eradicate weeds and bought back into production in an economical fashion. If such land is better utilised it may also warrant application of fertiliser further increasing the amount of work for aerial operators.

Result of a weed spraying job from a GA200B Fatman in Marlborough hill country. *Photo R. Patchett*

Patchett Ag Air is an innovative operation and along with traditional solid fertiliser application had developed suspension fertiliser spreading equipment (which has now been divested) and more recently spray gear which is used for spraying vineyards and crops for pests and diseases as well as hill country pasture and scrub weeds. The spraying operation is highly efficient and cost effective and provides a good return compared to the traditional solids work which is exposed to severe competition. The spray season begins in the vineyards from late September through into November. Spraying of weeds such as bracken fern, manuka, matagouri and tauwhini in the hill country occurs through the summer and autumn months until the first frosts arrive.

The spraying side of Patchett Ag Air's business has been very successful in its short time in operation with both vineyard owners and farmers increasingly demanding its services. From a vineyard perspective the early season fungicide sprays (mostly sulphur), applied before the canopy becomes too dense are more cost effective via the Fatman than from on-ground application.

GA200B Fatman applying fungicide spray to a Marlborough Vineyard in spring. Photo: Ray Patchett.

The spraying of hill country has also proven to be very affordable to farmers at around $50/ha for application (as opposed to around $200/ha for helicopter) and has also given very good kills of dense woody weeds such as manuka and gorse due to the excellent penetration of the large droplets being delivered from aircraft travelling at 95 knots as opposed to a helicopter at around 40-50 knots. The use of heavy droplets does have the downside of not being able to spray close to sensitive crops where drift is an issue.

Table 5 gives indications as to areas sprayed from the GA200 Fatman per hobs hour depending on job type and application rates.

Table 5. Area sprayed per hour from an aeroplane at different water rates.

Job type	Vineyard/crop 100L/ha	Hill Country 200L/ha	Hill Country 400L/ha
Area sprayed/hobs hr	96	45	25

Using the hill country spraying as an example if the charge out rate was $70 per hectare this would give a productive hourly rate of $3150. At $70 per hectare this is around half the application cost of a helicopter. At this charge out rate the farmer is still provided a very affordable service and the operator is achieving far greater margin from this work than from spreading solids. Both the operator and the farmer benefit. This also means that the operator can cover a large proportion of fixed costs from a relatively small number of hours.

The spraying operation is, however, reliant on calm weather conditions more so than is required for solids application. As a result the available weather windows are often short and it is not uncommon to fly out to a job and not get started or to fly for only an hour. After pulling out of a spray job, removing spray gear and relocating to a solids job the wind has often picked up to a level too high for solid application as well. This can result in excessive ferry flight time, a frustrated operator and farmer. The counter to reduced utilisation when spraying comes from the efficiency of service provided meaning hourly charge rates can be considerably higher than a solid application job can stand.

Patchett AgAir has also saved costs by downsizing the loader fleet to one truck in line with the reduced workload. The truck has been fitted it with a hiab. The plane can be self loaded by the pilot doing away with the need for a loader driver. The loader truck can be used for cartage and also for spray operations and during quiet times is hired to Marlborough Lines to provide supplementary income.

Ray Patchett operating his self loading truck at Omaka Aerodrome, Marlborough. *Photo: R. Patchett*

The downside of relying on one loader is that weather windows provided by the varying topography of the province can often not be taken advantage of with potential utilisation of aircraft and equipment lost. Also if rain comes while working a job where access to the strip is an issue trucks may not be able to deliver the remainder of the product to the strip to finish the job and/or the loader may not be able to relocate to the next job resulting in further downtime and reduction in utilisation.

Operators are caught in a catch 22 situation whereby investing capital in additional loaders could help to increase aircraft utilisation but does the benefit gained from the increased utilisation cover the cost of the capital invested in the additional loader/s? A cost benefit analysis is required to determine the correct course of action. This would be greatly aided if farmers were questioned as to their realistic expectations of the amount of product they require to be spread over the foreseeable future.

2.3.5 Other suggestions for improving utilisation and profitability.

Improving the utilisation of aircraft and equipment is critical to improve returns to operators without pricing themselves out of a price sensitive market.

A rationalisation of the FWAA industry which has an overcapacity is inevitable and is happening at present, largely through the dominant role of the two fertiliser coops in aerial spreading. If Marlborough farmers are to help ensure a range of services are provided from a locally based operation then coordination of Marlborough's aerial spreading and spraying requirements to maximise utilisation will be needed.

It is important that local operators have a good understanding of what services are required by farmers and that those services are providing farmers with economic benefit. Without knowing what services are required and in what quantity it is hard to determine the desired capacity.

Managing the volatility of work load from year to year is also no easy task. However, if each year farmers were to indicate what work they require to be done and in what quantity then an annual work plan could be drawn up. Periods with high workloads (e.g. autumn and spring) can be identified and jobs whose timing is less important can be shifted to a quieter time of the year.

2.4 Safety

Agricultural aviation is an inherently risky occupation with loaded aircraft (frequently overloaded) being flown off farm airstrips in hill country terrain. The fiercely competitive nature of the business has seen pilots being prepared to operate long hours when the weather is good and a work "rush" is on, from substandard airstrips, often dealing with product of compromised spreading quality. Under such conditions the risk factor escalates.

New Zealand's agricultural aviation industry has a lamentable safety record with 140 pilots having lost their life whilst engaged in aerial agricultural operations (Feeney, 2010). 13 topdressing pilots have been killed since 2000 (NZAAA, 2009). CAA stats (Stanton, J. Pers. Comm.) show that one third of FW ag. pilots will be killed on the job given an average 20 year career. These are shocking statistics that would make new entrant pilots think twice about entering the industry.

Examination of agricultural FW accidents has highlighted strip condition, overloading and pilot fatigue as being major contributing factors in accidents (Wackrow, A. 2005). In an overview of accident investigations from January 2008 to late April 2010 (CAA; Agricultural Aircraft Accident Safety Concerns) human related factors were found to contribute to accident causation. Such human factors include poor decision making with regard to personal health and safety, airstrip selection, weather conditions, jettison of loads and assessment of aircraft performance. Peer pressure to use inadequate strips, operational pressure due to competition for work, financial pressure and time management issues were also contributing factors.

Other factors identified were overloading, aircraft design and crashworthiness, lack of airstrip standards, operational ethics, customer expectations, failure of a functioning jettison system, and training standards.

This chapter will discuss overloading of aircraft, crashworthiness, farm airstrips and storage and other factors which contribute to the poor safety record of the FWAA industry.

2.4.1 Overloading of aircraft and Part 137.

In 1994 changes to Civil Aviation Rule Part 137 (certificate required for agricultural aviation operations) were made allowing agricultural aircraft to take-off at a weight greater than the maximum certifiable takeoff weight (MCTOW). This is known as the "Agricultural Overloading Rule". Appendix B of the rule provides that the pilot must take into account certain factors when considering whether to operate at a certain weight. However the Agricultural Overloading Rule does not provide any guidance as to what specific flight operational matters those may affect (CAA).

As an example the Fletcher FU24 was now permitted to carry a 31% more than previously. However initially this 31% increase in overload was probably rarely used as the performance of the piston engine would not allow the aircraft to gain enough speed for takeoff on most agricultural airstrips. As a result the turbine conversion of Fletchers were approved on the unsubstantiated assumption that operation weights up to the permitted maximum overload had been proven satisfactory and converting to a turbine engine would have no detrimental effects (CAA; Agricultural Aircraft Safety Review).

From the mid 1990's onwards the accident occurrence rate for the two predominant aircraft used for topdressing, the FU24 and the Cresco appeared to be worsening. In response to this the CAA released its Agricultural Aircraft Safety Review (The Safety Review) in 2008.

The CAA found that the performance related and landing gear accident occurrence rates for the FU24 were fairly constant from 1977 to 1994 but increased dramatically from 1994 (introduction of permitted overloading – refer to figure 1). The landing occurrence rates then nearly doubled from 2000 compared to the pre 1994 rate. This coincides with the conversion of a large number of FU24 piston engine aircraft to Walter Turbine engines. This had the effect of increasing the takeoff power rating from 400 horsepower (HP) to 550HP. The aircraft were now able to make full use of the 31% overload and so were subject to increased stresses from higher payloads and takeoff speeds and a longer ground roll explaining the increase in landing gear occurrence rates. Interestingly the performance related occurrence rates decreased from 2000 as the better performance afforded by the 550HP engine reduced fence strikes and other such takeoff related incidents.

Both the effect of the introduction of the agricultural overloading rule into part 137 (from 1994) and the conversion of significant numbers of Fletchers from piston to turbine engines (from 2000) are depicted by the changes in slope of the graph in Figure 1.

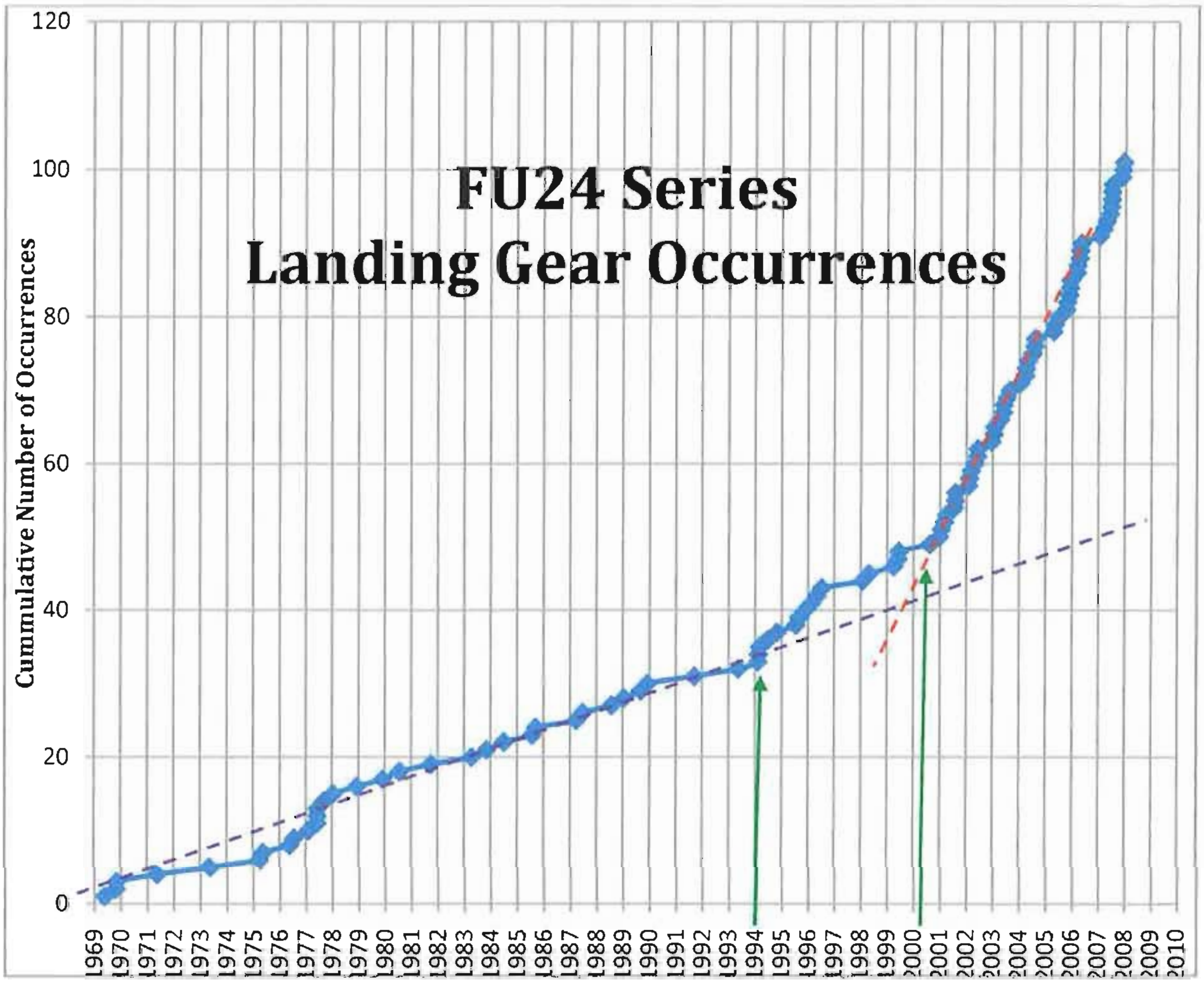


Figure 1. Fletcher FU24 Series Landing Gear Occurrences; source CAA Agricultural Aircraft Safety Review, December 2008.

The Part 137 permitted overloading enabled the Cresco to carry an extra 820kg over its standard certified category weight. The Safety Review found that the Cresco had an extremely high undercarriage defect rate, some 450% higher than that of the three most popular foreign agricultural aircraft types (GA200 Fatman, AirTractor and Agwagon) and 340% higher than the FU24.

As a result of the findings from the Lewis Report and resultant Agricultural Aircraft Safety Review a rewrite of the Part 137 has been undertaken and is now in its final stages. Changes to the rules of Part 137 include the reduction in payloads able to be carried unless an aircraft can be individually certified as suitable to operate at a specified overloaded weight. In practical terms this means that a turbine powered Fletcher instead of being able to carry 1.5 tonnes will now only be able to carry approximately 1 tonne. The Cresco's payload will decrease from around 2 tonnes to 1.3 tonnes.

The reduction in payload for the Fletchers and Crescos which represent around 80% of the hours flown in 2007 (CAA – Agricultural Aircraft Safety Review) will have a dramatic impact on the viability of operators using these aircraft unless this certification can be gained.

On questioning participants in the industry several who operate Fletchers and Crescos don't seem to perceive the Part 137 rewrite as a major issue. Their belief is that to have these aircraft certified as fit to carry loads as permitted by the overloading rule will not require major engineering changes. If this is in-fact the case will the rewrite result in a significant reduction in accident occurrences? If not then the rewrite may fail to achieve its original intent.

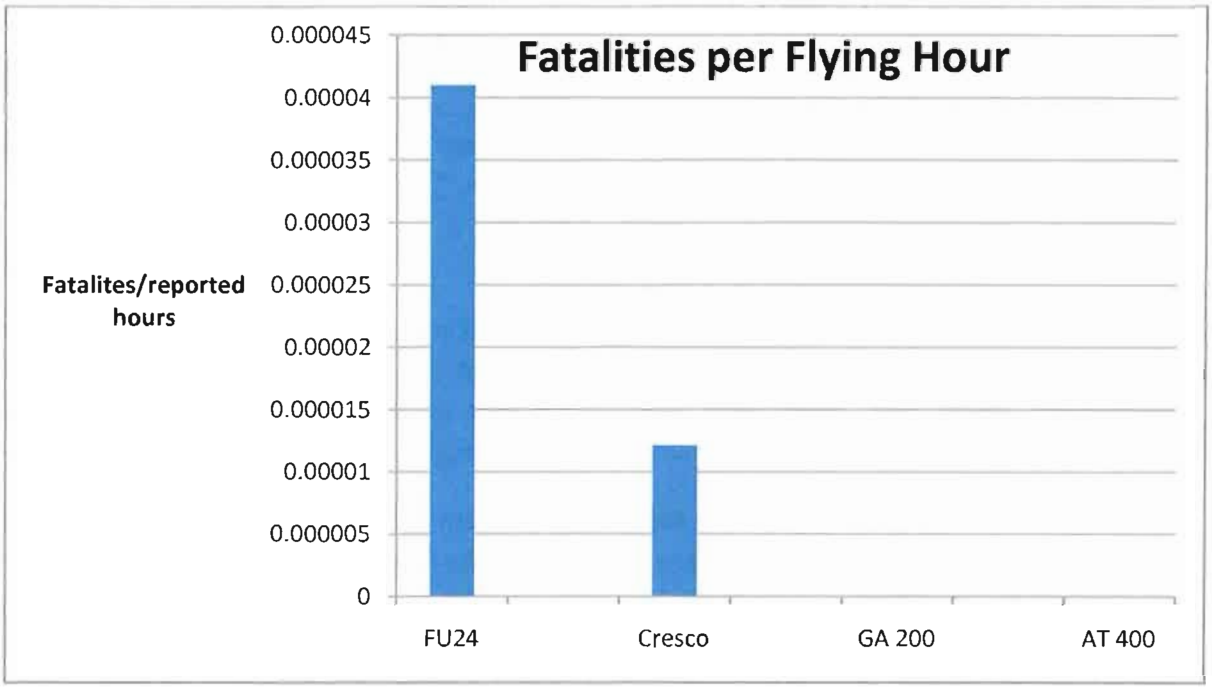
Aircraft such as the GA200 Fatman and the Air Tractor will not be subject to such severe reductions as their hopper capacities effectively restricted overloading in the first place.

2.4.2 Crashworthiness - comparative safety of different aircraft

When looking at the safety of different aircraft a comparison of fatal and serious harm injuries for each aeroplane is important, rather than just occurrence rate. This could be used to help determine the survivability or crashworthiness of different agricultural type aeroplanes. This should be compared on an hours flown per fatality& serious harm incident.

Jack Stanton from the CAA kindly compiled data from the CAA database for this report and his results are shown below in Figure 2. Data for the different ag. aircraft types was taken from 1990 to 2008.

Figure 2. Fatalities per flying hour for different agricultural type aeroplanes. (Stanton, J. CAA)



For the GA200 Fatman and the 402B AirTractor which have flown a reported 34895 and 16438 hours respectively from 1990 to 2008 in NZ agricultural service there have been no fatalities. There have been eight fatalities in the FU24 and two in the Cresco which over the same time period flew 439141 and 164714 hours respectively. Admittedly the later two aircraft have flown many more hours than either the GA200 or the AT400 but Figure 2 allows for this by comparing on an hours flown basis.

An interesting factor to consider is that in foreign agricultural aircraft such as the Fatman, Air Tractor and Agwagon the pilot has a crash bay, the hopper and then the engine in front of the cockpit. However, in a Fletcher or Cresco the hopper is situated aft of the pilot. From a layman's viewpoint the pilot in the case of the later two planes appears to be the "meat in the sandwich". Perhaps this is a contributing factor to the lower survivability rates suffered in Fletchers and Crescos? It's also interesting that no Fletchers or Crescos have been sold into the U.S. for agricultural operations because of this hopper placement.

The monocoque construction of the Fletcher and Cresco, while lightweight doesn't withstand impact the same as the tubular construction of the aircraft such as the Fatman and AirTractor (Patchett, R Pers. Comm.). This factor is also likely to affect crashworthiness of the monocoque constructed planes. The photo below is taken of a Fatman that flew into a Eucalypt tree while spraying in Australia and gives a good demonstration of the crashworthiness of the aircraft. The pilot escaped with a broken ankle.

The pilot walked out of this wreckage after the plane crashed into a eucalypt tree while spraying. Photo Courtesy of Ray Patchett.

An interesting comparison can be made of two recent accidents. One involving a 402B AirTractor and the other a FU24-950. Both accidents had very similar characteristics. The AT402B failed to achieve expected performance on takeoff and collided with rising terrain beyond the strip. The FU24, during initial takeoff failed to achieve the required climb gradient and collided with terrain immediately adjacent to the take-off flight path. The pilot of the AirTractor climbed out of the aircraft and later received stitches to an arm from a shard of plexi-glass broken from the canopy. The pilot of the FU24 was taken to the hospital spinal unit for serious injuries and is making a slow recovery to walk again. In this instance the crashworthiness of the tubular constructed, forward hopper Air Tractor proved to be superior to the monocoque constructed, aft hopper positioned FU24.

If one was to envisage how the fixed wing ag aviation industry would look in the future then a massive reduction in the fatality and serious injury rate would have to be at the top of the list. This will be necessary to help attract new pilots into fixed wing ag. aviation.

For a dramatic improvement in safety standards choosing aircraft with significantly superior safety records seems obvious. However complications arise when commercial realities are considered. If the safer aircraft happened to be less profitable to operate this presents ethical issues of profitability versus safety.

The ideal situation is to have an aircraft that is safe and profitable. This will be discussed further in Chapter 2.7 Fit for Purpose Planes.

2.4.3 Farm Airstrips, Access, and Storage.

The design and standards of farm infrastructure for FW ag. aviation, namely airstrips, access tracks and storage bins have a wide range of implications for both farmers and operators. Poorly designed and maintained airstrips rate highly as one of the contributing factors in accidents as do poor storage facilities which can lead to contamination of fertiliser and resultant flowability issues from the aircraft.

For sixty years now, by far the greatest case of stress damage and metal fatigue to NZ ag. Aircraft has been rough strips (Feeney, 2010). Graeme Martin (2010 pers. comm.) also suggested that rough strips played a major part in the undercarriage/landing gear occurrence rates.

Obstacles such as fences and trees around airstrips have also been a major contributor to accidents. A standard height fence at the end of a strip effectively reduces the operational length of the airstrip by 100 meters (Feeney, 2010).

The CAA and Department of Labour in 2006 published the Safety Guideline: Farm Airstrips and Associated Fertiliser Cartage, Storage and Application. This is an excellent source for informing farmers of the issues and their responsibilities with regard to safe aerial application of fertiliser onto their properties. However as noted by Graeme Martin (Country-Wide 1-12-2006) the guideline hasn't been given a very high profile. It is possible that many strip owners have not received the guidelines and for those that have the need for implementation of the guidelines may not have been impressed on them. While the guidelines are not mandatory strip owners/farmers may find themselves in a perilous position with OSH and DOL if poor infrastructure standards were found to be a causative factor in an accident.

Communication seems to be lacking between many operators and farmers. Super Air chief pilot Joe Cave suggests that in the past pilots have prided themselves on their "can do" attitude (Country-Wide 13-4-2009). The good relationships that pilots forge with their farmer clients and the competitive forces at play have seen many an unsafe strip flown or contaminated product spread.

For the FWAA industry safety aspects are the key concern with regard to substandard farm infrastructure. However other factors add significant costs to operators. Rough strips increase maintenance costs of aircraft. The downtime due to increased maintenance also compounds utilisation problems. Weather restricted access tracks and insufficient storage facilities at the airstrip can also result in downtime and sub-optimal utilisation. This may be especially so if operating a high capacity aircraft.

Better communication between operators and farmers is important to increase farmer awareness of the issues surrounding airstrips, storage and access roads. A change away from the "she'll be right" attitude from both operators and farmers is required. Without this improvements in farm infrastructure and pilot safety will be unlikely.

2.4.3.1 Marlborough's on farm FWAA infrastructure.

When asked about the conditions of farm airstrips, fertiliser storage and access in Marlborough local operators commented that many were of substandard quality. Poor design of airstrips was a common theme as was the lack of covered storage bins. Some strips were unsuitable for an inexperienced pilot or for a particular type of aircraft. Access to hill strips was also a problem when trying to operate off these in wet weather.

2.4.4 Costs associated with poor safety records.

The poor safety record of the FWAA industry sees the current insurance costs of aircraft at around 8% of hull value. For a Cresco or AirTractor with a value of around $1.5million this equates to $120,000 per year and represents a significant cost to the operation.

An analysis of recent ag. aviation accidents by the CAA (2010) put the social cost of one fatal accident at $3,522,800, three serious harm accidents at $368,000 each and 2 minor accidents at $15,600 each. Combine these costs with the capital cost of $5,150,000 for the equipment destroyed, and or repairs and the total costs of the six accidents equated to $9,808,000. This represented $11.80 / tonne when converted to a cost per tonne of product flown.

There appears to be opportunity for both FWAA operators and farmers to take a proactive approach to mitigating these costs for mutual benefit.

In discussions with several industry participants on their views of safety and aircraft maintenance they made it clear that some practices borne of severe competition did not pay. For example illegal overloading of aircraft to increase efficiency can prove a false economy. The stresses placed on the aircraft require more regular maintenance and increased downtime. This says nothing of the inherent risks involved with overloaded aircraft.

2.5 Existing pilots, new entrants and succession.

Agricultural aviation is a demanding and risky occupation with high barriers to entry due to the capital intensive nature of the business. Pay rates for pilots are below their expectations. Table 6 shows the industry's average take home pay for annual hours flown.

Table 6. Annual average take-home pay/hours flown

	<$50k	$50-75k	$75-100k	$100-150k	>$150k
Hours	500	500	700	800	Nil

Source: NZAAA

A survey of pilots by NZAAA found that of the 36 respondents 80% (29) had pay expectations of $100,000 or more and of those 29, seven expected $150,000 or more. With the knowledge of average hours flown per plane in the industry at present (194 hours for 2009) and comparing this with the data from Table 6 pay expectations are not being met for the majority of pilots. In an industry where around a third of pilots are killed on the job working for pay well below their expectations it is little wonder that there are only one or two new entrants per year.

Business succession is becoming increasingly difficult for owner operators and the main avenue in recent times has been to sell to Ravensdown's Wanganui Aero-Work (WAW) or the Balance owned Super Air. Lockhart (2009) suggests that as the industry stands at present the future for the conventional owner operator is limited, at best. However some may be able to exist if they can differentiate their services from the competition by innovative and entrepreneurial means.

It is likely that once the two fertiliser coops have sufficient capacity those looking to exit the industry will have very few options with regard to realising capital from their assets. The overcapacity in the industry will make many old aircraft unsalable if they do not have alternative uses. However the sunk costs and lack of an exit strategy plus the passion many pilots have for the occupation has seen them battle on for little or no reward. This exacerbates the overcapacity situation and associated issues.

To be able to foster new pilots into the owner/operator side of the industry it will be critical that such operations are profitable to allow succession.

The ability of pilots to borrow to help finance their way into the industry is somewhat limited. The poor profitability, volatility, high risks and limited exit strategies involved do not make for a sound business proposition. Mainstream banks have no apatite to lend to ag aviation business's but banking sources say that there are some finance companies that are willing to lend at interest rates currently in the order of 8.5 -10%. A minimum of 30% equity is required though and repayment terms are structured around key component rebuild times.

There is the opportunity to improve the bankability of ag. aviation business's though by supplying financiers an annual workload commitment provided by farmers through a coordination body.

While this may not be an absolute guarantee of work it helps to provide more substance to a business plan.

Increased flying hours achieved through improved coordination of work will also improve pilot wages, making the industry a more attractive proposition.

2.5.1 Pilot training

Training of pilots for agricultural flying is limited in New Zealand. Most companies have pilots with E Category certificates which are required to instruct new pilots. However the problem is that very few companies have dual control aircraft to train in. There are currently no training facilities for tail draggers (e.g. GA200 Fatman and AirTractor) in the country and pilots need to go to Australia to attain their rating. Larger operators such as WAW and Super Air do have dual controlled Fletchers and Crescos to train in which provides an avenue for pilots wishing to enter the industry.

A typical progression for a trainee ag. pilot once their commercial pilot licence is obtained is to gain an ag. rating in the particular aircraft they intend to use. From here they will generally become a loader driver/pilot under the chief pilot. The pilot may then work the easier jobs in favourable conditions while obtaining instruction from the chief pilot who loads for him. When conditions are less favourable for the inexperienced pilot the chief pilot takes over.

The trainee pilot can't expect to fly a job with the same efficiency as an experienced pilot and they may fly with a reduced load initially. This highlights an associated and unavoidable cost in training pilots on the job which needs to be considered and planned for.

Training of pilots in the location they are to operate in is also invaluable. There is a wealth of knowledge to be gained from experienced local operators as to the peculiarities of weather patterns unique to a region, and to airstrips within the region too. At present Marlborough's two pilots holding E Category status are near the end of their careers so it is important that the knowledge that they hold is passed on to succeeding pilots.

Ensuring that new pilots have had an excellent training and a gradual building of experience will play an important part in reducing accident rates. To the contrary a young pilot who is rushed in to fill a vacant position will face a higher risk of accident.

2.6 Regulations, compliance and administrative costs

Due to the high accident and fatality rate in the industry and with the Agricultural Aircraft Safety Review findings resulting in changes to Part 137 operators will be required to undertake more record keeping. One of the obligations from the proposed rule changes will require operators to document their operations and procedures in the form of an exposition. The following excerpt from the CAA's Notice of Proposed Rule Making (NPRM) for the Part 137 update gives an indication of what will be required.

Additional certification requirements to improve compliance and safety standards

Establish maintenance procedures

Establish maintenance programmes

Establish document control procedures

Establish maintenance and calibration records for safety critical equipment

Establish a flight following system

Establish an emergency situation action plan

Establishment of operations procedures – require the documentation of operating procedures and practices

Establishment of management system – require additional accountable persons to be approved and listed, and the documentation of a management system commensurate with the size of the organisation

Agricultural aircraft operator exposition – develop an exposition

Refuelling operations – document procedures

Maintenance – detail airworthiness responsibility, maintenance options, and maintenance review requirements

Training – detail requirements for crew training programmes and records

Crew member competency – establish records of competency assessments

Fatigue of flight crew – require development of a fatigue management system, and detail operator and flight crew responsibilities

Manuals, logs and records – detail responsibilities

The CAA has given indications as to the compliance costs arising from the Part 137 rewrite. For a small operator who is likely to contract a consultant to prepare the exposition the cost is estimated at $3500 and for CAA to view and accept the exposition will cost around $1060. This is but one of the costs that will be incurred in the rewrite.

Regional and District Councils are also looking at developing regulatory policies around the environmental impacts of agricultural aviation. Again the end result will most likely mean an increase in paper work and compliance costs for the operator. The NZAAA is in the process of investigating how plans can be drawn up that are reasonable and pragmatic to enable the industry to operate in a sustainable manner using best practice and in partnership with the regulatory authorities (Maber, J. 2010).

For owner operators the increasing demands on their time to maintain compliance with regulations and certification is an added stress that has both financial and safety implications. Larger operators such as WAW or Super Air have the administrative staffing capabilities to deal with these issues more easily. Improved profitability will be required if owner operators are to withstand the increasing regulatory and compliance costs.

2.7 Fit For Purpose Aeroplanes

When considering what is deemed to be an aeroplane fit for purpose the following considerations should be taken into account; work to be done, terrain to be flown over, safety, power to weight ratio, manoeuvrability, running costs, suitable capacity for workload, efficiency, capital cost and service life longevity. The climatic conditions of a region may restrict the number of hours that can typically be flown in a year and may therefore favour use of aircraft that require fewer hours to break even.

The ag. aviation industry in New Zealand to a large extent seems to take the approach that bigger is better. Several larger companies believe that the Cresco is the aircraft best suited to meet New Zealand's FWAA needs. However this may not be the case if throughput cannot be guaranteed. In Marlborough's situation even if a Cresco was to be the sole aircraft operating it would not be viable on current tonnages applied. NZAAA President Tony Michelle suggested(NZAAA newsletter, September 2009) that if hours flown per year are low, say 300, then it may mean you have the wrong aircraft in terms of capacity, regardless of whether it is a good aircraft and perhaps a smaller capacity aeroplane would be more suitable. Again maximising aircraft utilisation is the key which requires matching equipment capacity with workload.

Michelle also mentioned that at the NZAAA annual conference some predictions were made that there would be a gradual decline in the application of fertiliser by air as farming adapts to a new lower input cost system. Whether this is so will depend on the fortune of farmers. The type of product to be applied may also change especially if widely used fertilisers like superphosphate and high products (eg DAP) increase in price. Increasing acidification of hill country that has had years of acidulated superphosphate application may benefit from liming. An increase in the amount of lime applied would result in higher hours flown due to the typically higher application rates of lime.

The use of a Fletcher or Cresco which has the hopper aft of the cockpit may be more suited for lime application. An issue in aircraft with hoppers in front of the cockpit is that fine particles of lime during loading are deposited on the windscreen impeding vision (Patchett, R. pers. comm.). The static on the windscreen causes the lime particles to stick and this is very difficult to remove.

WAW's Marlborough based Fletcher applying lime to hill country . Photo courtesy of Rick Harding, WAW.

While the recent literature focuses on New Zealand's two predominant FW agricultural aircraft, the Fletcher and Cresco, an analysis of other aircraft, such as the GA200 Fatman and the AirTractor from both cost effectiveness, safety and performance aspects is worthy of consideration. This is particularly so given the imminent introduction of the rewritten Part 137 that may require reduction in payloads of which the Fletcher and Cresco will be most affected.

For a Cresco to be run profitably and at a charge out rate that is affordable to farmers a large number of hours must be flown. However even if sufficient work is available to fly 800-1000 hours a year climatic factors may prevent this being achieved. Therefore a Cresco may be unsuitable to service a region that typically has a high wind run. Marlborough is a case in point.

The rationale of bigger is better is questionable when considering the cost of larger new aircraft such as the Cresco, PAC XL750 or AirTractor as the cost of capital can severely impact on financial performance. A solution would be to look at planes that are less capital intensive relative to their spreading capacity and predicted work load. There may also be a trade-off between capital and spreading capacity. The right decision again will come back to the amount of available work in a region and its climatic restrictions.

With regard to new aircraft choice is limited. There is now only one new topdressing aircraft, the AirTractor from the U.S., being produced (Country-Wide, 13-04-2009) with Pacific Aerospace having ceased production of the Cresco. However there are options to bring other aircraft back into production if bulk orders are made. The GA200 Fatman could go back into production if a minimum order for six aircraft is received. These would have an approximate purchase price of $AUS 400,000 (Morgan, P. pers. comm., Gippsland Aeronautics Oceania Sales Manager). At the time of writing this converts to around $NZ 520,000. Pacific Aerospace can also produce an ag. variant of the 750XL. This has a price tag ex-factory of NZ$1.8 million.

A new AirTractor, produced in the United States for agricultural work. *Photo courtesy of R. Patchett.*

When making a decision as to what will be the most suitable aeroplane to purchase canvassing farmers and other users as to their requirements is crucial. This will help provide an understanding of the types and amount of work required. Focusing on applying services that really add value to a farmer's business will be a key to establishing a viable ag. aviation business.

A small region such as Marlborough lends itself to a multi-purpose aircraft that can cater for both farmer's spraying and solid application needs. A multipurpose plane is also of benefit to the operator if a particular job (e.g. spraying) can attract a higher charge out rate than that of solid fertiliser. For spraying, manoeuvrability is especially important as it is for accurate application of solid fertiliser on typical Marlborough hill country. However spraying, especially in hill country requires a highly skilled pilot and training younger pilots for such a role will take time and good planning.

In my opinion the GA200 Fatman appears to be the most suitable aircraft to meet Marlborough farmer's needs. It has the following attributes:

- Excellent safety record; high survivability/crashworthiness.
- Multi-purpose aircraft – excellent for spraying as well as solid application.
- Highly manoeuvrable, excellent power to weight ratio.
- Highly efficient and cost effective.
- Suitable capacity for Marlborough's spreading and spraying requirements.
- Low capital cost at $AUS 400,000 new.
- Holds its value well, has other uses outside of ag. work.
- Long service life and low maintenance costs.

The Fatman has probably been shunned by many in the industry as it is seen to lack capacity. This is interesting in an industry that has a significant overcapacity. It is also piston rather than turbine powered, which has less appeal to many pilots. Many New Zealand ag. pilots also appear to favour aircraft with tricycle undercarriages (e.g. FU24, Cresco) whereas the GA200 is a tail dragger. Of the pilots who fly the GA200 they don't find this an issue and the lower occurrence rate data for this aircraft would tend to support this.

2.8 The role of farmers.

Farmers have a crucial role to play if the future of the agricultural aviation industry is to be successful. They also have a vested interest to make sure that this is so. In many cases it is fair to surmise that the farmer has a limited understanding of many of the factors involved in running a safe, efficient and profitable ag. aviation business. The writer, for one, counts himself among such farmers before commencing this research. This is not to point blame at the farmer but highlights a lack of communication and education between farmers and operators.

In many cases farmer's airstrips, access and storage facilities need to be improved to ensure the safe and efficient operation of aircraft and equipment. Advanced planning of aerial services required provides the opportunity to better coordinate work and improve aircraft utilisation.

Unification of farmers will be required to achieve the common purpose of maintaining a sustainable locally based FWAA industry in Marlborough. Accepting work from outside operators with unrealistic and unsustainable pricing may be attractive in the short term but could have serious consequences for local operators and farmers in the long-run. Recent history has proven this to be so.

It is also crucial that farmers make judicious decisions with regard to their expenditure on aerially applied products. This can be difficult when farmers are faced with so many products to choose from and often contrary advice on what to use. Advanced planning and research will greatly enhance the chances of positive returns. Clearly this is in the best interest of the farmer but also the aerial operator if both are to have a sustainable future.

CHAPTER THREE

3.1 Designing a model that helps secure an affordable and sustainable fixed wing agricultural aviation service in Marlborough.

The preceding chapters have outlined many of the key issues that are facing the agricultural aviation industry in New Zealand and Marlborough. This Chapter will present recommendations and how some of these can be incorporated into a model to help secure an affordable and sustainable FWAA service in Marlborough.

3.1.1 Guidelines for a sustainable FWAA service in Marlborough.

For a FWAA service in Marlborough to be considered sustainable it would have to meet the following requirements:

- Provide an affordable service that adds value to farmer's businesses.
- Be sufficiently profitable to:
    - provide a return on capital.
    - allow money to be set aside for asset repairs and replacement.
    - enable staff to be paid a reasonable wage.
    - attract a successor to the business.
    - enable new pilots to be trained by the operation.
    - allow succession to take place.
- Provide a safe working environment.
- Meet all compliance and regulatory obligations.

3.1.2 The Coordination Organisation.

There is an opportunity to create a farmer organisation to help secure an affordable and sustainable agricultural aviation industry in Marlborough. Initially the primary role of the organisation would be indentifying and coordinating farmer's aerial service requirements with operators. There are many other possibilities for farmers that flow from this organisation, such as bulk buying power. For the purpose of this report the focus will remain on the FWAA.

The Marlborough Agricultural Aviation (MAA) steering committee is currently working through what is the most appropriate structure to use for a Coordination Organisation (CO). An Incorporated Society is a possibility. The setup costs are inexpensive and members pay an annual subscription to gain the benefits provided by the society. An annual sub would be used to cover staffing and administration costs. Initial thoughts are that the organisation could be staffed by one person. This would depend upon the full extent of roles the organisation takes on.

Early discussions were had as to whether the organisation should have any investment in aircraft and equipment. However this has been dismissed at this stage with the belief that farmer investment in aerial operations does not solve the root causes affecting the industry. The appetite from some farmers to invest would also be limited and causes complications. Ideally full farmer support of the organisation is sought so low barriers to participation are required. An organisation with low capital costs and operating expenses covered by a membership fee is attractive.

3.1.3 Governance of the Coordination Organisation.

Sound governance of the coordination organisation will be essential to meet the founding objective *– securing an affordable and sustainable fixed wing agricultural aviation service in Marlborough.*

The governance team will act as gate keepers to ensure that both local operators and farmers benefit from the organisation's activities. Guiding principles and relevant parameters will need to be developed to help aerial operators to perform profitably and sustainably. Establishment of these guiding principles is part of the FITT project being undertaken by the MAA steering committee and is work in progress. Legal and accounting issues would need to be addressed to ensure activities are compliant with New Zealand law. For example the CO would need to be mindful of not being involved in anti competitive behaviour that could find it in breach of the Commerce Act.

3.2 Solutions to the problems.

This section gives tables summarising some of the problems facing the ag. aviation industry in Marlborough and possible solutions.

3.2.1 Underutilisation of Aircraft and Equipment

Problem	Solution
Underutilisation of aircraft and equipment due to poor coordination of work load.	Farmer coordination organisation (C.O.) to register and coordinate region's flying work.
Loss of local service provider and associated specialist services due to poor profitability.	C.O. helps prevent fragmentation through planning of work load to optimise local operator utilisation.
Fragmentation of workload – effect of outside operators	Coordination of workload ensures local operator/s optimise utilisation.
Local service provider can't complete available work.	Regular review and updating of work calendar anticipates this and contracts in services as required.
Potential for monopoly operator to dictate unreasonable terms.	Farmer coordination body has ability to tender out work.
Insufficient loaders available to operators in region.	Encourage collaboration and coordination of loader resources.
Farmers unsure whether use of services will add value to their business.	Identify what products and services can provide farmers the best marginal returns*. This leads to improved profitability and ability to make increased use of FWAA services.
Single role aircraft struggling for utilisation	Use of multi-role aircraft to increase utilisation and to take advantage of higher margins from specialised work.
Unsuitable aircraft capacity for regions work load.	Use of aircraft that best matches workload. Farmers via CO provide info as to aerial work requirements.

*It is beyond the scope of this report and the author's knowledge to go into details of what products may provide farmers the best return. However it is the author's belief that many farmers are not getting a positive return on their fertiliser expenditure. This miss-targeted expenditure and its resultant impact on farm profitability certainly doesn't benefit the farmer nor in the longterm the aerial operator.

3.2.1 Coordination for improved utilisation.

Improved utilisation of aircraft and equipment through coordination of farmers work requirements with operators appears to present a huge opportunity to improve operator profitability while maintaining affordable services to farmers.

3.2.1.1 Annual work plan.

If farmers were able to present their next year's spreading/spraying requirements at an agreed time each year then an annual plan could be drawn up. The plan would detail product to be sown/sprayed, timing and whether the product use is timing critical or not. Consideration would also be given as to whether the airstrip and access are affected by wet weather or not.

From this an idea will be given as to peak workloads. To spread the peaks, products that are not timing critical can be shifted to a quieter time on the calendar. Work to be done from strips and access roads that cannot be operated on in wet weather should be booked in for summer and early autumn and work from all weather strips could be saved for wetter periods.

Producing and updating a work plan will also have the benefit of reducing fragmentation of the workload therefore improving utilisation of equipment for locally based operator/s.

The challenge will be changing many farmers' practices of last minute booking to one of greater lead time. However if farmers are shown how increased aircraft utilisation can result in their product being applied at a cheaper price (refer to Table 4) then this will provide incentive for change.

An annual work plan also presents opportunities to local farmers for discounts on fertiliser through the power of bulk ordering and reduced freight rates for a guaranteed amount of work.

3.2.1.2 Ordering of fertiliser and organising cartage.

Coordination of fertiliser suppliers and trucking companies to ensure product is available and can be carted to storage bins ready for application will also be important. This highlights the need to have adequate storage facilities at the strip so operators do not run out of product because the trucking company can't deliver product quickly enough.

Delivering product to bins in different areas of the province, for jobs that are booked in at a similar time may enable an operator to take advantage of weather windows that may exist in one area and not another on any given day. The installation of weather stations at strategic locations around the province would also provide useful information as to what areas can be worked on a particular day.

3.2.1.3 Loader numbers and location.

Having access to an adequate number of loaders which can be distributed around the region will also help to increase aircraft utilisation. The annual spreading requirements of Marlborough farmer's will dictate the appropriate number of loaders needed to adequately service the region. If demand requires more than one operator to service the province then collaboration between operators should be encouraged with regard to loaders. For instance in areas such as the Marlborough Sounds or the East coast which are more isolated and provide a smaller pool of work it may make sense to have a loader permanently located there and shared/ hired between operators.

3.2.2 Maintaining Affordable Services to Farmers.

Problem	Solution
Application costs too expensive for farmer.	Coordination leading to increased utilisation allows for more affordable pricing to farmer which in turn may increase workload and further improve utilisation.
Increasing farm costs.	Farmers band together via C.O. to benefit from bulk buying power.
Severe lack of profitability hampers innovation.	C.O. helps to provide a solid platform from which operators can develop innovations that provide improved margins to operators and provide farmers with cost effective services.
Inefficient monopoly operator lacks incentive for innovation.	C.O. operating guidelines don't allow this situation to eventuate. Ability to tender out work.

Sheep and beef farmers, especially in the current economic environment are price sensitive so the ability for aerial operators to increase prices without losing throughput is limited. Again emphasis must be given to increasing utilisation as the primary means of restoring ag. aviation profitability and service affordability. The other key aspect that needs focus is determining what products and services will add the most value to farmers and therefore withstand higher charge rates.

Innovation and introduction of new technologies into ag. aviation will also play a large role in adding value to operators and clients business's.

The C.O. will play an important role in ensuring efficiency if there was to be a monopoly operator. The C.O. through farmer unification will be valuable in keeping prices competitive. However balance is required and the C.O. as gatekeeper will have the responsibility of brokering what fair charge rates for both parties should be.

3.2.3 Improving Safety Standards.

Problem	Solution
Severe competition and low profitability leading to poor safety culture and decision making.	C.O. helps to provide profitable and sustainable FWAA operations – stable environment relieves stresses and associated safety implications.
Airstrip, access and storage facilities sub standard.	Educate farmers as to implications. Provide guidelines, OSH. Encourage standards to be met.
Poor crashworthiness of certain aircraft.	CAA to provide statistics of crashworthiness and survivability of different aircraft. Encourage use of safer types.
Inherently risky nature of operations, especially aerial spraying in hill country.	Ensure comprehensive and gradual training of pilots. Stable work environment relieves stresses and associated safety implications.

Improving safety standards is crucial if there is to be a sustainable FWAAA industry. Areas of opportunity exist, as described in the table above, to improve safety. The industry needs to take a serious look at the aircraft being used and current practices that are causing the high accident rate and make the necessary changes. If a proactive approach is not taken these changes may be forced upon operators. The rewrite of Part 137 is a case in point.

3.2.4 Use of Fit For Purpose Aircraft.

Problem	Solution
What aircraft is most suitable for an operator to use?	C.O. provides information as to quantity and type of services required enabling operators to determine most suitable aircraft to use.
Large aircraft suffering low utilisation.	Use aircraft with appropriate capacity for workload. Multi role aircraft to increase utilisation.
Costs of ownership are high.	Choose an aircraft that has a lower capital cost relative to its capacity, longer service life, better resale value.

For operators choosing the most suitable aircraft to use is a vital decision and can have a huge bearing on the profitability of the operation. The CO can play an important role in providing operators with information to help determine what the best aircraft choice will be. The major factors that must be considered have been discussed in Chapter 2.7. In making this decision the operator should give careful consideration as to what services are going to provide farmers with the best returns.

3.2.5 Enabling Succession.

Problem	Solution
Ability to attract new pilots.	C.O. helps to: - provide a sustainable and profitable business. - enable better pay prospects. - encourages safer working environment. - use of fit for purpose, safer aircraft. - training from experienced operators.
Succession difficult if new entrants can't finance their way into an operation.	-Annual work plan provided by coordination body is contracted to be serviced by pilot – increased certainty of work and therefore bankability. -help to maintain a business with sound track record that is more bankable.
Pilot training	Proactive approach – plan for training. Improved profitability makes ability to train easier.
Non-provision for aircraft and equipment replacement.	Improved financial planning and budgeting. - Use of appropriate measures – set up sinking fund.

Enabling succession is a key to ensuring the sustainability of FWAA services into the future. If there are no young pilots willing to enter the industry then there will be no future. Restoring operator profitability and improving the operating environment, especially with regard to safety are fundamental in attracting new participants. A CO could have an important role in helping to achieve this but there are other areas that will need to be tackled by the FWAA industry. Pilot training is one such area. For training to be undertaken to the highest standard it would seem dual controlled aircraft are essential. Having training facilities available for all ag. type aeroplanes in New Zealand would also be invaluable so pilots are trained in the conditions they are to operate in.

3.2.6 Getting Farmers Onboard.

Problem	Solution
Attaining high level of farmer support and farmer unwillingness to commit to advanced planning.	Low barriers of entry to C.O.: -Annual membership fee -Simple to understand Obvious benefits: C.O. activities support operators – quid pro quo – operator provides discounted service to farmer members. -non members don't receive discount and last priority in pilot workload.
Farmer backs out of registered work commitment	Provide discount incentive for keeping registered commitment.
Farmer unawareness of issues affecting ag aviation.	Focus group meetings and other means of disseminating information. Bring farmers up to speed with issues that need addressing and what role farmers can play. Highlight benefits to farmers.
Farmer apathy	Outline opportunities and benefits from implementing change and highlight consequences if status quo continues.

Hill country farmers have a vested interest in becoming more aware of the issues facing the FWAA industry and the role they can play in improving the performance of the industry for mutual benefit. Informing farmers of the benefits that could accrue to them through collaborating with other farmers and aerial operators will be essential to initiate change.

3.3 Where to from here?

The Marlborough Agricultural Aviation steering committee proposes to send out a brief information document to local farmers outlining the issues faced by Marlborough's fixed wing agricultural operators, accompanied with a questionnaire on their aerial spreading and spraying needs, products and tonnages historically applied, and future projections.

A series of focus group farmer meetings will then be held around the province to discuss in more detail the issues facing FWAA operators and how the introduction of a Coordination Organisation could benefit both farmers and aerial operators. Discussion on Marlborough farmers aerial service needs will be had and questionnaires filled out to record individual farmer requirements. The meetings will also allow farmers to raise questions and ideas and provide feedback on the proposed C.O. model.

CHAPTER FOUR

4. Conclusion

Both Marlborough sheep and beef farmers and fixed wing agricultural aviation (FWAA) operators are facing financially challenging times. The fortunes of both farmers and operators are inextricably linked and recent poor farmer returns have resulted in a reduced demand for aerial services. This situation is mirrored throughout the country. There is a real threat that Marlborough farmers may soon be without a locally based FWAA operation if the status quo continues as both operations are running unprofitably.

Maintaining locally based FWAA services is vital if farmers are to be provided with cost effective spraying, oversowing, poisoning and specialist fertiliser services that are all of a timing critical nature. Without these services the ability of farmers to improve the productive and financial performance of their properties will be severely compromised.

Research into the many issues facing the FWAA industry has identified opportunities that will help to secure an affordable and sustainable FWAA industry in Marlborough.

Extreme competition and poor profitability in the FWAA industry have resulted in practices such as aircraft overloading, use of obsolete equipment and use of substandard airstrips and associated infrastructure. Pilots have also at times been operating under high levels of stress. All have contributed to the terrible accident rate.

The poor safety record and profitability of the industry have also made it difficult to attract and train new pilots. In turn this makes business succession difficult and jeopardises the sustainability of locally based FWAA services.

Both local operators face a gross under-utilisation of aircraft and equipment. This is severely impacting profitability and is the key problem that needs resolving. Addressing the issue of under-utilisation will improve operator profitability which in turn will resolve the aforementioned issues facing the industry.

An overcapacity of equipment and fragmentation of the workload through poor planning and coordination between farmers and operators are major factors causing this under-utilisation. Therefore an opportunity exists to plan and coordinate farmer's FW aerial service requirements with operators. This will help improve utilisation of aircraft by reducing fragmentation of workloads caused by outside operators entering the district. Advanced planning will also indicate if outside operators are required to help during peak workloads. This will insure farmers' needs are continuously meet.

Preparation of annual work plans based on farmer requirements will provide a degree of certainty to local operator/s which may make the business more bankable. This could be useful in enabling business succession.

The use of fit for purpose aeroplanes will also play an important role in providing the range of services required by farmers. A multi-role aircraft providing solid and liquid application services both accurately and safely and in a cost effective manner is required. Specialist services such as spraying have the ability to increase aircraft utilisation and increase operator margins while still providing affordable services to farmers. Suitability of capacity, crashworthiness, capital cost, resale value and service life are all important aspects to consider. The GA200 Fatman currently appears to be the most suitable aircraft to meet both Marlborough farmer's and operator's needs.

It is proposed that a Coordination Organisation (C.O.) be set up to carry out the coordination of farmer's aerial service requirements with local FWAA operator/s. At this stage the preferred structure for this organisation is an Incorporated Society but further research is required. An incorporated society has low barriers to entry and exit and will be simple and cost effective to run therefore increasing the likelihood of farmer support. The C.O. will also have the responsibility of ensuring an ongoing and mutually beneficial relationship for both farmers and local operators.

A root cause of reduced fertiliser application is due to poor or negative marginal returns on injudicious fertiliser expenditure in the past. FWAA operators and other farm service providers need to focus on recommending and providing products and services that best add value to farmers' business's. It is also important for farmers to research what aerially applied products and services to use and then plan the work so it can be implemented to best effect. By achieving optimal outcomes farmers will be more able and inclined to increase expenditure in aerial services to further improve their profitability. This will increase the demand for FWAA services, improve utilisation of aircraft and equipment and improve profitability.

Research into which fertiliser and other aerially applied products will provide farmers with the best returns is beyond the scope of this report but needs addressing. There is potential for the farmer C.O. to facilitate in this area.

Farmers have a major role to play in ensuring a sustainable and affordable FWAA service is maintained in Marlborough. Better communication and collaboration is required between farmers and their local aerial service providers to address local industry issues. Improvements to airstrips and associated infrastructure and advanced planning of work are two key areas needing attention. Farmers have the best chance of ensuring ongoing affordable local aerial services by collaborating through a unified body.

A unified farmer body has many applications and opportunities beyond that of fixed wing agricultural aviation that has been discussed in this report.

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APPENDIX A.

Operating costs for a GA200b Fatman with two loaders and spraying equipment.

Owner/operator with 100% equity

Fixed costs		
Insurance aircraft	41600	8%
airport use	1500	
truck ins	2700	
chemical liability	5000	
public liability	2200	
admin	22000	
hangerage	8000	
	83000	

Utilisation GA200 Fatman

Hours / year	**200**	**300**	**400**	**500**	**600**	**1000**
fixed cost/hour	415	277	208	166	138	83
Direct operating cost/hr	536	536	536	536	536	536
Cost ownership/hr	919	613	460	368	306	184
all costs/hour	1870	1425	1203	1070	981	803
pilot/owner earning	26600	39900	53200	66500	79800	133000

Direct operating costs		
fuel oil	120	
maintenance	25	?
engine replcmt	50	
ferry flying(25%)	25	
loader	100	
driver	83	
pilot	133	
	536	

Cost of lime application at differnt rates/hour and hours flown per year.

Hours flown/yr	**200**	**300**	**400**	**500**	**600**	**1000**
15t/hr lime spread	125	95	80	71	65	54
13 t/hr lime spread	144	110	93	82	75	62
10t/hr lime spread	187	143	120	107	98	80

Core assets		Resale	Lost value
plane	520,000	280000	240000
loaders x 2	400,000	240000	160000
spray gear	45,000		
	965,000		

Assumptions - gear replaced after 8 years. Plane resale $280,000
Loader resale $ 120,00 each after 8 years = $240,000

Cost of ownership	
Replacement cost - sinking fund 7%	39059
Return on capital (15%)	144750
	183809.2