2010 Governor's Office Assessment of State-Owned Aircraft

In Compliance with SJ 22 (2009 Session)

A Report to the 62nd Legislature
October 2010

2010 GOVERNOR'S OFFICE ASSESSMENT OF STATE-OWNED AIRCRAFT
IN COMPLIANCE WITH SJ 22 (2009 Session)

A Report to the 62nd Legislature
from the
Office of the Governor

Prepared by Joe Brand, Chief Pilot
Office of the Governor

October 2010

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1. Introduction

The State of Montana operates a diverse fleet of aircraft performing a wide range of missions, including passenger transportation, search and rescue, game management and fire suppression. Although most of this fleet has been operated by the state for many years, no coordinated effort has previously been made to assess the effects of aging on the state's aircraft and to plan for their eventual replacement.

During the 2009 Legislative session, the House Joint Appropriations Subcommittee on General Government recognized the need to address these issues, and issued Senate Joint Resolution No. 22 directing that, "the Governor's Office conduct an assessment and analysis of state aircraft to determine an appropriate and phased replacement schedule for the state's fleet of aircraft prior to the commencement of the 2011 Legislature."

The state's fleet has always been maintained to appropriate standards; however, like all complex equipment, aircraft eventually wear out. The main focus of this study therefore was to assess the effects of aging on the state's aircraft to determine how long each could be safely and reliably flown. Unfortunately, there are no easy determinations that can be made as the issue involves many complex and often unpredictable factors. The only real certainty is that action will eventually be required.

Although much effort has been made to gather information from industry and national sources on the effects of aging on specific aircraft, definitive data is very rare. In the end, the greatest sources of information have been the people most intimately familiar with the State of Montana's aircraft – the pilots who fly them, the mechanics who maintain them, and the managers who run the programs. It is on the insights of these people that the conclusions of this report are largely based.

As stated elsewhere in this report, it is recommended that an updated assessment of the state fleet be conducted in another ten years.

2. Summary of the State of Montana Aircraft Fleet

The State of Montana currently operates 26 aircraft, consisting of 12 fixed-wing and 14 rotor-wing (helicopter) aircraft. Most of the rotor-winged, as well as two fixed-wing aircraft operated by DNRC, were donated by or are on loan from the federal excess property program.

A listing of State aircraft is as follows:

Office of the Governor

N28KP — 1979 Beechcraft King Air C-90 based in Helena. Twin-engine, high-performance turboprop used for all-weather passenger transportation.

Department of Transportation

N4622E — 1968 Turbo Commander based in Helena. Twin-engine, high-performance turboprop used for passenger transportation, aerial survey and mapping.

N447MA — 1976 Beechcraft A-36 based in Helena. Six-seat, single-engine aircraft used for airport facility maintenance, transportation for MDT personnel, and search and rescue.

N42178 — 1999 Cessna 206 based in Helena. Six-seat, single-engine aircraft used for search and rescue, airport maintenance and inspections, and conducting search & rescue clinics.

Department of Fish, Wildlife and Parks

N4465Y — 1983 Partnavia based in Helena. Small six-seat twin-engine piston aircraft used for passenger transportation.

N6110A — 1979 Piper PA-18 (Super Cub) based in Billings. Small, two-seat single-engine aircraft used for game tracking and management.

N8862Y — 1973 Piper PA-18 (Super Cub) based in Great Falls. Small, two-seat single-engine aircraft used for game tracking and management.

N4644Y — 1971 Piper PA-18 (Super Cub) based in Missoula. Small, two-seat single-engine aircraft used for game tracking and management.

N693 — 1971 OH58 based in Missoula. Helicopter used for game survey and fisheries support.

N7120 — 1971 OH58 based in Billings. Helicopter used for game survey, fisheries support and fish planting.

N1604Z	1989 Mac/Doug 500 based in Helena. Helicopter used for game survey, radio tracking and fisheries support.
N6690N	1968 OH58 based in Helena. Helicopter used for game survey and fisheries support.

<u>Department of Justice</u>

N1664R	1978 Cessna 182RG based in Helena. Four-seat single-engine aircraft used primarily for transportation of DOJ personnel and occasionally for traffic enforcement.
N151HP	1971 OH58 based in Helena. Helicopter used for law enforcement support, search and rescue, and radio repeater site maintenance.

<u>Department of Livestock</u>

N1095T	1980 Hughes 500 based in Helena. Helicopter used primarily for predator damage management, and also for assisting in brand inspections and bison control.
N 6962C	1968 OH58 based in Billings. Helicopter used primarily for predator damage management, and also for assisting in brand inspections and bison control.

<u>Department of Natural Resources</u>

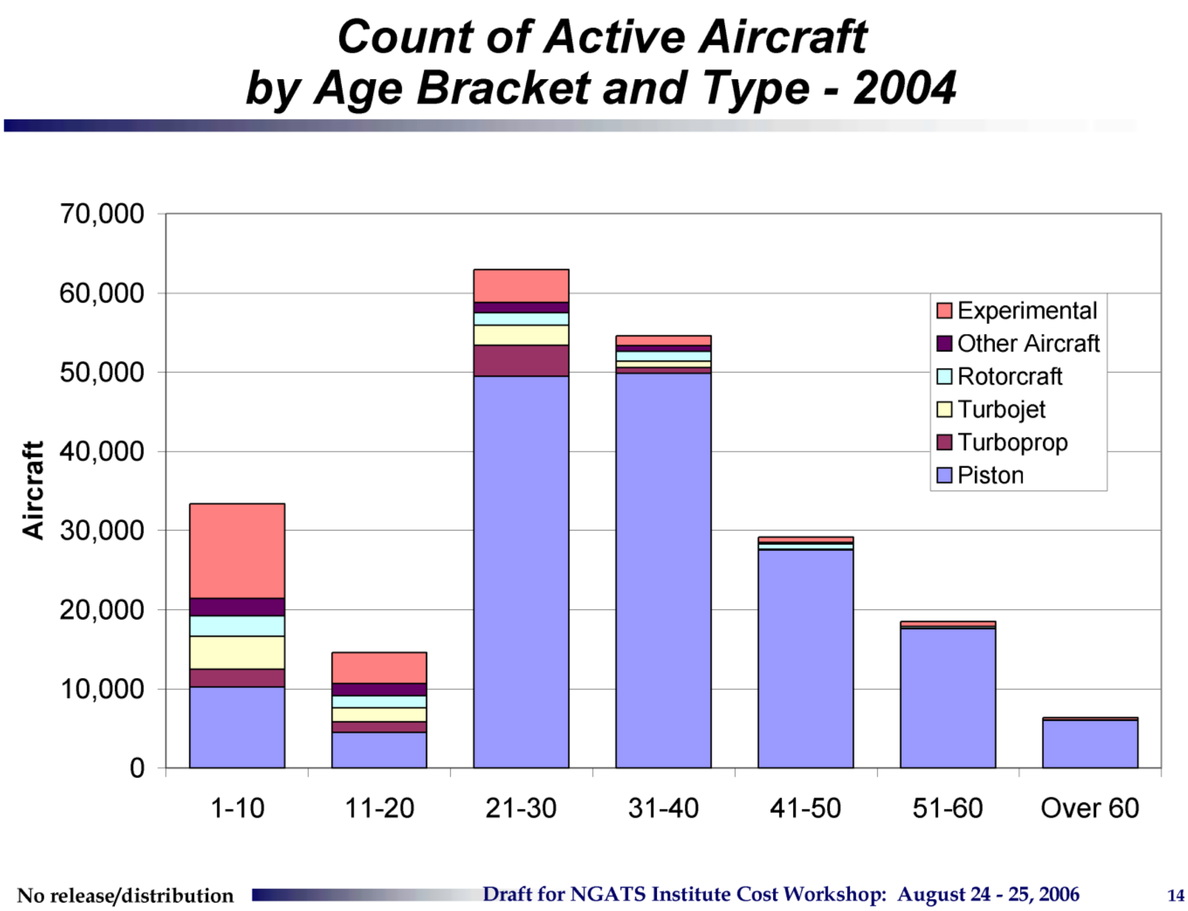
N9067M	1970 Cessna 180 based in Helena. Four-seat single-engine used primarily for fire detection.
N391M	1964 Cessna 185 based in Helena, Missoula or Kalispell as needed. Four-seat single-engine aircraft used primarily for fire detection.
N6312B	1957 Cessna 182 based in Helena, Missoula or Kalispell as needed. Four-seat single-engine aircraft used primarily for fire detection.
N392M	1969 OH58 based in Helena. Helicopter used for fire suppression support.
N384M	1982 OH58 based in Helena. Helicopter used for aerial survey and mine reclamation.
N387 N388 N394 N395 N398	Bell UH-IHs based in Helena. Medium helicopters used for fire suppression.

3. Age of the State Fleet

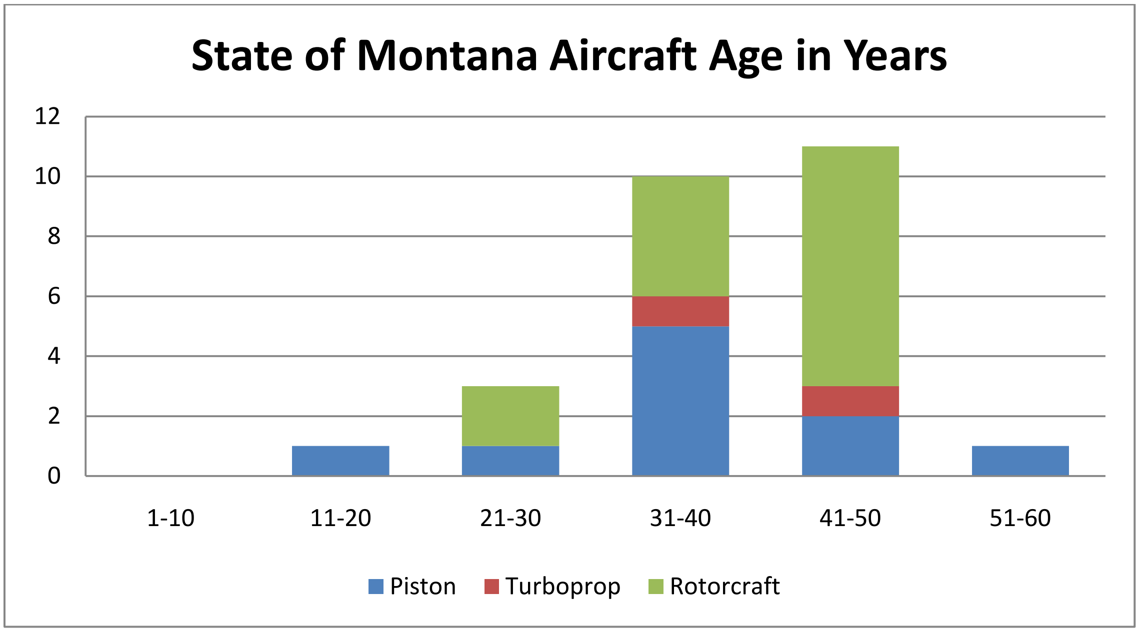
An important reference in determining the condition of Montana's fleet is comparing its age to the age of the national fleet. An effort was made to reference the age of specific state aircraft against the national average of similar aircraft. For example, attempts were made to determine the average age of the Beechcraft King Air fleet, and the percentage of 1979 King Airs that were still flying.

Unfortunately, national age data on specific makes and models does not appear to be available for general aviation aircraft. In aging studies, the FAA and NTSB have concentrated most of their focus on the commuter and airline aircraft fleets. The latest data on U.S. general aviation was compiled in 2004, and is referenced only by general categories (piston-engine, turboprop, etc.).

The general age of the state fleet may be compared against the national average. The following chart shows the age distribution of the United States general aviation fleet:



The following chart shows the age distribution of the State of Montana fleet:



The average age of Montana's fixed-wing fleet is roughly ten years older than the national average. On a national level, the largest percentages of active aircraft are in the 21-40 year brackets, while the majority of the state's aircraft are in the 31-50 year brackets. As mentioned previously, national data was compiled was in 2004, and does not reflect any changes that have developed since then.

The state's rotor-wing aircraft are considerably older than the national average. These helicopters have all been donated by or are on loan from the federal excess property program. The oldest of these, the five medium helicopters operated by DNRC, have been extensively refurbished and do not present any aging concerns at this time.

The state's two turboprop aircraft are also significantly older than the large majority of the national fleet.

4. Aircraft Aging Concerns

> "Aircraft are typically designed to a specific lifespan, known as the design life of the aircraft. This lifespan allows designers to ensure that throughout the specified life, the aircraft's structure and components operate reliably. *Generally, aircraft have a 20-year lifespan* with a specified number of flight hours and flight cycles (ATSB Transport Safety Report B20050205, February 2007, emphasis added)."

A very large portion of the national fleet (as well as virtually all of the state's fleet) is operating beyond the manufacturer's design life. The long-term effects of operating an aircraft beyond its design life are far from clear:

> "Thanks to the robust designs [of general aviation single-engine aircraft], these airplanes show few signs of aging. However, little is known about the condition of these old airplanes and the general effects of aging on them (Best Practices Guide for Maintaining Aging General Aviation Airplanes, AOPA/FAA September 2003)."

Likewise, there are no hard and fast rules that determine when an aircraft is at a point where it can no longer be flown safely or economically:

> "There is no single criteria that defines an aircraft as 'old' (Kizer, 1989). The age of an aircraft depends on factors including the chronological age, the number of flight cycles, and the number of flight hours. Determining the age of the aircraft is further complicated by the fact that individual aircraft components age differently depending on these factors.
>
> "Some aging mechanisms such as fatigue occur through repetitive or cyclic loading. While others, such as wear, deterioration, and corrosion occur over time (ATSB Transport Safety Report B20050205, February 2007)."

Some aircraft types are affected less by age than others. Individual aircraft of the same type will exhibit more or less aging effects depending on their mission, utilization, location and maintenance history. In determining the safety and economic viability of aircraft, each must be examined on a case-by-case basis.

Although the effects of aging will vary with each aircraft, they tend to fall into the following categories:

<u>Metal fatigue.</u> The weakening of structural components as a result of repeated flexing and stress over time. This is more likely to affect the larger turboprop aircraft in the state fleet, owing to their higher operating speeds, weights, and aerodynamic stresses.

<u>Metal corrosion.</u> The degradation of an aircraft's structure and metal components from extended exposure to moister, salt, and other corrosive substances. To a lesser extent, chronological age may also weaken some metals over time.

Systems Degradation. The deterioration of wiring, electrical connections, hydraulics pneumatics, etc. Some of these systems are integral with the airframe and very difficult to replace. The turbine fixed- and rotor-wing aircraft are more susceptible to this, as they have far more complex systems than the relatively simple piston aircraft.

Powerplant Degradation. Aircraft engines are affected by the long-term exposure to high temperatures, vibration and repeated power cycles. Piston engines are routinely replaced with remanufactured units, and for the purposes of this study were therefore not considered. Turbine engines, on the other hand, are typically retained with the airframe, with components replaced or overhauled as needed through a progressive maintenance program. Over time, it becomes increasingly more expensive to repair and maintain these engines.

Obsolescence. Older aircraft may have systems or safety margins deemed inadequate by contemporary standards. Many have been out of production for several years, making parts and maintenance support increasingly difficult. Some aircraft also have outdated flight instruments and avionics (radios, navigations devices, etc.) that are difficult to update, and less reliable than modern ones.

For a more in-depth discussion of these issues, refer to the appendix, pages 21-26.

All of these conditions have obvious safety implications. However, one prominent concern in operating older aircraft is economics. Although most aircraft can be kept airworthy almost indefinitely, it can be increasingly expensive to do so. Furthermore, as parts and maintenance support becomes more difficult, aircraft are grounded more often, resulting in cancellations or costly outsourcing of flights.

5. Examination of the State Fleet

To examine the current and projected condition of the state fleet, a committee of fixed- and rotor-wing pilots and mechanics was formed, consisting of the following members:

Joe Brand, Office of the Governor
Chuck Brenton, Department of Natural Resources
Tal Williams, Department of Natural Resources
Mike Rogan, Montana Aeronautics (MDT)
Jerry Gresens, Helena Aircraft

This committee was comprised of pilots and mechanics who collectively were familiar with all types of aircraft operated by the state. The committee set out to determine:

1. The known age-related issues that could affect each type of aircraft the state operates, based on national trends of aircraft of the same types
2. The specific condition and age-related issues of each of the state-operated aircraft
3. The condition and suitability of each aircraft's avionics
4. The quality of ongoing maintenance of each aircraft
5. The aircraft that warrant priority in a phased replacement plan

One or more representatives of each state aviation unit were interviewed and a questionnaire (appendix, page 26) was completed for each aircraft which covered topics such as aircraft usage, maintenance, age-related issues, and avionics. Most of the representatives interviewed were the heads of their aviation units, and all were active unit pilots. In most cases the mechanics who maintained the aircraft were also interviewed. All pilots and mechanics were encouraged to freely express any concerns they had with the condition of their aircraft.

After each interview, individual assessments (appendix, pages 29-51) were completed for each aircraft. The committee used these assessments to review the condition of the state fleet and establish a replacement priority list for use as the basis of a phased replacement plan.

6. Condition of the State Fleet

After examining the state fleet, the following conclusions were reached:

1. No major age-related issues were found with any aircraft that are expected to present problems in the near future. No aircraft appear to be in need of immediate replacement.

2. Most of the state aircraft are of designs that have so far proven to be very rugged and reliable, and are expected to have a reasonable amount of service life remaining. The exceptions to this are the MDT Turbo Commander and the FWP Partnavia, both of which are addressed in Section 7.

3. Maintenance on all aircraft appears to be excellent and in line with industry standards. Some aging issues have occurred in the past and have been dealt with as required. The more complex aircraft, such as the turboprops and helicopters, are operated on "progressive" maintenance programs. These programs involve a series of in-depth scheduled inspections that are usually effective at detecting any issues before they become a safety problem.

4. The avionics of most aircraft were found to be up-to-date and suitable to their mission. Some upgrades are recommended, as noted in the Individual Aircraft Assessments in the appendix of this report.

5. In general, all aircraft operators expressed satisfaction with the state of their aircraft. None had any safety or age-related concerns.

Almost all of the aircraft the state operates are flying beyond the original 20-year expectation of the manufacturers. This is by no means unusual. In fact, owing to the dramatic reduction in aircraft production starting in the early 1980's, a huge portion of the national fleet is operating beyond the original design life, as shown in the chart in Section 3 of this report. In general, the effects of aging on safety have been minimal, provided that maintenance and inspection procedures are followed.

The state's fleet currently appears to be in very satisfactory condition. However, there is no way of knowing what issues may arise in the future with any given aircraft type. In the general aviation fleet, several series of aircraft have developed structural problems after decades in service that have necessitated major repairs or modifications. The longer any aircraft is in service, the greater the chance that an age-related issue will arise that becomes a safety concern or involves prohibitively expensive repairs.

Regarding the state's fleet, the larger and more complex aircraft are of greater concern. These aircraft have very complex systems, some of which are susceptible to aging and are difficult to maintain. Of primary concern are the electrical systems which usually exhibit some degradation of the wiring over time (see appendix, page 23). Additionally, these aircraft are subject to high levels of aerodynamic stress due to their higher speeds, higher wing loadings, and pressurization cycles. Finally, the state's two turboprop airplanes, the MDT Turbo Commander and the Governor's Office King Air, fly passengers in all weather conditions, whereas the rest of the fleet aircraft typically carry only crewmembers in relatively good weather. These aircraft were therefore given higher priority in this study.

The state's small, piston-powered aircraft have relatively simple structures and are far less complex than the larger turbine-powered aircraft. These aircraft are very reliable, and are expected to have longer service lives than the larger turbine aircraft.

7. Priority of Replacement

After reviewing the condition of each aircraft, the committee determined an order of priority for replacement. The following factors were taken into account:

1. The aircraft's age in years, as well as total flight hours
2. The aircraft's overall condition, as well as known fleet issues
3. The aircraft's yearly accumulation of flight hours
4. The aircraft's complexity
5. The aircraft's mission
6. The aircraft's suitability for its mission

After review, each of the aircraft was placed into one of three categories:

<u>Tier 1 – Priority replacement</u>. These are the aircraft that should be considered for replacement first, in approximately a five- to ten-year time frame from the date of this report.

<u>Tier 2 – Eventual replacement</u>. These are the aircraft that are anticipated to eventually warrant replacement, starting at approximately ten years from the date of this report.

<u>Tier 3 – Future Evaluation</u>. These are aircraft that are not projected to need replacement in the foreseeable future. At this point it is simply impossible to know which of these aircraft may warrant replacement first. It is therefore recommended that the fleet be re-evaluated in ten years, after which a better understanding of the fleet condition at that time will be possible.

Tier 1 – Priority Replacement

<u>4622E Rockwell Turbo Commander</u> (MDT)
More than any aircraft in the state fleet, this plane suffers from obsolescence, owing to outdated systems that are increasingly difficult to maintain. Parts support is anticipated to be an increasingly greater issue. Furthermore, this aircraft operates in all weather conditions, making the malfunction of any system a potentially serious problem.

This aircraft might also be the most difficult and expensive to replace, owing to the installation of a sophisticated camera system used in aerial mapping and surveying. Due in part to a transition in aerial camera technology, replacing this aircraft immediately could be problematic. Next-generation digital camera technology for this type of mission is evolving, but is not anticipated to equal the quality of the current film-based camera system for another five years. It is therefore recommended that this aircraft be retained exclusively for aerial photo operations for the next several years, as set forth in the proposed replacement plan.

<u>28KP Beechcraft King Air</u> (GOV)
This aircraft was determined to be high on the priority list for three reasons: 1) It is typically used to transport the state's top executives; 2) It is operated in all weather and terrain conditions,

creating very challenging flight situations, and 3) As a large turboprop aircraft, it endures higher aerodynamic stresses, and is more susceptible to aging of its complex systems.

Because of updated engines and avionics, this aircraft should still have a fair amount of useful life. It is recommended that it be retained in the state fleet, as set forth in the proposed replacement plan.

<u>4465Y Partnavia</u> (FWP)
Of all the state aircraft reviewed, the Italian-built Partnavia alone was deemed to be generally unsuited to its mission of passenger transportation, both by its operators and by the committee. Parts support for this aircraft is increasingly difficult, as there are few aircraft of this type in the United States. Although it is not affected by aging concerns at this time, it is recommended that this aircraft be replaced by a more suitable plane, such as a Cessna 340.

<u>6962C Bell OH58</u> (LIV)
<u>1095T Hughes 500</u> (LIV)

These two light helicopters have high-time airframes combined with very high yearly accumulations of flight hours. For this reason, they are anticipated to warrant replacement ahead of the rest of the state's helicopters.

Tier 2 – Eventual Replacement

693 Bell OH58 (FWP)
7120 Bell OH58 (FWP)
6690N Bell OH58 (FWP)
151HP Bell OH58 (DOJ)
392M Bell 206 (DNRC)
384M Bell 206 (DNRC)
1604Z Mac/Doug 500 (FWP)

These aircraft are all light helicopters that are somewhat restricted in their capabilities. Unlike the state's medium helicopters, they have not benefited from a major refurbishment program. Because of their complexity, they will over time become increasingly expensive to maintain.

Tier 3 – Future Evaluation

42178 Cessna 206 (Aeronautics)
447MA Beechcraft A-36 (Aeronautics)
6110A Piper PA-18 (FWP)
8862Y Piper PA-18 (FWP)
4644Y Piper PA-18 (FWP)
9067M Cessna 180 (DNRC)
391M Cessna 185 (DNRC)

6312B Cessna 182 (DNRC)
1664R Cessna 182RG (DOJ)

The preceding are all single-engine aircraft that have proven very durable over the years. This category contains the state's newest airframe (the Cessna 206) as well as the oldest (the Cessna 182). One common characteristic of all of these aircraft is that the newer production models of each type are nearly identical to the earlier models. With the exception of the Beechcraft A-36, these aircraft possess simple airframes and systems with little potential for major problems in the future.

These aircraft have had some age-related maintenance: The Beechcraft A-36 has had both wing spars repaired, and the Piper Super Cubs (PA-18's) have been fitted with improved wing support struts. Eventually, the Cubs will need new fabric coverings at a cost of about $25,000 apiece. However, no serious problems are anticipated for the next ten years before another aircraft review is conducted.

Although the three DNRC Cessnas have the oldest airframes of the fixed-wing fleet, the DNRC maintenance staff possesses the ability to address any airframe structural issues that may arise with these aircraft.

The aircraft in this group are also the most economical to replace if needed.

387M Huey UH-1H (DNRC)
388M Huey UH-1H (DNRC)
394M Huey UH-1H (DNRC)
395M Huey UH-1H (DNRC)
398M Huey UH-1H (DNRC)

The medium helicopters in this group are all sixties-vintage aircraft, but have undergone extensive refurbishment and modification to bring them to the same standards as new helicopters of this type. The manufacturer, Bell Helicopters, has approved continued operation of these aircraft for another fifteen years, with no expected limitations beyond that time. Because of their relatively low yearly accumulation of hours, aging should not be an issue for these aircraft in the foreseeable future.

8. Proposed Replacement Plan

The following plan is divided into three phases which correspond to the three levels of priority identified in the previous section. The following timetable is recommended:

2016 – 2021 Complete Phase 1 replacements
2021 – 2028 Complete Phase 2 replacements
2029 – 2037 Complete Phase 3 replacements

It is also recommended that an updated assessment of the fleet be conducted every ten years, beginning in 2020. These ongoing assessments are considered necessary to maintain an accurate picture of the condition of the fleet, as well as to help determine replacement priorities in the future.

All projected costs associated with aircraft replacements are estimated in 2010 dollars. If the aircraft is still in production, estimates are based on the cost of a five-year-old airframe. If the aircraft is no longer in production, estimates are based on the cost of the last production year available, typically in the mid-1980's.

Phase 1

Approximate Time Span – FY 2016 – FY 2021
This phase addresses the five aircraft identified as first priority.

Step 1

A. The top-priority aircraft, MDT's Turbo Commander, would be retained as an aerial survey and mapping platform only. Passenger-carrying operations would be discontinued.

B. The Department of Transportation would acquire the Governor's Office King Air for use in passenger transportation.

C. The Governor's Office would acquire a newer aircraft similar to the present one, preferably a King Air 90GT or equivalent.

The MDT Turbo Commander is the only aircraft equipped to perform aerial survey and mapping operations, and should be able to be used in this capacity for some time. Since these operations are always conducted in daylight hours during good weather, the safety margins of operating this aircraft would be considerably increased, as any system malfunction or failure is potentially far more dangerous when encountered at night or in adverse weather.

Eventually this aircraft will need to be replaced with another aircraft capable of performing aerial survey and mapping work. Currently the industry is in a transition to digital-based camera systems, but these are not up to the standards of the state's current system, and may not be for several years. It would be impractical to acquire a newer aircraft in the near future, at least until the next-generation camera systems have matured.

This aircraft is also included in Phase 2 of the replacement plan, at which point it is anticipated that it would be retired from its role as a camera platform.

Estimated cost: $930,000

This estimate is the projected cost from the general fund budget, and is calculated by subtracting the value of the state's 1979 King Air C90 ($1,220,000, sold to MDT) from the cost of a 2006 King Air 90GT ($2,150,000).

Step 2

The following aircraft would be replaced at one-year intervals, in order:

4465Y Partnavia (FWP)	Est. cost: $130,000 (with trade-in)
6962C Bell OH58 (LIV)	Est. cost: $900,000 (without trade-in)
1095T Hughes 500 (LIV)	Est. cost: $900,000 (without trade-in)

Phase 2

Approximate Time Span – FY2021 – FY2028

The following aircraft would be replaced at one-year intervals. Although the order of these aircraft was established by the 2010 committee, it is recommended that an updated review be conducted prior to the beginning of this phase.

At this point it is difficult to determine what aircraft will be a suitable replacement for the Turbo Commander's aerial mapping and survey role, as that technology is changing rapidly. The cost estimate in this case is based on the market value of the latest model Turbo Commander available; however, a less costly alternative may be available at that time. The estimated costs in this phase do not factor in trade-in values.

4622E Turbo Commander	Est. Cost: $1,150,000
693 Bell OH58 (FWP)	Est. Cost: $900,000
7120 Bell OH58 (FWP)	Est. Cost: $900,000
6690N Bell OH58 (FWP)	Est. Cost: $900,000
151HP Bell OH58 (DOJ)	Est. Cost: $900,000
392M Bell 206 (DNRC)	Est. Cost: $900,000
384M Bell 206 (DNRC)	Est. Cost: $900,000
1604Z Mac/Doug 500 (FWP)	Est. Cost: $900,000

Phase 3

Approximate Time Span - FY2029-FY2037

The following aircraft would be replaced at appropriate intervals, in an order to be determined by a future study. The estimated costs in this phase do not factor in trade-in values.

42178 Cessna 206 (Aeronautics)	Est. Cost: $290,000
447MA Beechcraft A-36 (Aeronautics)	Est. Cost: $365,000
6110A Piper PA-18 (FWP)	Est. Cost: $18,000
8862Y Piper PA-18 (FWP)	Est. Cost: $24,000
4644Y Piper PA-18 (FWP)	Est. Cost: $24,000
9067M Cessna 180 (DNRC)	Est. Cost: $111,000
391M Cessna 185 (DNRC)	Est. Cost: $170,000
6312B Cessna 182 (DNRC)	Est. Cost: $99,000
1664R Cessna 182RG (DOJ)	Est. Cost: $130,000
387M Huey UH-1H (DNRC)	Est. Cost: $3,000,000
388M Huey UH-1H (DNRC)	Est. Cost: $3,000,000
394M Huey UH-1H (DNRC)	Est. Cost: $3,000,000
395M Huey UH-1H (DNRC)	Est. Cost: $3,000,000
398M Huey UH-1H (DNRC)	Est. Cost: $3,000,000

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Appendix A

61st Legislature SJ0022.01

SENATE JOINT RESOLUTION NO. 22

INTRODUCED BY R. ZINKE

BY REQUEST OF THE HOUSE JOINT APPROPRIATIONS SUBCOMMITTEE ON GENERAL GOVERNMENT

A JOINT RESOLUTION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA REQUESTING THAT THE GOVERNOR'S OFFICE PROVIDE AN ASSESSMENT OF STATE-OWNED AIRCRAFT TO DETERMINE A PHASED REPLACEMENT SCHEDULE.

WHEREAS, in reviewing the Governor's air transportation program, concerns arose on the age and condition of the state aircraft assigned to the Governor's Office and other state-owned aircraft; and

WHEREAS, current efforts for maintenance require inspections and regular service intervals but the age of the aircraft will require eventual replacement; and

WHEREAS, the House Joint Appropriations Subcommittee on General Government believes that it is reasonable and prudent to ensure that state-owned aircraft are in good condition and have up-to-date avionics for the safety of the Governor, the pilots, and other state employees; and

WHEREAS, an assessment and preparation of a long-term phased replacement schedule will assist the Governor and the Legislature in planning for the expenses related to maintenance and replacement of state aircraft.

NOW, THEREFORE, BE IT RESOLVED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA:

That the Governor's Office conduct an assessment and analysis of state aircraft to determine an appropriate and phased replacement schedule for the state's fleet of aircraft prior to the commencement of the 2011 Legislature.

BE IT FURTHER RESOLVED, that the assessment have a primary focus on the Governor's aircraft and a secondary focus on other current state aircraft assets.

BE IT FURTHER RESOLVED, that the Governor provide a report to the Legislative Finance Committee prior to the 2011 Legislative Session.

- END -

Appendix B

Effects of Aging

The most recent and comprehensive report on the effects of aging on general aviation aircraft was completed by the Australian Transport Safety Bureau in February 2007. Since Australia's fleet is mostly U.S.-manufactured and closely matches the United States fleet in distribution of aircraft types, this study is considered the best source of information on aging to date. The following are selected excerpts from this study.

How Old is Too Old?
The impact of aging aircraft on aviation safety
ATSB TRANSPORT SAFETY REPORT
Aviation Research and Analysis Report –B20050205

Fatigue

Fatigue predominately takes place in metal components, but it can also affect nonmetallic materials. Fatigue occurs through cyclic loading patterns, where a component is repeatedly loaded. Bending a metal paper clip backwards and forwards is an example of fatigue; the paper clip will not break if only bent once, however, if it is repeatedly loaded, it will eventually break. Fatigue failures will often take place at loads much lower than the materials ultimate strength.

Generally, the initiation point for fatigue will be a microscopic crack that forms at a location of high stress, such as a hole, notch, or material imperfection. The crack will then grow as loads are repeatedly applied. If not detected and treated, the crack will eventually grow to a critical size and failure will occur at loads well below the original strength of the material.

The relationship between repetitive loading and fatigue crack growth, creates a link between fatigue related aging, the number of flight cycles, and the number of flight hours that an aircraft has accumulated.

Aircraft components that are susceptible to fatigue include most structural components such as the wings, the fuselage, and the engine(s).

Fatigue and aircraft use

Different types of aircraft operations can influence the rate of fatigue, as they subject the aircraft structure to different structural loads. Operations that have the potential to increase fatigue include those likely to involve high-g maneuvers, such as:

aerobatics;
aerial mustering; and
aerial agriculture.

These operations produce increased and variable amounts of loading due to the high gust and maneuver loads. With this type of loading on the airframe, there will be an increased rate of fatigue.

In addition, for pressurized aircraft, the length of a flight sector influences the fatigue rate. As an aircraft climbs, the aircraft structure will expand due to pressurization, conversely as an aircraft depressurizes during the descent the aircraft structure will contract, thus producing fatigue. Hence, the number of pressurization cycles is more important than the length of time an aircraft is pressurized. An aircraft operated on short sectors will be subjected to a greater number of pressurization cycles compared to another aircraft with the same number of flight hours that is operated on long sectors, thereby increasing the rate of fatigue. Fatigue due to the short sectors was a contributing factor in the Aloha flight 243 accident. The average flight duration of the aircraft involved in the Aloha flight 243 accident was just 25 minutes.

Corrosion

Corrosion is a time dependent failure mechanism that occurs as a result of chemical or electrochemical degradation of metal. Corrosion generally affects the aircraft structure; however, it can also affect electrical connectors and flight control cables.

Corrosion is more prevalent in marine and coastal environments where there is high humidity and salt water. Salt can increase the rate of the chemical reactions that initiate corrosion. This has significant safety implications for the structures of seaplanes, as they are constantly exposed to salt and humidity.

To prevent or slow down the rate of corrosion, an aircraft’s design will incorporate a number of corrosion control methods. These include material selection, material coatings, joint design, and the use of water drainage. Corrosion cannot be eliminated in design, so regular maintenance and inspections are used as additional control measures.

The processes of fatigue and corrosion can interact, leading to an increased likelihood of structural failure. Corrosion can weaken the material and create locations of stress concentration. These locations of high stress are often initiation points for fatigue, and can lead to the failure of the structure earlier than predicted. The failure can also occur in unexpected locations, making detection prior to failure difficult. While corrosion can be a significant safety concern, the combination of fatigue and corrosion is of greater concern to safety than corrosion alone.

Systems

Aircraft systems can be defined as the non-structural components (excluding the powerplants). These components include items such as:

electrical wiring and cables;
fuel, hydraulic and pneumatic lines;
electro-mechanical systems; such as pumps, sensors, and actuators; and flight instrumentation.

Aircraft systems will generally age with usage and calendar time. This aging will often occur in the form of wear, deterioration, contamination, and embrittlement. Aging of flight systems can generate fires and/or failures in flight critical systems.

Wiring
The aging of aircraft wiring has become a particular area of concern as a result of high profile aircraft accident involving TWA flight 800. And the accident involving Swissair flight 111 off the coast of Nova Scotia, Canada on 2 September 1998, while not age-related, demonstrated the potentially devastating consequences of wire arcing. Accidents such as these have highlighted the potentially catastrophic consequences of aging aircraft wiring.

The aging of aircraft wiring often presents as a problem for the insulation rather than to the wiring itself. Insulation deterioration can result in arcing and electrical shorting, which can lead to equipment malfunction, or to smoke or fires. Wiring ages through the combination of a number of factors, including:

contamination;
physical abuse;
environmental factors; and
changes to the chemical properties of the insulator over time.

Contamination of wiring can be due to small objects, such as metal shavings from structural repairs, which work their way into wire bundles and cut the insulation. Another form of contamination comes from the exposure of wiring to fluids. Some fluids, such as washing solutions and hydraulic fluids, can change the properties of the insulation over time (Brown & Gau, 2001).

Physical abuse can generate breaking of the conductor or insulation. The abuse can occur in many ways, including:

hanging items from wire bundles;
handling the wire;
using the wire bundles as hand or foot holds;
using a bend radius that is too small; and
through the dynamic environment where the wire flexes or rubs against other components

Environmental degradation can affect the aging of the wire insulator over time through the effects of humidity, temperature, and exposure to the sun. These environmental conditions can lead to embrittlement or degradation of the wire by changing the chemical properties of the insulator.

Changes in the physical and mechanical properties of the conductor and insulator occur from general aging of the wiring. These changes include embrittlement, and subsequent cracking, of the insulator (Brown & Gau, 2001).

Inspection of wiring is difficult as it may be hidden, or inlayed into inaccessible locations within the aircraft. In addition, inspection techniques are often tedious and difficult. For example, it may be necessary to visually inspect each individual wire using a magnifying glass. The handling of the wires required in the visual inspection process can result in additional damage to the wires. Non-destructive inspection techniques improve the accuracy and reduce the risk of damage in wiring inspections.

Flight instrumentation

Flight instrumentation is another system that will wear over time. Instruments with components that move the most will generally exhibit the greatest wear. For example, gyroscopes are particularly susceptible to wear due to their constant high speed movement (Landsberg, 2000). Importantly, when flight instruments wear, their accuracy can degrade. Modern aircraft typically use glass cockpit displays that do not rely on mechanical gyros and eliminate many of the traditional problems associated with wear. As affordability of these systems improved, they have made their way from flight decks of modern airliners into general aviation aircraft.

Powerplants

Aircraft powerplants are generally overhauled regularly to replace components that are susceptible to ageing. The components in various types of engines will age differently. There are two types of engines discussed in this section; they are piston engines and turbine engines.

Piston engines

Piston engines typically power small aircraft, weighing less than 5,700 kg, and generally have a defined life known as the time between overhaul. At the scheduled overhaul, components that are susceptible to ageing are replaced, including those components that operate under high stresses. Generally, the major dynamic components in piston engines do not experience fatigue and as a result do not have a fatigue life. Rather, the lives of these components are determined through on-condition monitoring.

The number of flight hours and the calendar age of the engine are both important considerations when defining the time between overhaul. The engine(s) in an aircraft that is flown infrequently can deteriorate and the ageing process can occur at a faster pace than for the engine(s) in an aircraft flown on a regular basis (Lycoming, n.d.). With infrequent use, cylinders can rust, abrading the piston rings and resulting in high oil consumption and a loss in power (Landsberg, 2000). In addition, a lack of movement can lead to deterioration in lubrication.

Turbine engines

Unlike piston engines, many components in turbine engines fatigue as a result of the extreme operating environment, including very high temperatures, pressures, and rotational forces.

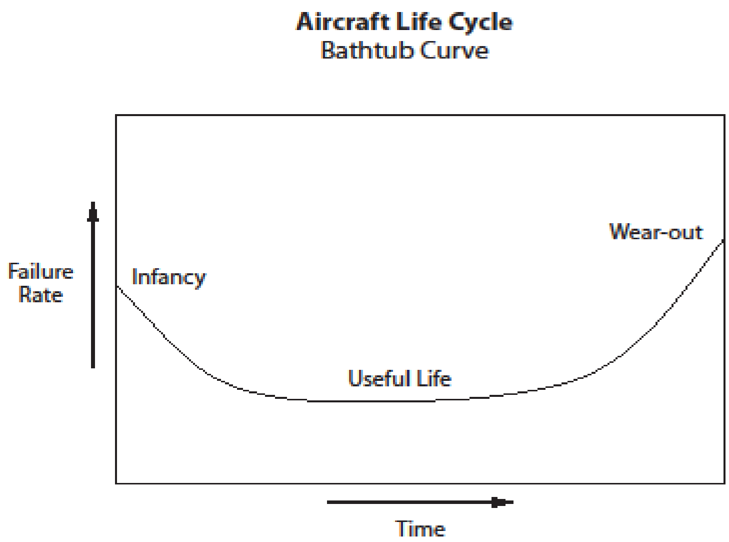
Components in turbine engines can experience temperatures of 1,100 ^{o}C. Changes in the operating temperature and in the engine speed can induce fatigue in the engine’s components. Hence, turbine engine components have stringent retirement times. There are a number of factors which affect the rate of fatigue and hence the retirement time. These factors include the amount of use, the type of operations flown, and the engine model (Tumer & Bajwa, 1999).

The engine(s) of an aircraft flown on short-haul operations will generally have increased wear and heat damage compared with the engine(s) of an aircraft flown on long-haul flights (Tumer & Bajwa, 1999). The frequent stopping and starting of the engine that occurs in short-haul operations can produce rapid changes in temperature and increased cyclic fatigue. The increased fatigue damage that occurs on short-haul flights leads to the time between overhaul being governed by the number of flight cycles as well as by the number of flight hours.

Aircraft life cycle – the bathtub curve

The overall reliability of a system or component throughout its life has been described as following a 'bathtub curve'. The lifecycle in the bathtub curve, shown in Figure 5, involves three phases:

infancy;
useful life; and
wear-out.



During infancy, the failure rate decreases over time, as many failures are due to material flaws or problems in manufacture. This phase is less relevant when considering aging aircraft. In the useful-life phase, failures due to initial flaws gradually decrease while failures due to wear-out gradually increase. Therefore, the average number of failures remains relatively constant throughout the useful-life phase. During the wear-out phase, failures will increase as the product reaches the end of its useful life.

Appendix C

Aircraft Survey Questionnaire

Aircraft:
Department:
Department Rep:

1. Aircraft Usage

Airframe Age:
Total Airframe Hours:
Engine(s) Hours:
Engine(s) TBO:
Yearly Flight Hours (approximate):

Primary Aircraft Use:

Secondary Use (if any):

This aircraft is primarily flown:
__ Day VFR
__ Day/Night VFR
__ Day/Night VFR/IFR
__ Other:

What are the most critical conditions (low-level, poor weather, etc.) under which this aircraft is operated?

Rate the suitability of this aircraft for its mission:

What aircraft (if any) would be more suitable?

If this aircraft is no longer in production, what aircraft would likely replace it?

2. Aging Issues

Does this aircraft have any known corrosion issues?

Has this aircraft had any metal fatigue repairs?

Has this aircraft had any major structural repairs that may affect its service life?

Is this aircraft usually hangered at its home base?

What, if any, known or anticipated age-related issues (time-limited components, AD’s, etc.) may affect this aircraft in the future?

To what extent does this aircraft’s age affect its ability to perform its mission (through increased downtime, parts availability, etc.)?

To what extent does this aircraft’s age affect the safety of its operation?

How large of an impact does this aircraft’s age have on the maintenance budget?

What (if any) investments will be necessary in the future to prolong this aircrafts service life?

Do you foresee a time when this airframe should be replaced?

Who maintains this aircraft, and to what standards?

3. Avionics

Nav/Com Radios ____
GPS (if any) ____
ELT type (121.5/243 MHz or 406 MHz)? __________________________
Weather Datalink ____
Other ____
____

Are the avionics up-to-date and suitable for the primary mission of this aircraft?

If not, what avionics upgrades would be necessary to enhance safety and/or efficiency?

What avionics upgrades do you anticipate in the future, and during what time frame?

4. Additional Comments

Appendix D

Individual Aircraft Assessment

Aircraft:	N28KP
Type:	King Air C-90
Department:	Governor’s Office
Airframe Hours:	6620
Airframe Age:	31 years
Average Yearly Hours:	240

Primary Use
Executive Transportation

Secondary Use

Flight Conditions
Day/night VFR and IFR, often in adverse weather and terrain

Airframe Status:
Mid-time airframe, no known life limitations.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
Two wing attach fittings had been replaced in 2006 at a total cost of $52,000. There are several other similar fittings which could possibly develop problems in the future.

Avionics Status:
Radios, GPS navigation, and ELT systems have been upgraded between 2007 and 2009.

Recommended Avionics Upgrades:
Traffic avoidance system is slated for upgrade, budget permitting, in FY2011-2012.

Recommended Replacement Priority:
Medium to high

Comments:
This type aircraft is still in production, which improves parts availability and service life. Recent engine and avionics upgrades have brought the performance standards of this plane up to par with contemporary turboprops in its class. However, it is older than most aircraft in its class, and the complex systems and higher stress-load airframes of this type of aircraft typically result in more age-related issues than smaller and simpler aircraft.

Individual Aircraft Assessment

Aircraft:	4622E
Type:	Turbo Commander
Department:	MDT
Airframe Hours:	10,800
Airframe Age:	43 years
Average Yearly Hours:	250

Primary Use:
Passenger transportation (60%)

Secondary Use:
Aerial photo, aerial survey (40%)

Flight Conditions:
Day/night VFR/IFR, often in adverse terrain and weather conditions

Airframe Status:
Relatively high-time airframe. This aircraft utilizes early-generation systems that are increasingly difficult to support. As very few of these aircraft are active in the United States, parts and maintenance support can be a serious issue.

Corrosion, Fatigue Status:
None known.

Known or Anticipated Airframe Issues:
Most Turbo Commanders of this era have had potential wing spar issues. As of this time, this aircraft is one of a small production run that is not affected by those issues.

Avionics Status:
Adequate.

Recommended Avionics Upgrades:
Updated GPS system

Recommended Replacement Priority:
High

Comments:
This is the only aircraft in the state capable of performing aerial photo, survey and mapping work. Although it should be considered for replacement soon, it is recommended that it remain in use until digital aerial photography is somewhat more mature, a period of perhaps 4-5 years.

Individual Aircraft Assessment

Aircraft:	447MA
Type:	Beechcraft A-36
Department:	Aeronautics
Airframe Hours:	8322
Airframe Age:	36 years
Average Yearly Hours:	145 (4 year average)

Primary Use:
Facility maintenance of state owned airports and Navigational Aids. Travel within state for Aeronautics personnel.

Secondary Use:
FAA 5010 Airport Inspections. Search and Rescue of aircraft in the state.

Flight Conditions:
Mostly day VFR

Airframe Status:
Mid-to-high time

Corrosion, Fatigue Status:
Two wing spar webs have been repaired after cracks were found. No other known issues.

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Up-to-date with GPS and 406 MHz transponder. One of two aircraft with ELT locating equipment installed.

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained to Part 135 standards by Montana Aeronautics mechanics. Although this airframe is somewhat high-time, it is well-maintained and should not have any additional issues for quite some time. One of only two aircraft owned by the state with homing equipment to locate downed aircraft.

Individual Aircraft Assessment

Aircraft:	42178
Type:	C-T206H
Department:	Aeronautics
Airframe Hours:	950
Airframe Age:	11 years
Average Yearly Hours:	145

Primary Use:
Search and Rescue

Secondary Use:
FAA 5010 Airport Inspections, Search & Rescue clinics, transportation for MDT personnel. Facility maintenance of state owned airports and Navigational Aids. Travel within state for Aeronautics personnel.

Flight Conditions:
Mostly day VFR

Airframe Status:
Very low time, no known issues

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Up-to-date with GPS and 406 MHz transponder. One of two aircraft with ELT locating equipment.

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Very low

Comments:
This aircraft is maintained by Montana Aeronautics mechanics to part 135 standards. This aircraft is the newest in the state fleet and should not warrant replacement in the foreseeable future. One of only two state owned aircraft with homing equipment to locate downed aircraft.

Individual Aircraft Assessment

Aircraft:	4465Y
Type:	Partnavia
Department:	FWP
Airframe Hours:	3500
Airframe Age:	28 years
Average Yearly Hours:	150

Primary Use:
Agency passenger transportation

Secondary Use:

Flight Conditions:
Day / Night VFR cross-country

Airframe Status:
Mid-time airframe. No known issues

Corrosion, Fatigue Status:
None known.

Known or Anticipated Airframe Issues:
This aircraft requires regular 500-hour wing spar inspections. A wing spar strengthening kit is recommended by the manufacturer to be installed at or before 6500 hours.

Avionics Status:
Adequate

Recommended Avionics Upgrades:
This aircraft lacks the more modern 406 MHz Emergency Locator Transmitter. It is recommended that one be installed.

Recommended Replacement Priority:
High

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. The Partnavia is considered only minimally suited for cross-country passenger transportation, as it suffers from relatively poor performance for a twin-engined aircraft. Because of this, it is not utilized as much as would a more capable aircraft. As a limited-production, Italian-built aircraft, parts and support may be difficult to obtain. It is recommended that a more suitable aircraft, such as a Cessna 340, be considered as a replacement.

Individual Aircraft Assessment

Aircraft:	6110A
Type:	PA-18
Department:	FWP
Airframe Hours:	4000
Airframe Age:	32 years
Average Yearly Hours:	225

Primary Use:
Game survey

Secondary Use:
Radio tracking

Flight Conditions:
This aircraft's operations often involve low-level, low-speed maneuvering in mountainous terrain. It is flown primarily in daytime VFR conditions.

Airframe Status:
Mid-time airframe. Wing support struts have been replaced with new "lifetime" struts.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
As with all fabric-covered aircraft, this aircraft's skin covering will eventually need replacement. This procedure typically costs about $25,000.

Avionics Status:
Avionics are adequate, with an older handheld GPS navigation unit. This aircraft has an obsolete 243 MHz Emergency Locator Transmitter.

Recommended Avionics Upgrades:
ELT should be converted to a modern 406 MHz unit. A panel-mount GPS unit would be useful. Because of the nature of this aircraft's mission, operations often involve unmonitored flight tracks. It is highly recommended that some type of flight tracking unit be installed.

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. The operators rate this aircraft as very suitable to the type of flying performed. Newer PA-18s may be available, but they are essentially the same as older models.
Individual Aircraft Assessment

Aircraft: 8862Y
Type: PA-18
Department: FWP
Airframe Hours: 2130
Airframe Age: 38 years
Average Yearly Hours: 225

Primary Use:
Game survey

Secondary Use:
Radio tracking

Flight Conditions:
This aircraft's operations often involve low-level, low-speed maneuvering in mountainous terrain. It is flown primarily in daytime VFR conditions.

Airframe Status:
Low-time airframe for this type of aircraft.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
As with all fabric-covered aircraft, this aircraft's skin covering will eventually need replacement. This procedure typically costs about $25,000.

Avionics Status:
Avionics are adequate.

Recommended Avionics Upgrades:
A panel-mount GPS unit would be useful. Because of the nature of this aircraft's mission, operations often involve unmonitored flight tracks. It is highly recommended that some type of flight tracking unit be installed.

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. The operators rate this aircraft as very suitable to the type of flying performed. Newer PA-18s may be available, but they are essentially the same as older models.

Individual Aircraft Assessment

Aircraft:	4644Y
Type:	PA-18
Department:	FWP
Airframe Hours:	7500
Airframe Age:	40 years
Average Yearly Hours:	225

Primary Use:
Game survey

Secondary Use:
Radio tracking

Flight Conditions:
This aircraft's operations often involve low-level, low-speed maneuvering in mountainous terrain. It is flown primarily in daytime VFR conditions.

Airframe Status:
This aircraft is fairly high-time, but has no known issues. Wing support struts have been replaced with "lifetime" struts.

Corrosion, Fatigue Status:
None known.

Known or Anticipated Airframe Issues:
As with all fabric-covered aircraft, this aircraft's skin covering will eventually need replacement. This procedure typically costs about $25,000.

Avionics Status:
Avionics are adequate, with an older handheld GPS navigation unit.

Recommended Avionics Upgrades:
A panel-mount GPS unit would be useful. Because of the nature of this aircraft's mission, operations often involve unmonitored flight tracks. It is highly recommended that some type of flight tracking unit be installed.

Recommended Replacement Priority:
Low to medium

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. The operators rate this aircraft as very suitable to the type of flying performed. Newer PA-18s may be available, but they are essentially the same as older models.

Individual Aircraft Assessment

Aircraft:	693
Type:	OH58
Department:	FWP
Airframe Hours:	4500
Airframe Age:	40 years
Engine Hours:	4500
Average Yearly Hours:	300

Primary Use:
Game survey

Secondary Use:
Fisheries support

Flight Conditions:
Day VFR with low-level operations in mountainous terrain

Airframe Status:
Mid-time airframe

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Fairly modern avionics. No panel-mounted GPS, partly because of space restrictions.

Recommended Avionics Upgrades:
Because in the course of normal operations the flight path of this aircraft is often unknown, it is recommended that some type of flight-tracking system be considered.

Recommended Replacement Priority:
Medium

Comments:
This aircraft is maintained to FAR Part 91 standards by Helena Aircraft. FWP pilots consider it well-suited for its mission. This line of aircraft is still in production, so suitable replacements should be available.

Individual Aircraft Assessment

Aircraft:	7120
Type:	OH58
Department:	FWP
Airframe Hours:	4500
Airframe Age:	40 years
Engine Hours:	4500
Average Yearly Hours:	300

<u>Primary Use:</u>
Game survey

<u>Secondary Use</u>:
Fisheries support, fish planting.

<u>Flight Conditions</u>:
Day VFR with low-level operations in mountainous terrain, including some flying over high mountain lakes.

<u>Airframe Status</u>:
Mid-time airframe

<u>Corrosion, Fatigue Status</u>:
None known

<u>Known or Anticipated Airframe Issues</u>:
None known

<u>Avionics Status</u>:
Fairly modern avionics. No panel-mounted GPS, partly because of space restrictions.

<u>Recommended Avionics Upgrades</u>:
Because in the course of normal operations the flight path of this aircraft is often unknown, it is recommended that some type of flight-tracking system be considered.

<u>Recommended Replacement Priority</u>:
Medium

<u>Comments</u>:
This aircraft is maintained to FAR Part 91 standards by Helena Aircraft. FWP pilots consider it well-suited for its mission. This line of aircraft is still in production, so suitable replacements should be available.

Individual Aircraft Assessment

Aircraft:	1604Z
Type:	Mac/Doug 500
Department:	FWP
Airframe Hours:	6000 hours
Airframe Age:	22 years
Engine Hours:	6000 hours
Average Yearly Hours:	350

Primary Use:
Game survey

Secondary Use:
Fish planting / fisheries support. It is anticipated that this aircraft will be increasingly used for radio tracking operations.

Flight Conditions:
Daytime VFR. Conducts low-level operations over lakes in high mountain terrain

Airframe Status:
Mid-time

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
The radios and intercom in this aircraft have been intermittent and trouble-prone. Navigation is primarily supplemented by a hand-held GPS, partly because of space restrictions.

Recommended Avionics Upgrades:
Updated nav/com package. Because in the course of normal operations the flight path of this aircraft is often unknown, it is recommended that some type of flight-tracking system be considered.

Recommended Replacement Priority:
Medium

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. The FWP pilots consider this aircraft very well suited for its mission.

Individual Aircraft Assessment

Aircraft:	6690N
Type:	OH58
Department:	FWP
Airframe Hours:	6000
Airframe Age:	43 years
Average Yearly Hours:	150

<u>Primary Use:</u>
Game survey

<u>Secondary Use</u>:
Fisheries support

<u>Flight Conditions</u>:
Day VFR with low-level operations in mountainous terrain

<u>Airframe Status</u>:
Average hours, older airframe

<u>Corrosion, Fatigue Status</u>:
None known

<u>Known or Anticipated Airframe Issues</u>:
None known

<u>Avionics Status</u>:
Adequate

<u>Recommended Avionics Upgrades</u>:
Because in the course of normal operations the flight path of this aircraft is often unknown, it is recommended that some type of flight-tracking system be considered.

<u>Recommended Replacement Priority</u>:
Medium

<u>Comments</u>:
This aircraft is currently a backup, and therefore flies less than the other FWP helicopters. It is maintained to FAR Part 91 standards by Helena Aircraft. FWP pilots consider it well-suited for its mission. This line of aircraft is still in production, so suitable replacements should be available.

Individual Aircraft Assessment

Aircraft:	1664R
Type:	C-182RG
Department:	Justice
Airframe Hours:	3650
Airframe Age:	33 years
Average Yearly Hours:	75

Primary Use:
Transportation of DOJ personnel (95%)

Secondary Use:
Traffic enforcement (5%)

Flight Conditions:
Mostly day VFR (90%) with some night VFR cross-country flying

Airframe Status:
Fairly low-time airframe for its age

Corrosion, Fatigue Status:
None

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Avionics are up-to-date with GPS, weather datalink and 406 MHz ELT

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Low to medium

Comments:
This aircraft is maintained to FAR Part 91 standards by Helena Aircraft. This aircraft is somewhat limited in its ability to carry passengers as it is often only able to carry two passengers in addition to the pilot. A six-place Cessna 210 or similar aircraft may be better suited as a replacement.

Individual Aircraft Assessment

Aircraft:	151HP
Type:	OH58
Department:	Justice
Airframe Hours:	3800
Airframe Age:	40 years
Engine Hours:	3800
Average Yearly Hours:	75

Primary Use:
Law enforcement support, search and rescue, repeater site maintenance

Secondary Use:

Flight Conditions:
Primarily day VFR, with some night VFR in mountainous terrain as well as low-level operations

Airframe Status:
Older airframe with relatively low flight hours.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Very up-to-date

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Medium

Comments:
This aircraft is maintained by Helena Aircraft to Part 91 standards. Although this aircraft is fairly old, it has relatively low airframe time and a low accumulation of flight hours. Because of power limitations, the OH58 is somewhat limited in its ability to carry passengers in some conditions. It also has limited performance in high-altitude and mountainous terrain, where search and rescue operations are often conducted. In view of increasing utility and safety margins, a more powerful version of this helicopter might be considered as a replacement.

Individual Aircraft Assessment

Aircraft:	N1095T
Type:	Hughes 500
Department:	Livestock
Airframe Hours:	13,334
Airframe Age:	31 years
Engine Hours:	13,295
Average Yearly Hours:	600

Primary Use:
Predator damage management (95%)

Secondary Use:
Brand inspection, bison control

Flight Conditions:
Day VFR, low-level operations over hazardous terrain

Airframe Status:
High time

Engine Status:
High time

Corrosion, Fatigue Status:
None Known

Known or Anticipated Airframe Issues:
None Known

Avionics Status:
Avionics are up-to-date, with GPS, datalink weather and 406MHz transponder

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
High

Comments:
This aircraft is maintained at Helena Aircraft to Part 91 standards. Because of the relatively high-time airframe and high (600 hours per year) utilization, this aircraft can be expected to be retired earlier than other state-operated aircraft of its type.

Individual Aircraft Assessment

Aircraft:	N6962C
Type:	Bell OH58
Department:	Livestock
Airframe Hours:	11,340
Airframe Age:	43 years
Average Yearly Hours:	600

Primary Use:
Predator damage management (95%)

Secondary Use:
Brand inspection, bison control

Flight Conditions:
Day VFR, low-level operations over hazardous terrain

Airframe Status:
High-time airframe, high utilization

Corrosion, Fatigue Status:
None Known

Known or Anticipated Airframe Issues:
None Known

Avionics Status:
Avionics are up-to-date, with GPS, datalink weather and 406MHz transponder

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
High

Comments:
This aircraft is maintained at Helena Aircraft to Part 91 standards. Because of fairly high yearly utilization, this aircraft will probably warrant retirement earlier than other state-operated aircraft of its type. This aircraft is well-suited for its mission and would most likely eventually be replaced with a similar Bell helicopter of a later model.

Individual Aircraft Assessment

Aircraft:	9067M
Type:	Cessna 180
Department:	DNRC
Airframe Hours:	10,000
Airframe Age:	41 years
Average Yearly Hours:	175

Primary Use:
Fire detection

Secondary Use:
Administration flights

Flight Conditions:
Day VFR, usually over mountainous terrain while conducting fire patrol.

Airframe Status:
High-time

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Very up-to-date

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained by DNRC mechanics to Part 91 standards. While high-time, this is a very durable airframe with no known aging issues. It is essentially the same as newer aircraft of a similar type. This aircraft is no longer in production, but newer aircraft of the same type are available.

Individual Aircraft Assessment

Aircraft:	391M
Type:	Cessna 185
Department:	DNRC
Airframe Hours:	5,000
Airframe Age:	47 years
Average Yearly Hours:	175

Primary Use:
Fire detection

Secondary Use:
Administration flights

Flight Conditions:
Day VFR, usually over mountainous terrain while conducting fire patrol.

Airframe Status:
Mid-time

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
Very up-to-date

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained by DNRC mechanics to Part 91 standards. Although fairly old, this is a very durable airframe with no known aging issues. It is essentially the same as newer aircraft of a similar type. This aircraft is no longer in production, but newer aircraft of the same type are available.

Individual Aircraft Assessment

Aircraft:	6312B
Type:	Cessna 182
Department:	DNRC
Airframe Hours:	5,000
Airframe Age:	54 years
Average Yearly Hours:	175

<u>Primary Use:</u>
Fire detection

<u>Secondary Use</u>:
Administration flights

<u>Flight Conditions</u>:
Day VFR, usually over mountainous terrain while conducting fire patrol.

<u>Airframe Status</u>:
Mid-time

<u>Corrosion, Fatigue Status</u>:
None known

<u>Known or Anticipated Airframe Issues</u>:
None known

<u>Avionics Status</u>:
Very up-to-date

<u>Recommended Avionics Upgrades</u>:
None

<u>Recommended Replacement Priority</u>:
Low

<u>Comments</u>:
This aircraft is maintained by DNRC mechanics to Part 91 standards. Although fairly old, this is a very durable airframe with no known aging issues. It is mostly the same as newer aircraft of a similar type. This type of aircraft is still in production

Individual Aircraft Assessment

Aircraft:	392M
Type:	Bell 206
Department:	DNRC
Airframe Hours:	10,000
Airframe Age:	42 years
Average Yearly Hours:	100

Primary Use:
Fire suppression

Secondary Use:
Aerial survey

Flight Conditions:
Day VFR, usually low-level operations over mountainous terrain.

Airframe Status:
Higher-time airframe, low-time engine.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
An avionics overhaul is in progress at this time.

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Low

Comments:
This aircraft is maintained by DNRC mechanics to part 91 standards. Although a higher-time airframe, yearly hour accumulation is low.

Individual Aircraft Assessment

Aircraft:	384M
Type:	Bell 206
Department:	DNRC
Airframe Hours:	5,000
Airframe Age:	29 years
Average Yearly Hours:	100

<u>Primary Use:</u>
Fire suppression

<u>Secondary Use</u>:
Aerial survey

<u>Flight Conditions</u>:
Day VFR, usually low-level operations over mountainous terrain.

<u>Airframe Status</u>:
Low-time airframe, mid-time engine.

<u>Corrosion, Fatigue Status</u>:
None known

<u>Known or Anticipated Airframe Issues</u>:
None known

<u>Avionics Status</u>:
An avionics overhaul is in progress at this time.

<u>Recommended Avionics Upgrades</u>:

<u>Recommended Replacement Priority</u>:
Medium

<u>Comments</u>:
This aircraft is maintained by DNRC mechanics to Part 91 standards.

Individual Aircraft Assessment

Aircraft:	387M, 388M, 394M, 395M, 398M
Type:	Bell UH-1H “Hueys”
Department:	DNRC
Airframe Hours:	Variable between 5,000 – 12,000
Airframe Age:	42 years (387M), 47 years on the others
Engine Hours:	2,000 hours average
Average Yearly Hours:	150 per aircraft

Note: These five aircraft have been retrofitted to a point where they are essentially identical except for engine and airframe times. For the state of brevity, therefore, they are evaluated together.

Primary Use:
Fire suppression

Secondary Use:

Flight Conditions:
Day VFR, with hazardous operations involving low-level operations over trees and difficult terrain in proximity to fires.

Airframe Status:
Relatively low- time, as fleet times for this type of aircraft are often 35-40,000 hours. All aircraft have been stripped down and rebuilt to the manufacturer’s standards for “Huey II” aircraft, making them essentially on par with new aircraft. Bell Helicopter has recently approved the aircraft for another 15-year of support, the longest extension that Bell grants any helicopters.

Engine Status:
All aircraft have been upgraded with more powerful engines with an average of 2,000 hours. This is very low-time for a turbine and no issues are expected.

Corrosion, Fatigue Status:
None known

Known or Anticipated Airframe Issues:
None known

Avionics Status:
All panels have recently been upgraded and standardized with GPS, satellite tracking and 406 MHz ELT’s

Recommended Avionics Upgrades:
None

Recommended Replacement Priority:
Very low

Comments:
Although these are older airframes, most fatigue issues in a helicopter are in the "dynamic" components, such as the rotor blades, rotor hub, etc. These issues are addressed as they arise, and are more easily dealt with than fatigue issues on a fixed-wing aircraft.

With a yearly accumulation of 150 hours, aging is not expected to be an issue for the foreseeable future.