

Wildland Fire Management Aerial Application Study



**Final Report
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AVIATION MANAGEMENT TRIANGLE

The Aviation Management Triangle reflects the essential elements of sound, professional aviation management. Aviation management is a service function. Our objective is to provide safe, cost effective, and appropriate aviation services.

The foundation of aviation management is SAFETY. If the mission cannot be accomplished without compromising safety, say NO! Insure an acceptable level of risk through sound risk management.

Strive for COST EFFECTIVE aircraft use. Question requests that are not cost effective - explain why and recommend a better alternative.

Use the RIGHT tool (aircraft) for the job. Question requests to the contrary - explain why and recommend a better way. Do what's right!



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Wildland Fire Management Aerial Application Study

Executive Summary

Summary of Findings and Comments

Listed below is a summary of finding and comments based on lessons learned as this study was conducted.

1. Fixed-wing Type 1 and 2 airtankers are justified as an integral component of the initial attack resources for land management agencies.
2. Due to differences in speed, tank size, effectiveness of long term versus short term retardants and daily availability cost, Type 1 and 2 fixed-wing airtankers are significantly more efficient in fireline building capability than Type 1 Limited helitankers. Comparison of acres burned and cost plus net value change (C+NVC) results in a conclusion that the staffing of eight Type 1, Category C, Limited helitankers is equivalent to the staffing of one to two Type 1 generic airtankers.
3. The ability to locate helibases in close proximity to the large fire incidents and to provide long term retardant at these helibases favors the use of Type 1 and 2 helitankers over Type 1 and 2 fixed-wing airtankers for large fire support.
4. Future fixed-wing airtanker platforms can be procured in the private sector and developed into airtankers that provide service in a cost efficient manner. Use of excess military platforms is also an option but not a requirement.
5. Future fixed-wing airtanker platforms of 3,000 to 5,000 gallons continue to show significantly greater economic benefit over smaller capacity platforms.
6. Due to the proximity of fires to the currently staffed set of airtanker bases, there are few instances where it is more effective for fixed-wing airtankers to climb to above 10,000 feet MSL in transit to a fire. As such, speed capability when traveling above 10,000 feet MSL provides only a minor effect on economic efficiency.

7. Based on the collective results of analysis in example fixed-wing airtankers, desirable design specifications for a future fixed-wing airtanker platform are as follows:

- Is turbine-powered
- Speed traveling under 10,000 feet is 250 KIAS
- Speed traveling above 10,000 feet 350-400 KTAS is desirable
- Retardant carrying capacity 4,000 to 5,000 gallons
- Ability to operate from 80-90% of the existing airtanker bases

The analysis also shows a positive economic benefit given the costs that follow:

- Has a flight rate of \$6,000 per hour or less
- Has daily availability of \$9,500 per day or less based on a 100-day contract

8. The modified analytical methods used in this study appropriately address the issues raised by reports critical of past National Studies (e.g. NATS1, NATS2, etc.) and provide supportable and confident results.

9. Significant savings in suppression costs for large fires can be achieved by the use of exclusive-use contracts for both Type 1 and Type 2 helicopters. The staffing of these contracts at locations where they can also support initial attack, when available, provides an added benefit.

10. The agencies should consider changes to the report keeping process at the National level to support the rapid attainment of the data needed to update this and other studies.

11. The TriSim model can be applied to study tradeoffs of alternative methods of procuring other fire management resources such as 20-person crews.

12. In the early 1990s, the Forest Service developed a report, which provides a blueprint for the conducting of National studies, includes an oversight group to manage the process. Revisiting that report and oversight process would provide timely guidance.

Background

In June 2005, the Forest Service Washington Office Fire and Aviation management team chartered this study to address staffing questions for Type 1 airtankers and Type 1 helicopters. The study was divided into two phases.

Phase 1 - Initial Attack Support

In NATS1, 38 large airtankers were justified nationally for initial attack based on an airtanker base by airtanker base analysis. The recommendation from the “NATS2” committee was that: The future composition of the large airtanker fleet be diverse in structure, turbine engine powered, 3,000 to 5,000 gallon in size capacity and compatible with a high percentage of federal airtanker bases.

Phase 1 of this study has the following two objectives:

Objective 1-1

Re-examine staffing of Type 1 and 2 airtankers as well as Type 1 helicopters at the airtanker bases recommended for staffing in NATS1 and NATS2. By airtanker base, recommend the aircraft type and number that supports the most cost efficient staffing.

Findings for Objective 1-1

Analysis of Type Fixed-Wing Airtankers for Initial Attack Support

Table ES-1 contains the results of analysis by GACC.

Table ES-1 – Summary of Number of Fixed-Wing Airtankers Using a Current Generic Airtanker and AutoAT4 Modeling

| Geographic Area | No. of Fixed-wing Airtankers | Suggested Locations | Comments |
|----------------------|------------------------------|--|---|
| Basin – W & E | 8 - 9 | Battle Mt., Boise, Cedar City, Hill, McCall, Minden | None |
| Eastern | 1 | Northern Minnesota | Unable to analyze fully due to lack of NFMAS files |
| No. & So. California | 5 - 7 | Chico, Chester, Fox Field, Lancaster, Fresno, Montague, San Bernardino, Porterville, Redding | Further analysis in So. Ops. using recalibrated analyses with adjusted ground resource production rates is supported. |
| No. Rockies | 3 - 4 | Coeur d’ Alene, Missoula, Helena, West Yellowstone | Multi-GACC analysis used for Coeur d’ Alene and West Yellowstone |
| Northwest | 6 - 7 | Klamath Falls, LaGrande, Moses Lake, Redmond | None |
| Rocky Mt. | 2 - 3 | Jeffco, Grand Junction, Durango | Multi-GACC analysis used for Durango |
| Southern | 3 | Chattanooga, Fayetteville | None |
| Southwest | 6 - 7 | Alamogordo, Albuquerque, | None |

Table ES-1 – Summary of Number of Fixed-Wing Airtankers Using a Current Generic Airtanker and AutoAT4 Modeling

| Geographic Area | No. of Fixed-wing Airtankers | Suggested Locations | Comments |
|-----------------|------------------------------|--|----------|
| | | Prescott, Silver City, Williams Gateway (Phx), Winslow | |
| Total | 34 - 41 | | |

Determining the actual number of airtanker platforms to staff annually is mainly based on the concurrent fire seasons in the California, East Basin, Northern, Northwest, Rocky Mountain and West Basin GACCs. For these geographic areas the range of airtanker platforms is 24-30. The fire occurrence in these GACCs shows an episodic pattern and applying a percent increase of 30% based on the Northwest GACC analysis using WIRAS and AutoAT4 modeling brings the staffing range to 31 – 39. Note that in the NATS1 study, three additional airtankers were recommended to provide an increased capability to support large fires.

The scope of this study is to determine the most cost efficient number of airtankers to support initial attack and large fire suppression. The use of the military (MAFFS) and aircraft from other sources when demand reaches a very high percentile of supply is still needed. It is recognized that other resources are needed when private vendor sources for large airtankers are fully committed. Use of the military is an integral part of the total airtanker support during these events.

Analysis of Type 1 Helicopters for Initial Attack Support

For all of the locations analyzed for staffing to support initial attack, the acres burned and C+NVC were less for the fixed-wing airtanker versus the Type 1 helitanker. The initial attack working circle radius of the Type 1 helitanker is about 90 miles. This limitation forces the fire business support for this platform to be restricted to, in general, one or two organizational units. The annual daily availability is based on days staffed. For a 100-day fire season, the total would be \$1,480,821. This cost together with the unit mission cost, mainly flight time, needs to be recovered from reduced C+NVC that results from a reduced number of acres burned. The analysis showed that at all locations modeled, the savings in C+NVC could not be recovered within this limited working circle. For analysis and discussion of the use of Type 1 helicopters in extended attack and large fire support, refer to the Phase 2 analysis.

Objective 1-2

Re-examine aircraft performance attributes recommended in NATS2 for a future airtanker platform. Recommend performance attributes for future airtanker and helicopter platforms that support a national cost efficient fire protection program.

Findings for Objective 1-2

Both AutoAT4 (NFMAS) and WIRAS modeling were completed in the Northwest GACC. Only AutoAT4 (NFMAS) analysis was done elsewhere. Analysis of platforms with a retardant load capacity less than 5,000 gallons was completed at five airtanker bases defined in the NATS2 study. These airtanker bases were shown to be representative of the entire set of airtanker bases. Analysis

of the platforms with a retardant load capacity greater than 5,000 pounds will be discussed in a later section.

AutoAT4 Modeling – Platform Capacity Less Than 5,000 Gallons - All GACCs

The result of runs at the five airtanker bases follows. The values in Tables ES-2a and ES-2b for each base are the changes in performance in the candidate platform’s C+NVC and the C+NVC for the generic airtanker platform. Positive values indicate an improvement in C+NVC and negative values a reduction in C+NVC.

Table ES-2a – C+NVC Changes Between Generic Airtanker and Specified Platform With Travel Above and/or Below 10,000 feet, Which Ever is the Most Effective

| Base | Example Airtanker Platforms | | | | | |
|---------------|--------------------------------|-------------------------------|-------------|--------------|--------------|--------------|
| | C-130H (Acquire from Military) | C-130H (Acquire Commercially) | BAe-146 | S-3 | Q-400 | Q-200 |
| Albuquerque | \$4,432,150 | \$2,912,950 | \$163,916 | -\$2,718,677 | -\$2,675,973 | -\$3,659,745 |
| Boise | \$1,445,267 | -\$73,933 | \$444,565 | -\$1,132,427 | -\$2,593,072 | -\$1,840,177 |
| Klamath Falls | \$15,385,627 | \$13,186,727 | \$1,189,758 | -\$2,515,558 | -\$2,616,948 | -\$4,290,709 |
| Phoenix | \$2,408,303 | \$899,103 | -\$198,652 | -\$4,061,674 | -\$2,665,819 | -\$7,504,611 |
| Redding | \$12,847,447 | \$11,328,247 | -\$105,894 | -\$1,785,976 | -\$2,521,701 | -\$3,115,234 |

Table ES-2b – Ordinate Ranking of Platforms

| | | | | | | |
|---------------|-----|-----|-----|-----|-----|-----|
| Albuquerque | 1 | 2 | 3 | 5 | 4 | 6 |
| Boise | 1 | 3 | 2 | 4 | 6 | 5 |
| Klamath Falls | 1 | 2 | 3 | 4 | 5 | 6 |
| Phoenix | 1 | 2 | 3 | 5 | 4 | 6 |
| Redding | 1 | 2 | 3 | 4 | 5 | 6 |
| Average | 1.0 | 2.2 | 2.8 | 4.4 | 4.8 | 5.6 |

WIRAS Modeling – Platform Capacity Less Than 5,000 Gallons in the Northwest GACC

At this time, WIRAS is built to run only on the Northwest GACC. Results where several of the candidate future airtanker platforms staffed are shown in Table E-3. Staffing was as follows: 1-Klamath Falls, 1-LaGrande, 2-Redmond and 1-Moses Lake. The staffing for each candidate airtanker was the same replacing the generic future platform with the candidate platform.

Table ES-3 – C+NVC Difference Between Five Generic Airtankers and Five of Each Specified Platform

| Base | Example Airtanker Platforms | | | | | |
|------------|--------------------------------|-------------------------------|------------|--------------|--------------|--------------|
| | C-130H (Acquire from Military) | C-130H (Acquire Commercially) | BAe-146 | S-3 | Q-400 | Q-200 |
| Difference | \$3,877,965 | \$79,965 | -\$409,203 | -\$6,518,502 | -\$7,923,955 | -\$9,101,272 |
| Ordination | 1 | 2 | 3 | 4 | 5 | 6 |

Summary of Results - Platform Capacity Less Than 5,000 Gallons

The ordination of the example platforms analyzed is the same regardless of cruise speed. The platform ordination using WIRAS modeling is the same as the ordination using AutoAT4 (NFMAS) modeling.

In general, the C-130H (Acquire from Military), the C-130H (Commercial Purchase) and the BAe-146 are more economically efficient than the generic current fixed-wing airtanker. This indicates that staffing of these platforms would not decrease the suggested number of platforms documented earlier. However, the remaining three platforms are less economically efficient than the generic current fixed-wing airtanker and staffing of these would most likely result in a reduced number of platforms that can be justified using economic efficiency criteria. Two of the top three platforms do not assume the use of surplus military platforms and can be justified based on a positive benefit to cost ratio.

Table ES-4

| Ordination of Example Platforms Using AutoAT4 and WIRAS Modeling |
|---|
| <ol style="list-style-type: none">1. C-130H (Acquire from Military)2. C-130H (Commercial Purchase)3. BAe-146 (Commercial Purchase)4. S-3 (Acquire from Military)5. Q-400 (Commercial Purchase)6. Q-200 (Commercial Purchase) |

Platform Capacity Greater Than 5,000 Gallons - All GACCs

The two platforms proposed with capacity greater than 5,000 gallons of retardant or water were the DC-10 and the B-747-200B. Prototypes of both platforms have been developed and some testing has occurred. The design of the National Type 1 and 2 fixed-wing airtanker fleet is to support primarily initial attack using an interchangeable, interoperable combination of aircraft platforms and airtanker bases. The aircraft proposed can operate only from a very limited number of airtanker bases (12%).

Phase 2 – Large Fire Support

The following objectives are proposed for Phase 2 of this study.

Objective 2-1

Re-examine economic efficiency for exclusive-use Type 1 and 2 helicopters to support large fire suppression.

Objective 2-2

Examine economic efficiency for the use of Type 1 and Type 2 airtankers to support large fire suppression.

Findings for Objectives 2-1 and 2-2

The large helicopters have a wide range of payload capacity. This is particularly true for those traditionally classified as Type 1. For this study, helicopters were grouped into three categories as shown in Table ES-5. Table ES-6 contains a summary of the results of modeling for Type 1 helicopters. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Table ES-5

| Category | Payload (lbs) |
|----------|---------------|
| A | < 5,000 |
| B | 5,001-15,000 |
| C | > 15,000 |

Table ES-6 - Summary of the Results of Modeling for Type 1 Helicopters

| Helicopter Specs | % Demand* | No. EU Contracts Based on Economically Efficiency | Approximate Net Savings Over 100% CWN Staffing |
|----------------------|-----------|---|--|
| Limited, Category C | 100% | 27 | \$34,932,293 |
| Limited, Category B | 100% | 17 | \$6,011,090 |
| Limited, Category C | 34% | 9 | \$11,086,398 |
| Limited, Category B | 67% | 11 | \$5,376,400 |
| Standard, Category C | 100% | 26 | \$36,392,915 |
| Standard, Category B | 100% | 29 | \$19,333,064 |

* - Average annual demand is 2450 helicopter days

Table ES-7 displays the number of exclusive-use helicopters based on percent of total demand divided between Category B and C, Type 1 helicopters.

| Table ES-7 – Summary of Optimum Number Type 1 Limited Exclusive-Use Contracts by Category Based on Economic Efficiency | | | | | | | | | | | |
|--|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Cat. | Demand Level | | | | | | | | | | |
| | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| C | 0 | 3 | 5 | 8 | 11 | 13 | 16 | 18 | 21 | 24 | 27 |
| | 100% | 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% | 0% |
| B | 17 | 15 | 14 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 |
| | All | 17 | 18 | 19 | 20 | 21 | 21 | 23 | 23 | 24 | 26 |

Table ES-8 displays the number of exclusive-use helicopters based on percent of total demand divided between Category B and C, Standard Type 1 helicopters.

Table ES-8 – Summary of Optimum Number Type 1 Standard Exclusive-Use Contract by Category Based on Economic Efficiency

| Cat. | Demand Level | | | | | | | | | | |
|------|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| C | 0 | 2 | 5 | 8 | 10 | 13 | 16 | 18 | 21 | 22 | 26 |
| | | | | | | | | | | | |
| B | 100% | 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% | 0% |
| | 29 | 26 | 24 | 20 | 17 | 15 | 12 | 9 | 6 | 3 | 0 |
| | | | | | | | | | | | |
| All | 29 | 28 | 29 | 28 | 27 | 28 | 28 | 27 | 27 | 25 | 26 |

Table ES-9 contains a summary of the results of modeling for Type 2 helicopters. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Table ES-9 - Summary of the Results of Modeling for Type 2 Helicopters

| Helicopter Specs | % Demand* | No. EU Contracts Based on Economically Efficiency | Approximate Net Savings Over 100% CWN Staffing |
|---|-----------|---|--|
| Limited, Category A | 100% | 33 | \$9,077,228 |
| Standard, Category A | 100% | 28 | \$8,347,416 |
| * - Average annual demand is 3433 helicopter days | | | |

Objective 2-3

Determine additional staffing requirements for Type 1 and 2 fixed-wing airtankers and Type 1 and 2 helicopters that were recommended for staffing in Phase 1 due to expected unavailability attributed to large fire suppression support needs.

Findings for Objective 2-3

Three additional Type 1 fixed-wing airtankers were added to the fleet in “NATS1” to support the draw down from large fire support. This conclusion remains reasonable for the foreseeable future. Phase I did not identify additional Type 1 and 2 helicopters to support large fires. Additionally, the Phase 2 analysis supports significant helicopter support to large fire. Hence, there are no further resources identified here.

Wildland Fire Management Aerial Application Study

Background

In 1992, the USDA Forest Service and USDI Department of Interior completed the National Study of Type 1 and 2 Helicopters to Support Large Fire Suppression (NHeli1). This study recommended exclusive-use staffing of two Type 1 and seven Type 2 helicopters to support large fire suppression. An update of this report (Kirsh 1998) (TFMHeli) recommended that six Type 1 helicopters be staffed to support large fire suppression to reflect the increase in demand since the 1992 study,

In 1995 and 1996, the USDA Forest Service and US Department of Interior completed two studies of the national large airtanker fleet and airtanker bases (USDA Forest Service 1995, 1996). The Phase 1 study completed in 1995 (NATS1) recommended a large airtanker (1000 gallons or greater) fleet of 41 fixed-wing, turbine powered aircraft. In the phase 2 study completed in November 1996 (NATS2), the study committee set the following goal after examination of all information presented:

- The future airtanker fleet should be diverse in structure, turbine engine powered, 3000 to 5000 gallon in size capacity and compatible with a high percentage of federal airtanker bases.

Given the range of aircraft examined, the 1996 study committee recommended:

- The procurement of excess military aircraft as this is the most cost effective way to acquire airtanker platforms.
- A future fleet composition of twenty P-3A aircraft, ten C-130B aircraft and 11 C-130E/K aircraft. This would provide a fleet that is essentially 75% 3000-gallon capacity and 25% 5000 capacity. From Phase 1, it was determined that a National fleet size of 41 large airtankers is needed. This is affirmed and is cost efficient considering the benefit/cost at the representative airtanker base studies. Maintaining a fleet size of 41 while the total gallonage capacity of the fleet is increasing provides for greater fireline construction "early on" in initial attack and provides adequate numbers to support multiple fire occurrence episodes. Estimated benefit/cost upon full implementation is 6.38.

The NATS2 study team proposed a transition schedule to a fleet of P-3A, C-130B and C-130E/K aircraft to occur by contract period as follows:

| | <u>1999</u> | <u>2002</u> | <u>2005</u> | <u>2008</u> |
|-------------|-------------|-------------|-------------|-------------|
| P-3A/C-130B | 4 | 4 | 6 | 4 |
| C-130E/K | 0 | 3 | 4 | 4 |

In the summer of 2002, two airtanker accidents prompted a review of the national airtanker program (USDA Forest Service and Department of Interior 2002) and the suspension of airtanker operations and testing of the airtanker fleet. In December, 2002, a report titled Federal Aerial Firefighting: Assessing Safety and Effectiveness, Blue Ribbon Panel Report to the Chief, USDA Forest Service and Director, USDI Bureau of Land Management stated:

- Although the recommendations of the comprehensive National Study of Air Tankers to Support Initial Attack and Large Fire Suppression were valid in the 1990s, events have shifted the basis upon which it was founded, rendering the conclusions moot. Its authors recommended that the Department of Defense provide newer ex-military aircraft, but the Pentagon is clearly not inclined to provide those aircraft, saying they are needed for national security purposes. The aircraft simply are not available for transfer, the Department of Defense maintains.

A further review of the NATS1 and NATS2 recommendations indicates that most of these recommendations are still valid, not moot as indicated by the Blue Ribbon Panel Report. The Blue Ribbon Panel's concerns were focused on how the aircraft procurement recommendations were implemented.

The Blue Ribbon Panel Report states:

- The panel believes obtaining and outfitting newer military aircraft, such as C-130s and P-3s, would only perpetuate a cycle that has proven to be unsustainable and dangerous. Unless the FAA and operator community change its methods, one could expect to see another cycle of structural failures and pilot fatalities within a decade or two. This strongly suggests that it is time to abandon what the panel considers a 50-year-old unsustainable strategy.

The recommendation from the NATS2 committee was that:

- The future composition of the large airtanker fleet be diverse in structure, turbine engine powered, 3000 to 5000 gallon in size capacity and compatible with a high percentage of federal airtanker bases.

To cover the alternative where excess military aircraft were not available, the committee analyzed civilian purchase of several aircraft including the Lockheed L-188 and the Lockheed C-130E/K and C-382G models. All of these alternative aircraft had a positive benefit-cost ratio under the assumptions the aircraft were purchased new. The recommendation for a future fleet composition of 20 P-3A aircraft, 10 C-130B aircraft and 11 C-130E/K aircraft was provided as an example for how the agencies could implement the study committee's proposal.

The NATS2 analysis of potential future aircraft was completed to support the aircraft recommendations from NATS1. In NATS1, 38 large airtankers were justified nationally for initial attack based on an airtanker base by airtanker base analysis. An additional three airtankers were justified to backfill anticipated draw down of initial attack airtanker support due to large fire demand for retardant.

- It is critical to note that the justification of the 41 large airtankers in NATS1 was based on initial attack firefighting demand. The grounding of the national large airtanker fleet following the 2002 fire season did not change this demand for retardant delivery.

The NATS2 recommendations were accepted by the agencies and the implementation plan was approved December 20, 1999.

For the 2003, 2004 and 2005 fire seasons, the USDA Forest Service has been staffing airtankers and helicopters to support the delivery of fire retardant for initial attack. A variety of Single Engine Airtankers, Type 1 helicopters and Type 1 and Type 2 airtankers have been used. The USDA Forest Service Washington Office proposed this study to provide recommendations on the value of aircraft providing fire retardant to support initial attack and large fire support.

Components and Phases for this Study

This study addresses the following components:

- The study shall analyze the past studies (NATS1 and 2, TARMS, Type 1 and 2 Helicopter, etc.) with regard to issues that may make them no longer valid. These issues shall be addressed and the modeling made to accommodate these issues.
- The study shall develop the aviation needs (both helicopter Type 1 and 2, and Type 1 airtankers). The needs shall be identified in terms of aircraft capacity, number and type (helicopter or fixed-wing). The study shall not identify specific aircraft, e.g. P-3 Orion. The study shall first consider the aviation needs without constraints. The study shall also consider the aviation constraints that exist today, e.g. current fixed-wing airtankers, etc.
- The study shall examine the basis of the data used in the study. The study shall consider more recent data and determine the impact to the needs analysis.
- The study shall examine other modeling products used in Forest Service studies (namely ADFP and WIRAS).
- The study shall define the approach used as the basis of the analysis. The study shall revalidate the representative location concept (if used).
- The study shall consider National Resources only.
- The study shall be proposed in phases at appropriate points to allow for potential changes in direction.

This study will be accomplished in two phases as described below.

Phase 1 - Initial Attack Support

In NATS1, 38 large airtankers were justified nationally for initial attack based on an airtanker base by airtanker base analysis. The recommendation from the NATS2 committee was that: “The future composition of the large airtanker fleet be diverse in structure, turbine engine powered, 3000 to 5000 gallon in size capacity and compatible with a high percentage of federal airtanker bases.”

Phase 1 has the following two objectives:

Objective 1-1

Re-examine staffing of Type 1 and 2 airtankers as well as Type 1 helicopters at the airtanker bases recommended for staffing in NATS1 and NATS2. By airtanker base, recommend the aircraft type and number that supports the most cost efficient staffing.

Objective 1-2

Re-examine aircraft performance attributes recommended in NATS2 for a future airtanker platform. Recommend performance attributes for future airtanker and helicopter platforms that support a national cost efficient fire protection program.

Scope

Aircraft platforms to be examined are fixed and rotary-wing with a fire retardant carrying capacity of 1000 gallons or greater.

Phase 2 – Large Fire Support

The following objectives are proposed for Phase 2 of this study.

Objective 2-1

Re-examine staffing efficiency for exclusive-use Type 1 and 2 helicopters to support large fire suppression.

Objective 2-2

Examine economic efficiency for the use of Type 1 and Type 2 airtankers to support large fire suppression.

Objective 2-3

Determine additional staffing requirements for Type 1 and 2 fixed-wing airtankers and Type 1 and 2 helicopters that were recommended for staffing in Phase 1 due to expected unavailability attributed to large fire suppression support needs.

Scope

Aircraft platforms to be examined are fixed and rotary-wing with a fire retardant carrying capacity of 1000 gallons or greater.

Aircraft

Fire protection planning is performed at three levels: the local level, the regional level and the national level. When planning is done for a National (Shared) Resource such as large airtankers and helicopters, assumptions are made based on the local and regional analysis that has already been performed. It is critical to understand that initial attack resources are initially justified at the local level (Forest Service National Forest, BLM District, etc).

Some initial attack resources require an analysis covering more than a single local unit level. Examples of these types of resources may include Type 1 and 2 helicopters and Type 1 and 2 fixed-wing airtankers. This multi-unit analysis requirement is usually dictated by the cost of the resource and the fire business needed to provide a justification for the resource.

As designed in NATS1 and NATS2, the National Large Airtanker Fleet was designed to be interoperable, effective and efficient in initial attack fire suppression support on a national basis. There are several key words in this design statement.

The first is the word “national,” next is the word “interoperable,” and the last are the words “effective” and “efficient.” National and interoperable mean that the fleet is mobile and can perform its mission throughout the United States. Effective means the mission of the resource accomplishes its fire suppression mission as defined. Fire suppression missions can be accomplished in many ways all of which are effective, but some may be more cost efficient than others.

Fixed-Wing Platforms

Up until 2003, the multi-engine large airtanker fleet was composed of reciprocating engine models such as the PB4Y2, DC-4, Super DC-4, SP-2H, P-2V, DC-6, DC-7 and KC-97. In addition, two turbine aircraft models were part of the fleet, the P-3A and the C-130A.

In 2005, 17 aircraft were placed under contract. This fleet is composed of seven P-3As, nine P2Vs and one DC-7. Two of the P2Vs are instrumented (Avenger Testing) and the DC-7 is instrumented (Genesis Testing) to gather data during fire retardant dropping missions.

Aircraft defined in the NATS2 study as potential future platforms for the fixed-wing airtanker fleet are as follows (NATS2 report, page 14):

| <u>Civil Aircraft</u> | <u>Military Excess Aircraft</u> | <u>Turbine Refit Aircraft</u> |
|-----------------------|---------------------------------|-------------------------------|
| - CL-215T | - E-2C | - C-123T |
| - CL-415T | - S-3 | - P-2T |
| - F-27 | - A-6 | - DC-4T |
| - CV-580 | - A-10 | - S-2T |
| - L-188 | - P-3A | |
| - L-382G | - C-130A,B | |
| - C-130E/K | - C-130E/K | |
| - B-737-200 | | |
| - B-747-200B | | |

Initial analysis of costs and aircraft compatibility at airtanker bases resulted in the elimination of several potential future platforms. Aircraft analyzed in NATS2 for initial attack efficiency are follows:

| <u>Civil Aircraft</u> | <u>Military Excess Aircraft</u> | <u>Turbine Refit Aircraft</u> |
|-----------------------|---------------------------------|-------------------------------|
| - CV-580 | - E-2C | - P-2T |
| - L-188 | - S-3 | - S-2T |
| - L-382G | - A-10 | |
| - C-130E/K | - P-3A | |
| - B-737-200 | - C-130A,B,E,K | |

Definition of Attributes of Example Airtanker Platforms Uses in this Study

S-3, Viking

This turbine-powered aircraft was a carrier based anti-submarine platform. Deliveries to the Navy began in 1974 and ended in 1978 with the 187th being manufactured. The aircraft has received electronic warfare system upgrades since then. The Viking is powered by two GE TF3-GE-2 high bypass turbofan engines, each rated at 9,275 static pounds thrust. The retardant capacity is estimated at 2,400 gallons, and the aircraft's cruise speed is 250 KTAS, below 10,000 MSL, and 269 KTAS at 15,000 feet.

Figure 1 – S3, Viking



250 KTAS, below 10,000 MSL, and 269 KTAS at 15,000 feet.

Bombardier Aerospace Q-200

Introduced in 1998, it has the increased speed and payload over the Q-100 version. The aircraft has Pratt and Whitney 123C/D engines. The PW 123D engine offers full power at higher ambient temperatures for improved hot-and-high airfield performance. The retardant capacity is estimated at 1,500 gallons. The aircraft's cruise speed is 237 KTAS, below 10,000 MSL, and 265 KTAS at 15,000 feet.

Figure 2 – Q-200



Bombardier Aerospace Q-400

The Q400 is an upgraded version of the Q200. It is longer and has a higher cruise speed and payload than the Q200. The aircraft has Pratt and Whitney 150A engines. While the Q400 is larger and faster than the other Q Series models, the same pool of pilots can fly this aircraft, resulting in reduced crew costs for airlines with a mixed Q Series fleet. The retardant capacity is estimated at 2,642 gallons.

Figure 3 – Q-400



The aircraft's cruise speed is 250 KTAS, below 10,000 MSL, and 340 KTAS at 15,000 feet.

BAe-146

The BAe-146 (also known as the Avro RJ) is a medium-sized commercial aircraft manufactured by BAe Systems. It carries its four jet engines on a high wing above the fuselage. Production began in 1983 with the series 100, carrying 70 - 84 passengers, and ended during the 2001 world slump in the aviation market. Minden Air is in the process of converting a platform to an airtanker. The retardant capacity is estimated at 3,100 gallons. The BAe-146 has a cruise speed of 250 KTAS, below 10,000 MSL and 314 KTAS at 15,000 feet.

Figure 4 – BAe-146



C-130H (Acquisition from the Military)

The C-130H has upgraded performance over the C-130A model (3,000 gallon capacity) and is estimated to carry 4,200 gallons of retardant. The aircraft is powered by 4 Allison 501 Model turbo-prop engines, which generate over 4000 shaft horsepower. The C-130H has a cruise speed of 250 KTAS, below 10,000 MSL and 269 KTAS at 15,000 feet.

Figure 5 – C-130H (Military)



C-130H (Commercial Acquisition)

The C-130H Hercules (also known as L-382G and L-100-30) is a commercial version of the military C-130H model. The aircraft will have the same payload and speed as the C-130H (Acquisition from the Military) but the expected daily availability cost will be different as the purchase price will vary for the C-130H (Commercial Acquisition).

Figure 6 – C-130H (Private)



DC-10

The DC-10 was designed and built in Long Beach, California, by Douglas Aircraft Company, now the Long Beach Division of Boeing Commercial Airplanes. Production was started in January, 1968, and first deliveries were in 1971. In a production run extending to 1989, 386 commercial DC-10s were delivered, plus 60 KC-10 tanker/cargo models built for the U.S. Air Force. The retardant capacity is estimated at 12,000 gallons. A prototype platform has been converted into an airtanker. The DC-10 has a cruise speed of 250 KTAS, below 10,000 MSL and 442 KTAS at 15,000 feet.

Figure 7 – DC-10



Boeing 747-200B

This aircraft was selected for study because of its large lift capability, and represents other commercial aircraft in the heavy lift aircraft category. The 747-200B is a derivative of the original 747. One commercial vendor has developed a prototype aircraft as an airtanker. Production of the 200B model began in 1971 and was completed with 226 delivered by 1991. The aircraft is still in production but in other models. The aircraft is powered by four turbofan engines produced by either Pratt & Whitney, General Electric or Rolls-Royce. Evergreen Aviation is in the process of converting a platform to an airtanker. The estimated retardant capacity for the B-747 is 20,000 gallons. Its cruise speed below 10,000 MSL is 250 KTAS and 442 KTAS at 15,000 feet.

Figure 8 – B-747-200B



Fixed-Wing Airtanker Specifications, Daily Availability Cost and Flight Rate Cost

Table 1 displays the average daily availability and flight rates from the 2003 and 2005 Large Airtanker Contract in 2004 dollars. The rates for Type 1 and 2 airtankers in 2005 are believed to be in response to the lack of availability of aircraft to fulfill the agency’s desires. It is felt that with competition in the future, these daily availability rates will be less.

Table 1 – Large Airtanker Contract Costs

| 2003 Contract | | | |
|----------------|-----------------|--------------------|-------------|
| Size (gallons) | Aircraft Number | Daily Availability | Flight Rate |
| 2,000 | 12 | \$3,398 | \$2,076 |
| 2,450 | 15 | \$3,722 | \$2,613 |
| 3,000 | 12 | \$4,747 | \$3,438 |
| All | 39 | \$3,960 | \$2,702 |
| 2005 Contract | | | |
| Size (gallons) | Aircraft Number | Daily Availability | Flight Rate |
| 2,450 | 9 | \$3,578 | \$3,186 |
| 3,000 | 8 | \$8,329 | \$5,383 |
| All | 17 | \$5,814 | \$4,220 |

Aircraft use rates were developed in similar fashion to that presented in NATS2. For the Daily Availability, the acquisition costs of aircraft were obtained from an aircraft industry analyst. These were compared to airline industry studies that are available through on-line searches. It is noted that some aircraft prices are volatile to market trends and changes. For example, some cargo aircraft have seen price changes due to the US conflict in Iraq. Estimates were made for aircraft conversion (tank system, striping, avionic changes, load monitoring equipment, engineering analysis for Operational Service Life, etc.) using NATS2 as a basis, modified through inflation, and professional judgment. These costs were totaled and amortized for 15 years as 6.5%. Then insurance, other fixed costs (salaries and overhead), and extraordinary maintenance were applied resulting in the figures above.

The flight rate was determined using a combination of several methods. NATS2 was used for aircraft that were common to this study, and also provided a parametric analysis using all of the aircraft provide in the NATS2 study. (The NATS2 data were adjusted for inflation.) The Airline Transport Association annual reports for 2003 and prior, provides operating costs by aircraft type for Part 135 operators. A parametric analysis of the US Forest Service Large Airtanker contracts from 1999 to the present was conducted. Also the general rule that fuel costs are between 10 and 20

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percent of operating cost was used. And finally professional judgment was applied. In cases where one or more of the future fleet was not available in any of the above methods, interpolation or extrapolation available data was employed to obtain an estimate. The flight rate values that appear in the above table represent an average of the methods described.

Table 2 displays the assumptions made in the analysis for the daily availability and flight rates as well as other performance criteria.

Table 2 – Summary of Future Fixed-Wing Airtanker Platform Attributes

| | | Example Airtanker Platforms | | | | | | | |
|--|-------------|-----------------------------|---------|------------------------|---------|-------------------------|------------------------|-----------|-----------|
| | | S-3 | Q-200 | Q-400 | BAe-146 | C-130H Military Acquire | C-130H Private Acquire | DC-10 | B747-200 |
| Daily Avail. | Low | \$4,434 | \$5,906 | \$17,670* \$36,524# | \$6,520 | \$5,729 | \$12,721 | \$43,109* | \$56,812* |
| | Average | \$5,052 | \$7,507 | \$18,226* \$37,785# | \$8,107 | \$6,797 | \$14,393 | \$51,058* | \$66,617* |
| | High | \$5,670 | \$9,107 | \$18,782* \$39,046# | \$9,695 | \$7,866 | \$16,065 | \$59,007* | \$76,423* |
| Flight Rate | \$/Hr | \$3,530 | \$2,400 | \$4,280 | \$6,500 | \$5,700 | \$5,700 | \$10,500 | \$16,000 |
| Retardant Load | Gallons | 1,800 | 1,600 | 2,642 | 3,100 | 4,200 | 4,200 | 10,700 | 18,080 |
| Water Load | Gallons | | | | | | | 12,000 | 20,500 |
| Climb Rate | Feet/minute | 3,400 | 1,800 | 2,500 | 4,000 | 2,000 | 2,000 | 1,100 | 2,000 |
| | Min/1000 ft | 0.29 | 0.56 | 0.40 | 0.25 | 0.50 | 0.50 | 0.91 | 0.50 |
| Speed below 10,000 feet | KIAS | 250 | 237 | 250 | 250 | 250 | 250 | 250 | 250 |
| Speed above 10,000 feet (Operated from FS bases) | KTAS | 269 | 265 | 340 | 414 | 269 | 269 | 442 | 442 |
| Speed above 10,000 feet (Operated from Large AC bases) | KTAS | | | | | | | 528 | 490 |
| * - Daily availability costs for the Q400, DC-10 and B747 are based on the aircraft having work outside of the airtanker contract (i.e. Costs are amortized by other customers outside of FS contract period). | | | | | | | | | |
| # - Airtanker FS contract bares the full annual cost. | | | | | | | | | |

The description and performance data for each aircraft were developed from a combination of vendor responses, flight manuals, the Airliners.net Internet site, parametric analysis, and professional judgment. Initially, vendors who are considering an individual aircraft for conversion were contacted to provide performance information. Unfortunately, either due to the short time frame for the response or being the middle of fire season, only one response was obtained. Flight manuals were acquired and information extracted. In cases where the flight manual did not provide the information in a suitable form and other sources were sought for the information. Parametric analysis was also utilized where information could not be obtained.

Rotary-Wing Platforms

Aircraft defined in the NATS2 study as potential future platforms for the rotary-wing airtanker fleet are as follows (NATS2 report, page 14):

Type 1 Helicopters

- BV-234
- S-64F
- BV-107

BV-234

The Boeing-Vertol Model 234, which is the commercial version of the military CH-47 Chinook, began deliveries in 1981. The military CH-47 was developed during the same time as the CH-46, except that the customer was the US Army who defined a different role and requirements from that of the US Navy and Marines. The CH-47 has greater capability than that of the CH-46 (Model 107). The CH-47 began development in 1956, and by 1984, 732 aircraft had been delivered in various model configurations. In 1980, a major upgrade of the existing fleet of helicopters was begun. The upgrade made improvements to 13 major systems in the helicopter and included engines, transmissions, flight deck and others. Of the commercial versions, fewer than 15 aircraft were delivered. The aircraft speed (KIAS) is 135.

Figure 10 – BV-234



S-64 Skycrane

The Sikorsky S-64, also known as CH-54 or Skycrane, started deliveries in 1964 to the US Army. The helicopter was designed for universal military transport duties and was equipped with interchangeable cargo pods which could carry personnel or equipment. Variation in this universal pod, were intended to appeal to a wide variety of customers, and in 1969, Sikorsky received FAA certification for commercial sale of the helicopter. Customers were mainly oil companies who used the aircraft to support exploration drilling. However, by 1974 a total of fewer than 100 aircraft were built. This aircraft is in current production by Erickson Air Crane. The aircraft speed (KIAS) is 80.

Figure 11 – S-64 Skycrane



BV-107

The Boeing-Vertol Model 107 began design in 1956 and was to take advantage of the small, lightweight, yet powerful turbo-shaft engines that were becoming available. The prototype was built in 1957 and after extensive demonstration tours, orders for three variants were received, the CH-46A, CH-46C and the Model 107 2 (Commercial version). Production of these variations was started and deliveries began in 1958 to the US Navy, US Marines, and other countries. In total, nearly 100 of these were built by 1962 before additional modifications were made to provide greater capacity. The CH-46D and UH-46A (Sea Knights) began deliveries in 1966 and by 1968 over 1,000 twin rotor aircraft were delivered. The aircraft speed (KIAS) is 120.

Figure 12 – BV-107

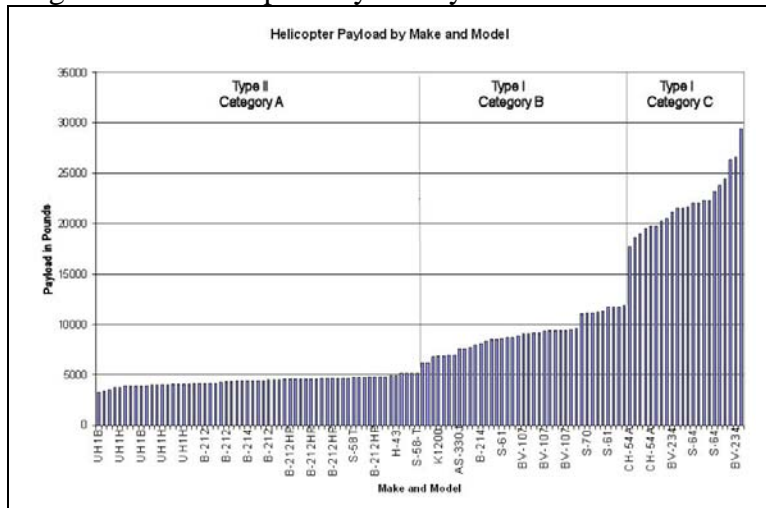


Helicopter Size Categories

The large helicopters have a wide range of payload capacity. This is particularly true for those traditionally classified as Type 1. For this study, helicopters were grouped into three categories as follows:

| <u>Category</u> | <u>Payload (lbs)</u> |
|-----------------|----------------------|
| A | < 5000 |
| B | 5001 – 15,000 |
| C | > 15,000 |

Figure 13 – Helicopter Payload by Make/Model



Helicopter Daily Availability and Flight Rate Costs

Exclusive-Use (EU) and Call-When-Needed (CWN) contracts for 1999 through 2005 were used to determine an average daily availability and flight rate for each type of contract by helicopter category and contract length. For Exclusive-Use (EU) contracts, 2002 through 2005 was used and for Call-When-Needed (CWN) contracts, 1999 through 2005 was used.

Specifically, costs for Call-When-Needed (CWN) medium and heavy-lift helicopters were derived from the following contract:

- Interagency Call-When-Needed Helicopters, 1999, 2000 and 2001
- Interagency Call-When-Needed Helicopters, 2002, 2003 and 2004
- National Call-When-Needed Helicopters, 2005, 2006 and 2007

Costs for Exclusive-Use (EU) were gathered and provided by the acquisition management section at NIFC for the years 2002 through 2005. Flight rates for each contract period were defined in the contract for each period by make and model of aircraft. The same flight rates were used for both CWN and EU contracts. For EU contracts, the actual availability period was recorded.

The daily availability and flight rates were documented for each aircraft by tail number. Based on the make and model of the helicopter as well as the helicopter's tail number, each helicopter was assigned to a Category (A, B or C) and FAA Transport Category (Limited or Standard). Costs were changed to 2004 dollars based on the factors shown in Table 3. Average values were then developed for each category of aircraft by contract type (CWN vs. EU). The same process was used to determine average flight rates. The results are shown in Tables 4 and 5.

Table 3

| Year | Factor | Multiplier |
|-------------|--------------|-------------|
| 1990 | 1.041 | 1.45 |
| 1991 | 1.039 | 1.39 |
| 1992 | 1.027 | 1.36 |
| 1993 | 1.031 | 1.32 |
| 1994 | 1.032 | 1.28 |
| 1995 | 1.031 | 1.24 |
| 1996 | 1.031 | 1.20 |
| 1997 | 1.013 | 1.19 |
| 1998 | 1.029 | 1.15 |
| 1999 | 1.030 | 1.12 |
| 2000 | 1.030 | 1.09 |
| 2001 | 1.021 | 1.06 |
| 2002 | 1.021 | 1.04 |
| 2003 | 1.021 | 1.02 |
| 2004 | 1.021 | 1.00 |
| 2005 | 1.018 | 0.98 |

For EU contracts, the length of contract period was broken into three periods. These were generally those below 80 days, those between 80 and 100 days and those greater than 100 days. The purpose was to examine how costs are reflected by the length of the contract period. For the analysis, the costs associated with a 90-day contract period were used.

Appendix B contains a summary of the findings for EU and CWN contracts. Appendix C contains documentation on the development assumptions for management module costs. All dollar values are in 2004 dollars.

Table 4 – Exclusive-Use Helicopter Costs

| | | Limited | | | Standard | | |
|---------------|-----------|----------|----------|----------|-----------|---------|----------|
| | | Cat A | Cat B | Cat C | Cat A | Cat B | Cat C |
| Daily Avail.* | \$ / Day | \$3,273 | \$12,666 | \$14,150 | \$3,273 | \$3,483 | \$13,873 |
| Flight Rate | \$ / Hr | \$1,159 | \$2,564 | \$4,947 | \$1,159 | \$1,492 | \$5,018 |
| Mgmt Module | \$ / Year | \$65,821 | | | \$258,587 | | |

* - Daily availability is for a 90 day contract

Table 5 – Call-When-Needed Helicopter Costs

| | | Limited | | | Standard | | |
|---------------|----------|---------|----------|----------|----------|---------|----------|
| | | Cat A | Cat B | Cat C | Cat A | Cat B | Cat C |
| Daily Avail.* | \$ / Day | \$5,745 | \$16,292 | \$29,399 | \$5,745 | \$9,879 | \$30,261 |
| Flight Rate | \$ / Hr | \$1,196 | \$2,311 | \$4,850 | \$1,196 | \$2,044 | \$4,913 |
| Mgmt Module | \$ / Day | \$817 | | | \$2,977 | | |

* - Daily availability is for a 90 day contract

Airtanker Bases

Airtanker Base Compatibility

Compatibility of the potential future airtanker fleet with the existing base structure was examined.

Runway Load Bearing

The NOAA Airport Facilities Directory was used as the source for runway load bearing information. Airport load bearing data are reported in thousands of pounds based on the wheel configuration of the main landing gear (single, dual, dual tandem, and double dual tandem). The estimated operational weight developed for the study on each aircraft and its gear configuration were compared to the airport data. Additionally, the Forest Service has been granted over weight authority (allowances to operate airtankers in excess of the published capacity) at some bases, and has other restrictions. These agreements as they are reflected in the 2005 Interagency Airtanker Base Directory were used as well regarding base compatibility.

Wing and Tail Clearances

The 2005 Interagency Airtanker Base Directory was used as the source for clearances. The directory identifies aircraft excluded from a tanker base based on several criteria, which includes aircraft dimensional issues. Where current aircraft were excluded from a base due to size, their dimensions were compared to the future fleet and exclusions or inclusions were made.

Take off Performance

Takeoff performance was based on the capability of the aircraft on hot day conditions as published in flight manuals, from vendors known to be considering the aircraft as tankers, and/or parametric analysis. Hot day conditions are defined as ISA (International Standard Atmosphere) plus 30 degrees Fahrenheit at the altitude of the base with zero wind and zero slope. The ground roll required to either takeoff or accelerate and stop was compared to the longest available base runway. Based on the Interagency Airtanker Board Criteria, two engine aircraft are acceptable at a base as long as the distance required to accelerate and stop when one engine becomes inoperative (also known as critical field length) is less than the longest available runway. Three and four engine aircraft are acceptable so long as the ground roll required for takeoff is less than 80 percent of the longest available base runway. The runway lengths used in this study were obtained from the NOAA Airport Facilities Directory.

The results of the compatibility analysis are summarized in Table 6. As can be seen, several potential future airtankers have a low percentage of compatibility with the bases that are in consideration for the future. However, this alone would not be the reason for elimination from further consideration as future fleet candidates.

Table 6 - Airtanker Compatibility With Airtanker Bases (1=Yes, 0=No)

| Base | Geo. Area | S-3 | Q-200 | Q-400 | BAe-146 | C-130H | DC-10 | B-747 |
|---------------------------|-----------|-----|-------|-------|---------|--------|-------|-------|
| Fairbanks | AK | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ft. Yukon, Reload | AK | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Galena, Reload | AK | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Kenai | AK | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| McGrath | AK | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Palmer | AK | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Tanacross | AK | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Bishop, Reload | CA | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Chester | CA | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Chico | CA | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Columbia | CA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fresno | CA | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Hollister | CA | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Fox Field/Lancaster | CA | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| Grass Valley | CA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Siskiyou/Montague, Reload | CA | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| San Bernardino Intl | CA | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Paso Robles | CA | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Porterville | CA | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Ramona | CA | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Redding | CA | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Rohnerville | CA | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Santa Barbara | CA | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Santa Rosa/Sonoma | CA | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Stockton, Reload | CA | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Bemidji | East | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Brainard | East | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Ely | East | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| Hibbing | East | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Battle Mountain | GB | 0 | 1 | 1 | 1 | 1 | 0 | |
| Boise | GB | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cedar City | GB | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Hill | GB | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| McCall | GB | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| Minden | GB | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Pocatello | GB | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Reno/Stead | GB | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Billings | NO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Coeur d'Alene | NO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Grangeville | NO | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Helena | NO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Kalispell/Glacier | NO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Missoula | NO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| West Yellowstone | NO | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| Kingsley/Klamath Falls | PNW | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| La Grande | PNW | 0 | 1 | 1 | 1 | 1 | 0 | 0 |

Table 6 - Airtanker Compatibility With Airtanker Bases (1=Yes, 0=No)

| Base | Geo. Area | S-3 | Q-200 | Q-400 | BAe-146 | C-130H | DC-10 | B-747 |
|--------------------------------|-----------|-----|-------|-------|---------|--------|-------|-------|
| Medford | PNW | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Moses Lakes | PNW | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Troutdale, Reload | PNW | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Redmond | PNW | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Durango, CO | RM | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Greybull, WY | RM | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Jeffco | RM | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Grand Junction | RM | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Rapid City, Reload | RM | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Alexandria | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Chattanooga (Lovell Field) | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Fayetteville (Drake Field) | SO | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Ft. Smith | SO | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Kinston | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Knoxville | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Lake City | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| London | SO | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Tallahassee | SO | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Weyers Cave/Staunton | SO | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| Alamogordo | SW | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Albuquerque | SW | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Libby/Ft Huachuca | SW | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Phoenix/Williams Gateway | SW | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Prescott | SW | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| Roswell | SW | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Silver City | SW | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Winslow | SW | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| Total Number of Bases | 73 | | | | | | | |
| Number of Compatible Bases | | 45 | 67 | 63 | 64 | 62 | 9 | 9 |
| Percentage of Compatible Bases | | 62% | 92% | 86% | 88% | 85% | 12% | 12% |

Aircraft Compatibility with Airtanker Bases

The Q-200 had the highest compatibility, 92%. Being an aircraft designed for the low volume commercial passenger market where airport facilities may have short runways, this finding is understandable. It was followed by the Q-400 designed for similar capabilities as the Q-200. In that NATS2 study, it was determined that the C-130 A,B models were compatible at 91% of the bases. The reduction of the percentage to 85% for the C-130H model is due to the increased tank capacity (4,300 gallons versus 3,000 gallons). This reduction was mainly due to the need for a longer runway to meet the takeoff performance criteria.

The S-3 was compatible with only 62% of the base locations. The major reason for this incompatibility was the requirement to meet accelerate-and-stop distances (critical field length) within the paved portion of the airport runway. The only exception to this was the B-747. The driving reason for these aircraft not being compatible with the studied bases is its load bearing. The take off performance of the B-747 proved to meet the 60 percent of available runway for ground roll

criteria, but most of the studied bases are municipal airports or smaller airports with the runway and taxiway bearing strength too low to withstand the weight of the aircraft.

In all of the cases where incompatibility exists, except for size fit at the tanker base, downloading of the aircraft could be considered. However, the effort in this study is to find aircraft, which will meet the needs of the studied future bases without compromising the capability of the aircraft.

The NATS2 report provided recommendations on the infrastructure for air tanker bases to support the National fixed-wing large airtanker fleet. To date, approximately \$68,000,000 has been spent to upgrade existing airtanker bases and to construct new airtanker bases. For this study, the locations of large fixed-wing airtanker bases are noted in Table 7 as defined in the 2005 Interagency Airtanker Base Directory.

Table 7 – Large Airtanker Bases Used in This Study

| GACC | Airtanker Bases |
|------------------|--|
| Alaska | Ft. Wainwright, Galena, Homer, Kenai, McGrath, Palmer, Tok (Tanacross) |
| Eastern | Bemidji, Brainerd, Ely, Hibbing (All MN state bases) |
| Eastern Basin | Boise, Cedar City, Hill, McCall, Pocatello |
| No. Ops. | Chester, Chico, Montague, Redding, Stockton |
| Northern Rockies | Billings, Coeur d' Alene, Grangeville, Kalispell (Glacier), Helena, Missoula, West Yellowstone |
| Northwest | Klamath Falls, LaGrande, Medford, Moses Lake, Troutdale, Redmond |
| Rocky Mts. | Jeffco, Durango, Grand Junction, Rapid City |
| So. Ops. | Bishop, Fresno, Hemet, Lancaster, Porterville, Ramona, San Bernardino, Santa Barbara |
| Southern | Chattanooga, Fayetteville, Lake City (FL) |
| Southwest | Alamogordo, Albuquerque, Ft. Huachuca, Prescott, Roswell, Silver City, Winslow, Williams |
| Western Basin | Battle Mountain, Minden, Stead |

One of the potential future airtanker platforms is the B-747-200. The developer, Evergreen International, has suggested staffing as a “turn-key” operation where both the retardant mixing and loading would be contracted with the airtanker. Table 8 contains locations suggested by the vendor for this operation. However, this list is not exhaustive since the vendor is still negotiating with additional airports.

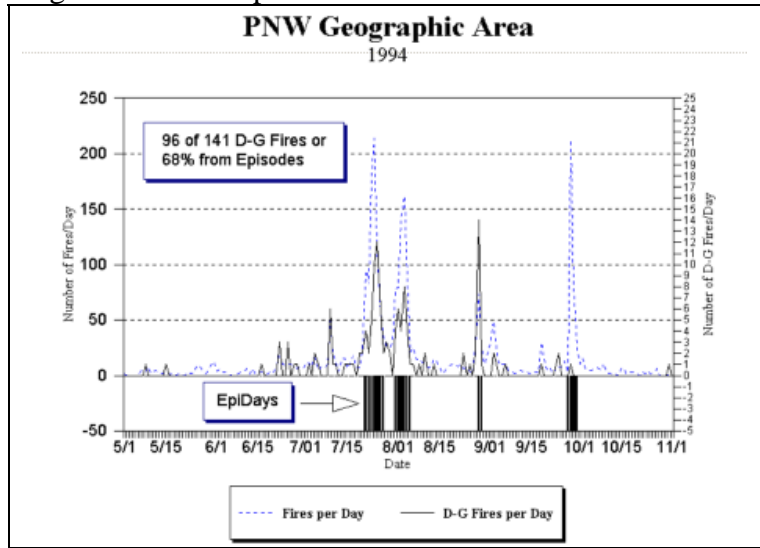
Table 8 – Locations Suggested for Use by B-747-200

| Independent | Common with Agency Airtanker Bases |
|-------------------------------------|------------------------------------|
| Castle, CA | Albuquerque, NM |
| Charleston AFB, SC | Boise, ID |
| Colorado Springs, Co (Peterson AFB) | Fresno, CA |
| March AFB, CA | Moses Lake, WA |
| Mather, CA | Rosewell, NM |
| McClellan, CA | Williams, AZ |
| Vandenberg, CA | |
| Victorville, CA | |

Patterns of Fire Occurrence

The National Airtanker Study, Phase 1, (NATS1) displays on pages 44 and 45 graphs of fires per day for the year 1994 in the Great Basin, Northwest and Northern Geographic Areas. Superimposed on these graphs is the number of fires 100 acres (size class D) or greater in size by day. Figure 14 shows an example of daily fire occurrence. It is from the PNW GACC. Note in Figure 14, the relationship between the total number of 100-acre and larger fires per day and the days when a large number of fires happened on that day. These days are referred to as an “EpiDay” and a series of these EpiDays form a fire occurrence episode.

Figure 14 – Example of Year Fire Occurrence



Staffing of airtankers during episodes is critical. The data in Table 9 is from a recent 18-year period. Columns 1 - 2 provide the percent of all fires and of fires in the D size class (100-299 acres) or greater that occur during fire occurrence episodes. On EpiDays, the average daily fire occurrence is displayed in column 3 and increase to the level noted in column 4. This increase is frequently at a magnitude of three to four-fold. Column 5 provides the percent of the total fire season days that are within fire occurrence episodes.

Note than in most Geographic Areas, this percent is relatively low indicating a high percent of fires on a small percent of days. Under this dynamic of fire occurrence, mobility of aircraft is critical.

Table 9

| Geographic Area | Percent of Fires From Episodes | | Number of Fires | | Days in Episodes |
|------------------|--------------------------------|----------|-----------------|---------------|------------------|
| | All Fires | D+ Fires | Avg. / Day | Avg. / EpiDay | Percent |
| Column ID=> | 1 | 2 | 3 | 4 | 5 |
| Alaska | 47% | 60% | 3 | 14 | 6% |
| Basin – W & E | 60% | 63% | 14 | 33 | 39% |
| Eastern | 41% | 48% | 7 | 14 | 27% |
| No. & So. Ops. | 32% | 22% | 13 | 58 | 13% |
| Northern Rockies | 44% | 39% | 11 | 38 | 21% |
| Northwest | 42% | 44% | 13 | 67 | 12% |
| Rocky Mt. | 40% | 37% | 8 | 23 | 26% |
| Southern | 47% | 49% | 8 | 14 | 33% |
| Southwest | 52% | 54% | 15 | 42 | 41% |

Analysis of Phase 1 - Initial Attack Support

Phase 1 has the following two objectives:

Objective 1-1

Re-examine staffing of Type 1 and 2 airtankers as well as Type 1 helicopters at the airtanker bases recommended for staffing in NATS1 and NATS2. By airtanker base, recommend the aircraft type and number that supports the most cost efficient staffing.

Objective 1-2

Re-examine aircraft performance attributes recommended in NATS2 for a future airtanker platform. Recommend performance attributes for future airtanker and helicopter platforms that support a national cost efficient fire protection program.

Objective for Fire Management Analysis and Planning

The Forest Service Handbook FSH 5109.19 - FIRE MANAGEMENT ANALYSIS AND PLANNING HANDBOOK, 1/83 WO AMENDMENT 1, provides the Objective for fire management planning.

10.2 - Objective. Fire management analysis and planning is accomplished through the use of the National Fire Management Analysis System (NFMAS). NFMAS was developed to:

1. Provide a formal process to integrate fire management planning with land management planning.
2. Provide input into the program development and budgeting processes at Forest, Regional, and National levels.
3. Establish a consistent budget analysis process for evaluating the efficiency and effectiveness of the fire program at the National and Regional levels.
4. Provide a means to determine fire suppression resource and program needs, which are considered National or Regional in scope.

Overview of the National Fire Management Analysis System (NFMAS)

Forces used for initial attack of wildland fires have been traditionally analyzed and justified using the National Fire Management Analysis System (NFMAS) by the USDA Forest Service and the USDI Bureau of Land Management and Bureau of Indian Affairs. A replacement system called Fire Program Analysis (FPA) is under construction and is not complete. Hence the legacy system, NFMAS, will be one analysis system used in this study.

NFMAS initial attack assessment (IAA) model analyzes initial attack effectiveness and was used to analyze the effectiveness and efficiency of the alternatives. The local initial attack forces remained constant as airtanker staffing and locations were changed. Where use of the IAA model was not current or was unavailable for the area, an equivalent process was allowed as long as consistency was maintained.

Several key assumptions do apply to airtankers. The amount of fireline produced by an aerial drop is based on the use of long term fire retardant and varies by the number of gallons in the drop as well as the National Fire Danger Rating System (NFDRS) fuel model. In the Phase 1 Report, the formula used was:

$$\text{Chains of line} = (\text{Gallons in Drop})/100 * \text{Production Factor}$$

where the production factor is 1.0 for NFDRS fuel models A, L and S; 0.7 for NFDRS fuel models C, H, R, E, P and U; 0.6 for NFDRS fuel models T, N, F and K; 0.5 for NFDRS fuel model G; 0.3 for NFDRS fuel models D and Q; and 0.2 for NFDRS fuel models B, O, J, and I.

For drops of water or foam (short term retardants), it was assumed the number of chains of fireline built was 50% of the number of chains of fireline built using long term fire retardant.

In the IAA, the effectiveness of retardant drops as it relates to rate of fire spread, the amount of fireline produced is reduced linearly from its maximum value described by the formula above. Maximum fireline production is assumed when the rate of fire spread is equal to one chain/hour. The fireline production rate is decreased linearly so that the fireline production rate is zero when the rate of fire spread is equal to eighty chains per hour or greater in NFDRS fuel models A, L, S and T. These fuel models represent grass, Alaska tundra and sagebrush. For the rest of the NFDRS fuel models, there was no change from the forty chains per hour limit.

All dollar amounts displayed in this report are in 2004 dollars unless otherwise stated. The current OMB Price Adjustment Index was used to calculate factors as follows to move all dollars to 2004 dollars (Table 3).

The term Fire Suppression (FFF) Costs is used to describe the sum of the cost to suppress a wildfire. These costs are accounted for in two ways, unit mission costs and average acre (suppression) costs. Unit mission costs are “trip” costs for fire suppression resources. For airtankers, these costs would be the flight costs (flight rate times hours flown) and retardant cost. Retardant cost was assumed to be \$0.72 per gallon. Average acre costs include all other fire suppression costs expressed on a per acre basis.

The term Net Value Change (NVC) Costs is used to describe the algebraic sum of the effects of a fire keeping in mind that some effect is negative and some positive. In general, the algebraic sum is a negative number.

The term Fire Program Costs is used to describe the staffing of the airtanker, and is generally the daily availability times the number of staffing days for an exclusive-use contract. It also includes the module staffing costs.

Overview of the Wildfire Initial Response Assessment System (WIRAS)

The Wildfire Initial Response Assessment System (WIRAS) is a simulation model designed to address the importance of wildfire occurrence and suppression response dynamics in planning initial attack organizations. A key feature that distinguishes it from other models is its ability to assess how the ebb and flow of fire occurrence intensity across the landscape and over time affects the economic and physical performance of an initial attack organization. This approach better addresses the value of resource mobility and the consequence of peak demand requirements that are so important in determining the size, location, and composition of an initial attack organization.

WIRAS models the dynamics of fire occurrence as it affects suppression activities by using historically recorded fire times and locations from multiple fire seasons. This approach preserves the spatial and temporal nature of fire occurrence with all its implications for defining initial attack program performance. Programs are tested against a set of historical fire seasons.

On the initial attack side of the equation, WIRAS models resource deployment with a system of rules intended to closely reflect how managers make resource allocation decisions in a multiple fire environment. This set of rules defines a hierarchy of preferred resource responses that recognizes the fire location, behavior, management objectives, and accessibility, among other things, but also takes into account the availability of different kinds of initial resources at any point in time. In general, the dispatch rules in WIRAS favor responding to a fire with local ground resources provided the response times are reasonable given a fire's behavior. When ground resource response times are not reasonable, the model seeks to dispatch helitack, and finding none, will request smokejumpers, if available. Airtanker support is determined by projected fire intensity. If no resources are available, fires just wait and grow until resources returning from earlier responses become available for dispatch. Fires that reach predefined sizes or perimeters either while waiting or during suppression are declared escaped. All resources have the ability to attack several fires on a given day depending on how quickly they can contain fires and prepare for another dispatch.

Projected fire behavior and fuel model determines the "might" of the initial attack response. During multiple fire episodes, new fires and those waiting for service are prioritized based on highest fire intensity level (FIL) with a somewhat diminished priority if located in wilderness or roadless areas.

WIRAS currently provides capabilities for evaluating regional and national resources, Type 1 and 2 helicopters, smokejumpers, helitankers, and airtankers. The software has some local program analysis capabilities, but these have not been fully developed.

Analysis to Determine Number of Fixed-Wing Airtankers

Due to the availability of data, the WIRAS model is only implemented in the northern part of California, Oregon, Washington and parts of Idaho and Montana. The WIRAS model was used in conjunction with the AutoAT4 (NFMAS) model to allow for understanding of each model's strengths and weaknesses. The AutoAT4 (NFMAS) software models initial attack on each representative fire assuming all firefighting resources are available. The WIRAS model is a time-based spatial model where fires receive "services," firefighting resources, only if the resource is available. Modeling using WIRAS should allow for a much better estimate of effects in a multiple fire occurrence area such as the Northwest GACC.

Generic Airtanker Defined

Review of the recommendations from the NATS2 report provided some insight to the characteristics of a generic current airtanker. In addition, a review was made of the schedule of items in the 2005 airtanker contract. Professional judgment was applied to estimate the daily availability and flight rate for the generic fixed-wing airtanker. Following assessment of future fixed-wing airtanker platforms, the number of fixed-wing airtankers to staff will be revisited. The attributes for a generic exclusive-use Type 1 fixed-wing airtanker based on a 100-day contract follow.

Size – 2,700 gallons

Speed below 10,000 feet = 250 knots

Speed above 10,000 feet = 323 knots

Climb Rate = 0.67 minutes/1000 feet

Daily Availability = \$6,500 per day

Flight Rate = \$4,000 per hour

Retardant Cost = \$0.72 / gallon

Analysis Results – AutoAT4 (NFMAS) Modeling

Within each GACC, a run was made assuming staffing of no large fixed-wing or large helicopter aircraft. Next, runs were made with one airtanker staffed within a GACC at each airtanker base. This allowed for determination of the most efficient location to place one airtanker within a GACC. The most efficient airtanker location was then staffed with one generic airtanker and runs were made to determine the next best location within a GACC to staff a second airtanker. This process was iterated until an alternative with the lowest FFF + NVC + Program Costs (C+NVC) was determined.

Table 10 provides an example of how this analysis process was completed in the Northwest GACC using only fires that occurred on National Forest lands. Alternative F1 with a specific six airtanker staffing configuration has the lowest C+NVC. This configuration has one airtanker at Klamath Falls, two at LaGrande, two at Redmond and one at Moses Lake. The second most efficient alternative is G2, which has a specific staffing configuration of seven airtankers. This second configuration is the same as alternative F1 with a second airtanker added at Moses Lake. Even though alternative F1 has the lowest C+NVC, alternative G2 has a difference from F1 of only \$95,989 or 0.14% of the totals C+NVC for alternative F1.

Table 10 – Example of Results from AutoAT4, Northwest GACC

| ID | No of ATs | Acres Burned | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. from Low |
|-----------|-----------|---------------|---------------------|----------------------|---------------------|--------------------|---------------------|-----------------|
| A0 | 0 | 61,496 | \$58,814,963 | -\$62,072,265 | \$120,887,228 | \$0 | \$120,887,228 | |
| A3 | 1 | 47,370 | \$42,639,981 | -\$50,512,621 | \$93,152,602 | \$650,000 | \$93,802,602 | \$25,913,204 |
| A2 | 1 | 51,412 | \$46,141,776 | -\$52,115,170 | \$98,256,946 | \$650,000 | \$98,906,946 | \$31,017,548 |
| A4 | 1 | 52,867 | \$46,994,193 | -\$52,158,683 | \$99,152,876 | \$650,000 | \$99,802,876 | \$31,913,478 |
| A1 | 1 | 51,771 | \$45,254,997 | -\$51,017,138 | \$96,272,135 | \$650,000 | \$96,922,135 | \$29,032,737 |
| B1 | 2 | 36,877 | \$34,029,645 | -\$43,931,611 | \$77,961,256 | \$1,300,000 | \$79,261,256 | \$11,371,858 |
| B2 | 2 | 37,295 | \$34,446,108 | -\$43,776,965 | \$78,223,073 | \$1,300,000 | \$79,523,073 | \$11,633,675 |
| B3 | 2 | 48,815 | \$41,833,381 | -\$47,641,377 | \$89,474,758 | \$1,300,000 | \$90,774,758 | \$22,885,360 |
| B4 | 2 | 47,456 | \$40,594,941 | -\$48,259,613 | \$88,854,554 | \$1,300,000 | \$90,154,554 | \$22,265,156 |
| B5 | 2 | 45,391 | \$39,481,180 | -\$46,566,636 | \$86,047,816 | \$1,300,000 | \$87,347,816 | \$19,458,418 |
| B6 | 2 | 36,877 | \$34,029,645 | -\$43,931,611 | \$77,961,256 | \$1,300,000 | \$79,261,256 | \$11,371,858 |
| C1 | 3 | 43,661 | \$36,303,971 | -\$43,336,673 | \$79,640,644 | \$1,950,000 | \$81,590,644 | \$13,701,246 |
| C2 | 3 | 35,806 | \$31,722,407 | -\$41,011,595 | \$72,734,002 | \$1,950,000 | \$74,684,002 | \$6,794,604 |
| C3 | 3 | 35,492 | \$31,045,889 | -\$40,798,387 | \$71,844,276 | \$1,950,000 | \$73,794,276 | \$5,904,878 |
| C4 | 3 | 34,439 | \$30,645,816 | -\$40,609,228 | \$71,255,044 | \$1,950,000 | \$73,205,044 | \$5,315,646 |
| D1 | 4 | 34,299 | \$30,086,367 | -\$40,423,955 | \$70,510,322 | \$2,600,000 | \$73,110,322 | \$5,220,924 |
| E1 | 5 | 32,056 | \$29,181,767 | -\$38,681,491 | \$67,863,258 | \$3,250,000 | \$71,113,258 | \$3,223,860 |
| E2 | 5 | 33,943 | \$29,404,100 | -\$38,359,337 | \$67,763,437 | \$3,250,000 | \$71,013,437 | \$3,124,039 |
| E3 | 5 | 32,897 | \$28,774,574 | -\$36,297,109 | \$65,071,683 | \$3,250,000 | \$68,321,683 | \$432,285 |
| E4 | 5 | 33,984 | \$29,544,595 | -\$40,235,163 | \$69,779,758 | \$3,250,000 | \$73,029,758 | \$5,140,360 |
| F1 | 6 | 31,554 | \$28,203,035 | -\$35,786,363 | \$63,989,398 | \$3,900,000 | \$67,889,398 | \$0 |
| F2 | 6 | 31,700 | \$28,499,500 | -\$36,616,873 | \$65,116,373 | \$3,900,000 | \$69,016,373 | \$1,126,975 |
| F3 | 6 | 32,869 | \$28,735,945 | -\$36,185,889 | \$64,921,834 | \$3,900,000 | \$68,821,834 | \$932,436 |
| F4 | 6 | 32,056 | \$29,181,767 | -\$38,681,491 | \$67,863,258 | \$3,900,000 | \$71,763,258 | \$3,873,860 |
| F5 | 6 | 32,601 | \$28,276,128 | -\$36,189,292 | \$64,465,420 | \$3,900,000 | \$68,365,420 | \$476,022 |
| F6 | 6 | 33,628 | \$28,862,328 | -\$38,170,545 | \$67,032,873 | \$3,900,000 | \$70,932,873 | \$3,043,475 |
| G1 | 7 | 31,526 | \$28,164,406 | -\$35,675,143 | \$63,839,549 | \$4,550,000 | \$68,389,549 | \$500,151 |
| G2 | 7 | 31,287 | \$27,731,068 | -\$35,704,319 | \$63,435,387 | \$4,550,000 | \$67,985,387 | \$95,989 |
| G3 | 7 | 31,414 | \$27,984,207 | -\$36,453,854 | \$64,438,061 | \$4,550,000 | \$68,988,061 | \$1,098,663 |
| G4 | 7 | 32,573 | \$28,237,499 | -\$36,078,072 | \$64,315,571 | \$4,550,000 | \$68,865,571 | \$976,173 |
| H1 | 8 | 31,259 | \$27,692,439 | -\$35,593,099 | \$63,285,528 | \$5,200,000 | \$68,485,538 | \$596,140 |

Analysis Results – WIRAS Modeling

The same alternatives analyzed using AutoAT4 were analyzed using WIRAS. Additional alternatives were built for analysis also. Table 11 provides analysis results in the Northwest GACC. Alternative K2 with a specific ten airtanker staffing configuration has the lowest C+NVC. This configuration has two airtankers at Klamath Falls, three at LaGrande, three at Redmond and two at Moses Lake. The second most efficient alternative is K3, also having a specific staffing configuration of ten airtankers and the third most efficient option, J1, has a specific staffing of nine airtankers. Even though alternative K2 has the lowest C+NVC, alternative J1 has a difference from K2 of only \$9,055 or 0.01% of the totals C+NVC for alternative K2, essentially equal given the variability inherent in the analysis.

Table 11 – Example of Results from WIRAS, Northwest GACC

| ID | No of ATs | Acres Burned | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. from Low |
|-----------|-----------|---------------|---------------------|---------------------|---------------------|--------------------|---------------------|----------------|
| A0 | 0 | 62,883 | \$83,128,100 | \$38,416,685 | \$121,544,785 | \$0 | \$121,544,785 | \$27,613,449 |
| A3 | 1 | 57,996 | \$76,862,294 | \$35,499,836 | \$112,362,130 | \$650,000 | \$113,012,130 | \$19,080,795 |
| A2 | 1 | 57,893 | \$76,844,843 | \$35,485,836 | \$112,330,680 | \$650,000 | \$112,980,680 | \$19,049,344 |
| A4 | 1 | 57,741 | \$76,555,433 | \$35,381,137 | \$111,936,570 | \$650,000 | \$112,586,570 | \$18,655,235 |
| A1 | 1 | 57,818 | \$76,610,597 | \$35,365,104 | \$111,975,701 | \$650,000 | \$112,625,701 | \$18,694,365 |
| B1 | 2 | 55,511 | \$74,122,403 | \$33,561,648 | \$107,684,051 | \$1,300,000 | \$108,984,051 | \$15,052,716 |
| B2 | 2 | 55,622 | \$74,280,257 | \$33,465,945 | \$107,746,201 | \$1,300,000 | \$109,046,201 | \$15,114,866 |
| B3 | 2 | 55,612 | \$74,142,427 | \$33,446,607 | \$107,589,034 | \$1,300,000 | \$108,889,034 | \$14,957,698 |
| B4 | 2 | 55,671 | \$74,413,241 | \$33,596,021 | \$108,009,262 | \$1,300,000 | \$109,309,262 | \$15,377,927 |
| B5 | 2 | 55,480 | \$74,160,392 | \$33,596,138 | \$107,756,530 | \$1,300,000 | \$109,056,530 | \$15,125,195 |
| B6 | 2 | 55,394 | \$74,300,190 | \$33,843,965 | \$108,144,155 | \$1,300,000 | \$109,444,155 | \$15,512,820 |
| C1 | 3 | 52,881 | \$70,999,419 | \$32,056,833 | \$103,056,252 | \$1,950,000 | \$105,006,252 | \$11,074,917 |
| C2 | 3 | 53,022 | \$70,974,272 | \$32,265,197 | \$103,239,469 | \$1,950,000 | \$105,189,469 | \$11,258,134 |
| C3 | 3 | 52,530 | \$70,793,440 | \$31,647,925 | \$102,441,364 | \$1,950,000 | \$104,391,364 | \$10,460,029 |
| C4 | 3 | 52,723 | \$70,973,635 | \$32,069,959 | \$103,043,593 | \$1,950,000 | \$104,993,593 | \$11,062,258 |
| D1 | 4 | 51,641 | \$69,290,127 | \$31,442,165 | \$100,732,293 | \$2,600,000 | \$103,332,293 | \$9,400,958 |
| E1 | 5 | 49,158 | \$66,529,705 | \$29,119,366 | \$95,649,072 | \$3,250,000 | \$98,899,072 | \$4,967,737 |
| E2 | 5 | 49,234 | \$66,623,287 | \$28,437,503 | \$95,060,790 | \$3,250,000 | \$98,310,790 | \$4,379,454 |
| E3 | 5 | 48,727 | \$66,089,541 | \$28,332,847 | \$94,422,388 | \$3,250,000 | \$97,672,388 | \$3,741,053 |
| E4 | 5 | 49,283 | \$66,946,942 | \$28,823,161 | \$95,770,103 | \$3,250,000 | \$99,020,103 | \$5,088,768 |
| F1 | 6 | 47,637 | \$64,946,466 | \$27,159,410 | \$92,105,876 | \$3,770,000 | \$95,875,876 | \$1,944,541 |
| F2 | 6 | 47,789 | \$65,096,939 | \$27,237,896 | \$92,334,834 | \$3,900,000 | \$96,234,834 | \$2,303,499 |
| F3 | 6 | 47,750 | \$64,994,219 | \$27,260,978 | \$92,255,198 | \$3,770,000 | \$96,025,198 | \$2,093,862 |
| F4 | 6 | 47,915 | \$65,273,077 | \$27,367,811 | \$92,640,888 | \$3,900,000 | \$96,540,888 | \$2,609,553 |
| F5 | 6 | 47,672 | \$64,993,235 | \$27,225,911 | \$92,219,147 | \$3,900,000 | \$96,119,147 | \$2,187,811 |
| F6 | 6 | 47,831 | \$65,161,023 | \$27,305,029 | \$92,466,052 | \$3,900,000 | \$96,366,052 | \$2,434,717 |
| G1 | 7 | 47,245 | \$64,542,451 | \$26,923,091 | \$91,465,542 | \$4,355,000 | \$95,820,542 | \$1,889,207 |
| G2 | 7 | 47,215 | \$64,670,733 | \$26,854,252 | \$91,524,985 | \$4,550,000 | \$96,074,985 | \$2,143,650 |
| G3 | 7 | 47,519 | \$64,952,822 | \$26,924,328 | \$91,877,150 | \$4,355,000 | \$96,232,150 | \$2,300,815 |
| G4 | 7 | 47,351 | \$64,750,616 | \$26,820,747 | \$91,571,363 | \$4,550,000 | \$96,121,363 | \$2,190,028 |
| H1 | 8 | 46,487 | \$63,833,417 | \$26,113,213 | \$89,946,629 | \$5,200,000 | \$95,146,629 | \$1,215,294 |
| H2 | 8 | 46,106 | \$63,448,649 | \$25,812,333 | \$89,260,982 | \$5,200,000 | \$94,460,982 | \$529,647 |
| J1 | 9 | 45,221 | \$62,608,774 | \$25,481,616 | \$88,090,390 | \$5,850,000 | \$93,940,390 | \$9,055 |
| K1 | 10 | 45,033 | \$62,319,655 | \$25,299,038 | \$87,618,693 | \$6,500,000 | \$94,118,693 | \$187,358 |
| K2 | 10 | 44,859 | \$62,221,800 | \$25,209,535 | \$87,431,335 | \$6,500,000 | \$93,931,335 | \$0 |
| K3 | 10 | 44,933 | \$62,225,681 | \$25,209,578 | \$87,435,259 | \$6,500,000 | \$93,935,259 | \$3,924 |

Analysis Results – Differences Between AutoAT4 (NFMAS) and WIRAS Modeling

This comparison is only possible in the Northwest GACC using only fires that were on National Forest lands. The current fire occurrence database in the WIRAS model is based on National Forest lands. The WIRAS model dispatches airtankers to fires as they occur based on fire behavior and availability. As was noted in the section titled Patterns of Fire Occurrence, a high percentage of fires occur in episodes and frequently airtankers are already committed when a fire starts. These new starts only receive airtanker services when a platform becomes available. The AutoAT4 (NFMAS) modeling models initial attack with the assumption that all staffed firefighting resources are available when the fire starts. Comparison of the results from these two models provides insight into the effects of concurrent fire occurrence during episodes on airtanker availability. This can lead to an estimation of the number of additional airtanker platforms that can efficiently be staffed to support initial attack when fires occur in episodes versus one at a time.

The results from AutoAT4 and WIRAS show both similarities and differences. Using AutoAT4 (NFMAS) modeling, the most efficient number of airtankers to staff was 6-7 versus 9-10 using WIRAS. In general, the WIRAS model points to 30-60% increased staffing level to support a fire occurrence regime that is episodic in nature. The C+NVC curves flatten substantially in both models at this number of airtankers suggesting that investments in additional airtankers would not necessarily be economically detrimental given the inherent variability associated with the results. WIRAS does show a fair economic benefit to pushing the airtanker investment envelope beyond the 6 to 7 airtankers suggested by AutoAT4. This increase of additional airtankers indicated by WIRAS might be mollified to some degree by an analysis conducted in a wider geographic context that permits using and the sharing of airtankers from adjacent geographic areas. The correlation of fire workload and competing demand for airtankers between the PNW geographic area and adjacent geographic areas would determine the nature of this moderating effect.

When looking at airtanker location, for any specific number of airtankers, WIRAS tends to show less difference between location-based alternatives than AutoAT4. This is probably due to the ability of WIRAS to move airtankers among bases in response to fire activity. Despite this capability, as noted in the previous section, both models expressed similar preferences for the locating of 6-7 airtankers, generally favoring Redmond for two airtankers and the remaining airtankers spread among Klamath Falls, Moses Lake and LaGrande.

When looking at incremental investments in airtankers, AutoAT4 tends to show higher returns for each additional airtanker beyond the first airtanker, whereas WIRAS shows that diminishing returns to additional airtankers sets in much more quickly. This may be due to WIRAS's ability to move the first airtankers around the Pacific Northwest to bases near outbreaks of fires. This tends to shorten the average initial attack time for WIRAS and give relatively higher returns to the initial airtankers, leaving less benefit to be received by the addition of the later airtankers.

There remain some subtle differences between the databases driving the two models. This, of course, introduces some risk that the observed similarities and differences between the results of the two models are less a function of modeling approaches than input differences. Future investigation will eventually illuminate these questions more fully.

Analysis Results for All GACCs

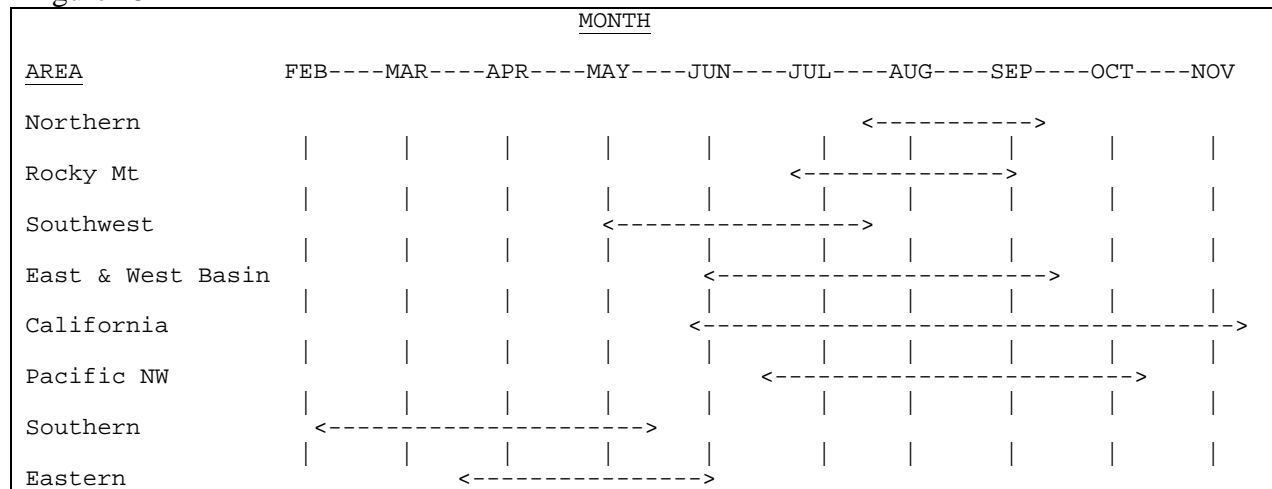
Table 12 contains the results of analysis by GACC using the same process described. Detailed tables for each GACC that are similar to Table 10 are provided in Appendix E.

Table 12 – Summary of Number of Fixed-Wing Airtankers Using a Current Generic Airtanker and AutoAT4 modeling

| Geographic Area | No. of Fixed-wing Airtankers | Suggested Locations | Comments |
|-----------------|------------------------------|--|---|
| Basin – W & E | 8 - 9 | Battle Mt., Boise, Cedar City, Hill, McCall, Minden | None |
| Eastern | 1 | Northern Minnesota | Unable to analyze fully due to lack of NFMAS files |
| No. & So. Ops. | 5 - 7 | Chico, Chester, Fox Field, Lancaster, Fresno, Montague, Norton, Porterville, Redding | Further analysis in So. Ops. using recalibrated analysis with adjusted ground resource production rates is supported. |
| No. Rockies | 3 - 4 | Coeur d' Alene, Missoula, Helena, West Yellowstone | Multi-GACC analysis used for Coeur d' Alene and West Yellowstone |
| Northwest | 6 - 7 | Klamath Falls, LaGrande, Moses Lake, Redmond | None |
| Rocky Mt. | 2 - 3 | Jeffco, Grand Junction, Durango | Multi-GACC analysis used for Durango |
| Southern | 3 | Chattanooga, Fayetteville, Shenandoah Valley | None |
| Southwest | 6 - 7 | Alamogordo, Albuquerque, Prescott, Silver City, Williams Gateway (Phx), Winslow | None |
| Total | 34 - 41 | | |

The geographic areas do not all have concurrent fire season dates (Figure 15) hence one airtanker platform can support more than one of the identified locations noted in Table 12.

Figure 15



Determining the actual number of airtanker platforms to staff annually is mainly based on the concurrent fire seasons in the California, East Basin, Northern, Northwest, Rocky Mountain and West Basin GACCs. For these geographic areas the range of airtanker platforms is 24-30. The fire occurrence in these GACCs shows an episodic pattern and applying a percent increase of 30% based on the Northwest GACC analysis using WIRAS and AutoAT4 modeling brings the staffing range to 31 – 39. Note that in the NATS1 study, three additional airtankers were recommended to provide an increased capability to support large fires.

The scope of this study is to determine the most cost efficient number of airtankers to support initial attack and large fire suppression. The use of the military (MAFFS) and aircraft from other sources when demand reaches a very high percentile of supply is still needed. It is recognized that other resources are needed when private vendor sources for large airtankers are fully committed. Use of the military is an integral part of the total airtanker support during these events.

Analysis to Determine Number of Rotary-Wing Helitankers

The attributes for a generic exclusive-use Type 1 Limited helitanker based on a 100-day contract and for a generic fixed-wing airtanker follow.

Figure 16

| Type 1 Limited Helitanker | Fixed-Wing Airtanker |
|---------------------------------------|--------------------------------------|
| Size – 1,800 gallons | Size – 2,700 gallons |
| Speed below 10,000 feet = 105 knots | Speed below 10,000 feet = 250 knots |
| Speed above 10,000 feet = N/A | Speed above 10,000 feet = 323 knots |
| Climb Rate = 1 minutes/1000 feet | Climb Rate = 0.67 minutes/1000 feet |
| Daily Availability = \$14,150 per day | Daily Availability = \$6,500 per day |
| Flight Rate = \$4,947 per hour | Flight Rate = \$4,000 per hour |
| Flight Time to Refuel = 120 minutes | Flight Time to Refuel = 120 minutes |

A general analysis of the speed capabilities of the two aircraft allow for some initial observations on the size of the working circle around a refuel location. Assuming refueling is done at the initial dispatch location, the working circle for the fixed-wing airtanker is 6 to 11 times larger than for the helitanker

Table 13

| Knots | MPH | Max. Miles | Square Miles | Ratio to Heli |
|-------|-----|------------|--------------|---------------|
| 105 | 121 | 89 | 24,667 | N/A |
| 250 | 288 | 230 | 166,414 | 6.7 |
| 323 | 372 | 297 | 277,790 | 11.3 |

(Table 13). The maximum distance allows for the helitanker to make two water drops and the airtanker to make one retardant drop. The distance Nationally from an airtanker base to representative fire locations is 91 miles (NATS2).

Analysis Results

As with fixed-wing platforms, analysis was completed in the Northwest GACC using both the AutoAT4 (NFMAS) model and the WIRAS model. These results will be summarized first followed by results for other geographic areas using AutoAT4 modeling only.

AutoAT4 Modeling in the Northwest GACC

Table 14 summarizes the runs in the Northwest area. Alternative 0 is the no staffing of aircraft alternative. Alternatives A1- A5, X1 – X4 and X7 were run to show the comparison of a generic future airtanker with a Type 1, Category C, Limited helitanker. The differences can be explained by noting the difference in cruise speed below 10,000 feet (250 KTAS vs. 105 KTAS), the tank size (2,700 vs. 1,800) and the fireline production difference between long term retardant and the short term retardant water. The helitanker was allowed to make drops each 8 minutes.

Table 14 – Comparison of Airtanker and Helicopter Staffing in Northwest GACC Using AutoAT4

| ID | Description | Acres | FFF | NVC | FFF+NVC | Program Costs | C+NVC | Difference Between AT & Heli |
|--|----------------|--------|--------------|---------------|---------------|---------------|---------------|------------------------------|
| A0 | No A/C | 61,496 | \$58,814,963 | -\$62,072,265 | \$120,887,228 | \$0 | \$120,887,228 | |
| A1 | 1 AT @ RD | 51,771 | \$45,254,997 | -\$51,017,138 | \$96,272,135 | \$650,000 | \$96,922,135 | \$11,413,936 |
| X1 | 1 Heli @ RD | 56,426 | \$51,063,391 | -\$55,791,859 | \$106,855,250 | \$1,480,821 | \$108,336,071 | |
| A2 | 1 AT @ ML | 51,412 | \$46,141,776 | -\$52,115,170 | \$98,256,946 | \$650,000 | \$98,906,946 | \$13,851,670 |
| X2 | 1 Heli @ LC | 56,581 | \$53,703,086 | -\$57,574,709 | \$111,277,795 | \$1,480,821 | \$112,758,616 | |
| A3 | 1 AT @ LG | 47,370 | \$42,639,981 | -\$50,512,621 | \$93,152,602 | \$650,000 | \$93,802,602 | \$15,017,105 |
| X3 | 1 Heli @ LG | 54,078 | \$51,723,785 | -\$55,615,101 | \$107,338,886 | \$1,480,821 | \$108,819,707 | |
| A4 | 1 AT @ KF | 52,867 | \$46,994,193 | -\$52,158,683 | \$99,152,876 | \$650,000 | \$99,802,876 | \$13,150,899 |
| X4 | 1 Heli @ KF | 58,514 | \$53,051,305 | -\$58,421,649 | \$111,472,954 | \$1,480,821 | \$112,953,775 | |
| A5 | 1 AT @ MD | 53,270 | \$47,522,152 | -\$52,421,563 | \$99,943,715 | \$650,000 | \$100,593,715 | \$12,893,254 |
| X7 | 1 Heli @ MD | 58,826 | \$53,434,950 | -\$58,571,198 | \$112,006,148 | \$1,480,821 | \$113,486,969 | |
| Average ATs = | | | | | | | \$98,005,655 | |
| Average T-1s = | | | | | | | \$111,271,028 | |
| Average Difference = | | | | | | | \$13,265,373 | |
| X5 | 1 Heli @ JD | 55,188 | \$51,833,275 | -\$55,421,050 | \$107,254,325 | \$1,480,821 | \$108,735,146 | |
| X6 | 1 Heli @ OA | 57,715 | \$52,130,364 | -\$56,674,822 | \$108,805,186 | \$1,480,821 | \$110,286,007 | |
| X8 | 1 Heli @ RB | 60,670 | \$56,925,320 | -\$61,455,914 | \$118,381,234 | \$1,480,821 | \$119,862,055 | |
| Average = | | | | | | | \$112,538,559 | |
| H1 | AK2L2R2W2 | 31,259 | \$27,692,439 | -\$35,593,099 | \$63,285,538 | \$5,200,000 | \$68,485,538 | \$25,208,127 |
| X9 | 8 Type 1 Helis | 45,921 | \$38,294,482 | -\$43,552,615 | \$81,847,097 | \$11,846,568 | \$93,693,665 | |
| - Option X9 has eight Type 1 Category C Limited helitankers simultaneously staffed at the bases in alternatives X1 – X 8. - Alternative H1 has two generic future airtankers each staffed at Klamath Falls, LaGrande, Redmond and Moses Lake. | | | | | | | | |

Staffing of one or eight Type 1, Category C, Limited helitankers yields a C+NVC that is less than no aircraft staffing (Table 12). Comparison of acres burned results in a conclusion that the staffing of eight Type 1, Category C, Limited helitankers is equivalent to the staffing of two Type 1 generic future airtankers (Table 9). Comparison of C+NVC values results in a conclusion that the staffing of eight Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic future airtanker (Table 10).

WIRAS Modeling in the Northwest GACC

Table 15 summarizes the runs in the Northwest GACC. Alternative 0 is the no staffing of aircraft alternative. The table also shows eight alternatives where a single Type 1, Category C, Limited helitanker was staffed. At the end of the table, two alternatives are shown where eight Type 1, Category C, Limited helitankers are staffed or eight Type 1 future generic airtankers are staffed. The helitanker was allowed to make drops each 8 minutes.

Table 15 – Comparison of Airtanker and Helicopter Staffing in Northwest GACC Using WIRAS

| Alternative | Acres Burned | FFF | NVC | FFF+NVC | Program Cost | C+NVC |
|-------------------------------------|--------------|--------------|--------------|---------------|--------------|---------------|
| Alt 0 - No Aircraft | 62,883 | \$83,128,100 | \$38,416,685 | \$121,544,785 | \$0 | \$121,544,785 |
| Single Helicopter Scenarios | | | | | | |
| John Day | 61,874 | \$82,144,540 | \$38,116,552 | \$120,261,092 | \$1,415,000 | \$121,676,092 |
| Klamath Falls | 62,058 | \$81,268,273 | \$37,992,608 | \$119,260,881 | \$1,415,000 | \$120,675,881 |
| LaGrande | 61,821 | \$82,220,059 | \$38,155,420 | \$120,375,479 | \$1,415,000 | \$121,790,479 |
| Lake Chelan | 62,138 | \$82,580,470 | \$38,561,551 | \$121,142,021 | \$1,415,000 | \$122,557,021 |
| Medford | 62,059 | \$81,252,830 | \$37,993,383 | \$119,246,213 | \$1,415,000 | \$120,661,213 |
| Oakridge | 59,721 | \$78,089,185 | \$35,557,787 | \$113,646,972 | \$1,415,000 | \$115,061,972 |
| Redmond | 59,724 | \$78,218,552 | \$35,562,716 | \$113,781,268 | \$1,415,000 | \$115,196,268 |
| Roseburg | 62,061 | \$81,307,329 | \$37,996,024 | \$119,303,353 | \$1,415,000 | \$120,718,353 |
| Average | 61,432 | \$80,885,155 | \$37,492,005 | \$118,377,160 | \$1,415,000 | \$119,792,160 |
| Average for Staffing of 1 airtanker | 57,862 | \$76,718,292 | \$35,432,978 | \$112,151,270 | \$650,000 | \$112,801,270 |
| Eight Aircraft Scenarios | | | | | | |
| 8 - Type 1 Helis | 54,353 | \$72,296,671 | \$32,753,025 | \$105,049,696 | \$11,320,000 | \$116,369,696 |
| 8 - Type 1 AT | 46,297 | \$63,641,033 | \$25,962,773 | \$89,603,806 | \$5,200,000 | \$94,803,806 |

As with modeling with AutoAT4 (NFMAS), staffing of one or eight Type 1, Category C, Limited helitankers yields a C+NVC that is less than no aircraft staffing. This indicates that staffing with the Type 1, Category C, Limited helitankers as noted is better than doing no staffing of helitankers. But the staffing of one fixed-wing Type 1 airtanker versus one Type 1, Category C, Limited helitanker showed a significant benefit to the staffing of the fixed-wing airtanker.

Comparison of acres burned or C+NVC results in a conclusion that the staffing of eight Type 1, Category C, Limited helitankers is equivalent to the staffing of one to two Type 1 generic fixed-wing airtankers.

Analysis Results for Other GACCs

Table 16 contains the results of analysis by GACC using the same process described. Detailed tables for each GACC are provided in Appendix F. The C+NVC values in the table are stated as provided by the model. Though written to the nearest dollar, there is no intent for these values to be accurate to the level of resolution.

Table 16 – Comparison of Airtanker and Helicopter Staffing Using AutoAT4

| | GACC | | | | | |
|---|---------------|---------------|--------------|--------------|--------------|--------------|
| | California | Great Basin | Northern | Rocky Mt. | Southern | Southwest |
| No AT or T-1 Heli | | | | | | |
| Ac. Burned | 114,815 | 358,966 | 44,828 | 31,327 | 31,683 | 120,433 |
| C+NVC | \$237,070,338 | \$157,683,482 | \$22,108,025 | \$16,882,739 | \$14,665,423 | \$73,358,160 |
| Staffing 1 AT or 1 T-1 Heli at Airtanker Base | | | | | | |
| Number of Sites | 6 | 6 | 4 | 4 | 4 | 3 |
| Avg. C+NVC for AT | \$147,163,142 | \$131,935,787 | \$13,631,112 | \$14,798,490 | \$12,327,348 | \$55,774,233 |
| Avg. C+NVC for T-1 Heli | \$178,762,779 | \$147,280,266 | \$14,495,564 | \$16,201,482 | \$15,639,774 | \$65,565,953 |
| Difference | \$31,599,637 | \$15,344,476 | \$864,453 | \$1,402,992 | \$3,312,425 | \$9,791,719 |
| Staffing 1 T-1 Heli Not at an Airtanker Base | | | | | | |
| Number of Sites | 6 | 1 | 3 | 5 | 0 | 0 |
| Avg. C+NVC for T-1 Heli | \$193,207,445 | \$148,419,331 | \$14,452,015 | \$16,553,350 | --- | --- |
| Staffing ATs versus T-1 Helis at the Number of Airtanker Bases Noted | | | | | | |
| Number Staffed | 6 | 6 | 3 | 3 | 3 | 6 |
| Avg. C+NVC for AT | \$125,053,292 | \$114,311,003 | \$13,136,099 | \$15,360,930 | \$10,074,800 | \$41,422,675 |
| Avg. C+NVC for T-1 Heli | \$139,000,484 | \$137,389,929 | \$16,063,601 | \$17,840,499 | \$16,287,382 | \$53,462,337 |
| Difference | \$13,947,192 | \$23,078,926 | \$2,927,502 | \$2,479,569 | \$6,212,582 | \$12,039,662 |

California

The Region suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker were: Bighill, Chester, Chico, Montague, Quincy, Redding, San Bernardino (Norton) and Santa Barbara. The staffing of the Type 1 helitanker had an average annual C+NVC of \$31,599,637 more than the C+NVC for the fixed-wing airtanker.

The Region suggested locations for analysis of a Type 1 helitanker solely were: Bighill, Casitas, Hemet, Mariposa, Quincy and Van Nuys. The staffing of the Type 1 helitanker had an average annual C+NVC of \$193,207,445. This is \$14,444,666 more than the average from current fixed-wing airtanker base locations with a staffing of one fixed-wing airtanker.

A comparison was done with staffing of six fixed-wing airtankers and six Type 1 helitankers using the following locations: Chico, Chester, Fresno, Montague, Redding and San Bernardino. The staffing of the Type 1 helitankers had an average annual C+NVC of \$13,947,192 more than the C+NVC for the fixed-wing airtankers.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker. The two locations where the staffing of a Type 1 helitanker had significantly lower C+NVC values than the other locations modeled were Bighill and Quincy.

Comparison of acres burned results in a conclusion that the staffing of six Type 1, Category C, Limited helitankers is equivalent to the staffing of two Type 1 generic fixed-wing airtankers. Comparison of C+NVC results in a conclusion that the staffing of six Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic fixed-wing airtanker.

Great Basin

The Region suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker were: Boise, Cedar City, Minden and Hill (Ogden). The staffing of the Type 1 helitanker had an average annual C+NVC of \$15,344,476 more than the C+NVC for the fixed-wing airtanker.

The Region suggested analysis of a Type 1 helitanker only staffed at Salmon, Idaho. The staffing of the Type 1 helitanker there had an average annual C+NVC of \$148,419,331 which is \$16,483,544 more than the average for fixed-wing airtankers staffed at fixed-wing airtanker bases. It is also \$1,139,065 more than the average for Type 1 helitankers staffed at fixed-wing airtanker bases with a staffing of one fixed-wing airtanker.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker.

Comparison of acres burned or C+NVC results in a conclusion that the staffing of six Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic fixed-wing airtanker.

Northern

The Region suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker were: Coeur d' Alene, Helena, Kalispell and Missoula. The staffing of the Type 1 helitanker had an average annual C+NVC of \$864,453 more than the C+NVC for the fixed-wing airtanker.

The Region suggested locations for analysis of a Type 1 helitanker solely were: Hamilton and Dillon. Grangeville was also included in this group since the generic airtanker could not operate from Grangeville. The staffing of the Type 1 helitanker had an average annual C+NVC of \$14,452,015. This is \$820,904 more than the average from current fixed-wing airtanker base locations with a staffing of one fixed-wing airtanker.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker.

Comparison of acres burned results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic fixed-wing airtanker. Comparison of C+NVC results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers is equivalent to the staffing of one-half to one Type 1 generic fixed-wing airtanker.

Rocky Mountain

The Region suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker were: Durango, Grand Junction, Jeffco and Rapid City. The staffing of the Type 1 helitanker had an average annual C+NVC of \$1,402,992 more than the C+NVC for the fixed-wing airtanker.

The Region suggested locations for analysis of a Type 1 helitanker solely were: Casper, Cody, Craig, Lake George, Pueblo and Rifle (Garfield Co. Airport). The staffing of the Type 1 helitanker had an average annual C+NVC of \$16,553,350. This is \$ \$1,754,860 more than the average from current fixed-wing airtanker base locations with a staffing of one fixed-wing airtanker.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker.

Comparison of acres burned results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic fixed-wing airtanker. Comparison of C+NVC results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers results in a C+NVC that is about \$1,000,000 more than the no airtanker or helitankers staffing alternative.

Southern

The Region did not provide suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker. Analysis was done though at the following locations: Fayetteville, Chattanooga, Shenandoah Valley and Lake City. The staffing of the Type 1 helitanker had an average annual C+NVC of \$3,312,425 more than the C+NVC for the fixed-wing airtanker.

Analysis of a Type 1 helitanker staffed at a location where there is not a current fixed-wing airtaker base did not occur.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker.

Comparison of acres burned results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers is equivalent to the staffing of one to two Type 1 generic fixed-wing airtankers. Comparison of C+NVC results in a conclusion that the staffing of three Type 1, Category C, Limited helitankers results in a C+NVC that is about \$1,600,000 more than the no airtanker or helitankers staffing alternative. Given the distance between areas of National Forest land used in this modeling effort, this last finding is understandable.

Southwest

The Region suggested locations for analysis of a Type 1 helitanker rather than a Type 1 or 2 fixed-wing airtanker were: Albuquerque and Prescott. Also suggested was Tucson which is not currently a fixed-wing airtanker base facility. For comparison purposes though, an alternative with a generic fixed-wing airtanker was analyzed. The staffing of the Type 1 helitanker had an average annual C+NVC of \$9,791,719 more than the C+NVC for the fixed-wing airtanker.

Analysis of a Type 1 helitanker staffed at a location where there is not a current fixed-wing airtaker base did not occur.

The staffing of a Type 1 helicopter at all locations had a C+NVC that was less than not having any staffing of Type 1 helitankers but in all cases was significantly higher than the staffing of a Type 1 or 2 fixed-wing airtanker.

Comparison of acres burned results in a conclusion that the staffing of six Type 1, Category C, Limited helitankers is equivalent to the staffing of one to two Type 1 generic fixed-wing airtankers. Comparison of C+NVC results in a conclusion that the staffing of six Type 1, Category C, Limited helitankers is equivalent to the staffing of one Type 1 generic fixed-wing airtanker.

Summary – Use of Type 1 Helicopters for Initial Attack

Given all of the locations analyzed for staffing to support initial attack, the acres burned and C+NVC were less for the fixed-wing airtanker versus the Type 1 helitanker. As noted, the initial attack working circle radius of the Type 1 helitanker is about 90 miles. This limitation forces the fire business support for this platform to be restricted to, in general, one or two organizational units.

The annual daily availability is based on days staffed. For a 100-day fire season, the total would be \$1,480,821. This cost together with the unit mission cost, mainly flight time, needs to be recovered from reduced C+NVC that results from a reduced number of acres burned. The analysis showed that at all locations modeled, the savings in C+NVC could not be recovered within this limited working circle.

Use of Type 1 Helicopters for Extended Attack and Large Fire Support

For analysis and discussion of the use of Type 1 helicopters in extended attack and large fire support, refer to the Phase 2 analysis later in this report.

Analysis of Example Fixed-Wing Airtanker Platforms for Initial Attack

The purpose of this analysis is to define the attributes for future fixed-wing airtanker platforms which best serve the initial attack fire demand. Example platforms have been defined earlier in this document with required attributes for costs and performance.

Example Platforms

Table 17 is the same as Table 2 and summarizes the attributes of the example fixed-wing airtanker platforms provided to the study team.

Table 17 – Summary of Example Fixed-Wing Airtanker Platform Attributes

| | | Example Airtanker Platforms | | | | | | | |
|---|-------------|-----------------------------|---------|------------------------|---------|-----------------|----------------|-----------|-----------|
| | | S-3 | Q-200 | Q-400 | BAe-146 | C-130H Military | C-130H Private | DC-10 | B747-200 |
| Daily Avail. | Low | \$4,434 | \$5,906 | \$17,670* \$36,524# | \$6,520 | \$5,729 | \$12,721 | \$43,109* | \$56,812* |
| | Average | \$5,052 | \$7,507 | \$18,226* \$37,785# | \$8,107 | \$6,797 | \$14,393 | \$51,058* | \$66,617* |
| | High | \$5,670 | \$9,107 | \$18,782* \$39,046# | \$9,695 | \$7,866 | \$16,065 | \$59,007* | \$76,423* |
| Flight Rate | \$/Hr | \$3,530 | \$2,400 | \$4,280 | \$6,500 | \$5,700 | \$5,700 | \$10,500 | \$16,000 |
| Retardant Load | Gallons | 1,800 | 1,600 | 2,642 | 3,100 | 4,200 | 4,200 | 10,700 | 18,080 |
| Water Load | Gallons | | | | | | | 12,000 | 20,500 |
| Climb Rate | Feet/minute | 3,400 | 1,800 | 2,500 | 4,000 | 2,000 | 2,000 | 1,100 | 2,000 |
| | Min/1000 ft | 0.29 | 0.56 | 0.40 | 0.25 | 0.50 | 0.50 | 0.91 | 0.50 |
| Speed below 10,000 feet | KIAS | 250 | 237 | 250 | 250 | 250 | 250 | 250 | 250 |
| Speed above 10,000 feet (Operated from FS bases) | KTAS | 269 | 265 | 340 | 414 | 269 | 269 | 442 | 442 |
| Speed above 10,000 feet (Operated from Large AC bases) | KTAS | | | | | | | 528 | 490 |
| * - Daily availability costs for the Q400, DC-10 and B747 are based on the aircraft having work outside of the airtanker contract (i.e. Costs are amortized by other customers outside of FS contract period). # - Airtanker FS contract bares the full annual cost. | | | | | | | | | |

Generic Airtanker Defined

The attributes for a generic exclusive-use Type 1 fixed-wing airtanker are based on a 100-day contract that were defined earlier and are repeated below.

- Size – 2,700 gallons
- Speed below 10,000 feet = 250 knots
- Speed above 10,000 feet = 323 knots
- Climb Rate = 0.67 minutes/1000 feet
- Daily Availability = \$6500 per day
- Flight Rate = \$4000 per hour
- Retardant Cost = \$0.72 / gallon

Analysis Results

Analysis of platforms with a retardant load capacity less than 5,000 gallons was completed at five airtanker bases defined in the NATS2 study as being representative of the entire set of airtanker bases. Analysis of the platforms with a retardant load capacity greater than 5,000 pounds will be discussed in a later section. A narrative of results is provided in Appendix H.

AutoAT4 Modeling – Platform Capacity Less Than 5,000 Gallons - All GACCs

The results of runs at the five airtanker bases follows. The values in Tables 18a and 18c for each base are the difference between the candidate platform’s C+NVC and the C+NVC for the generic future airtanker platform. Positive values indicate an improvement in C+NVC and negative values a reduction in C+NVC.

Table 18a – C+NVC Changes Between Generic Airtanker and Specified Platform With Travel Above and/or Below 10,000 feet, Which Ever is the Most Effective

| Base | Example Airtanker Platforms | | | | | |
|---------------|--------------------------------------|-------------------------------------|-------------|--------------|--------------|--------------|
| | C-130H (Acquire from Military) | C-130H (Acquire Commercially) | BAe-146 | S-3 | Q-400 | Q-200 |
| Albuquerque | \$4,432,150 | \$2,912,950 | \$163,916 | -\$2,718,677 | -\$2,675,973 | -\$3,659,745 |
| Boise | \$1,445,267 | -\$73,933 | \$444,565 | -\$1,132,427 | -\$2,593,072 | -\$1,840,177 |
| Klamath Falls | \$15,385,627 | \$13,186,727 | \$1,189,758 | -\$2,515,558 | -\$2,616,948 | -\$4,290,709 |
| Phoenix | \$2,408,303 | \$899,103 | -\$198,652 | -\$4,061,674 | -\$2,665,819 | -\$7,504,611 |
| Redding | \$12,847,447 | \$11,328,247 | -\$105,894 | -\$1,785,976 | -\$2,521,701 | -\$3,115,234 |

Table 18b – Ordinate Ranking of Platforms

| | | | | | | |
|---------------|-----|-----|-----|-----|-----|-----|
| Albuquerque | 1 | 2 | 3 | 5 | 4 | 6 |
| Boise | 1 | 3 | 2 | 4 | 6 | 5 |
| Klamath Falls | 1 | 2 | 3 | 4 | 5 | 6 |
| Phoenix | 1 | 2 | 3 | 5 | 4 | 6 |
| Redding | 1 | 2 | 3 | 4 | 5 | 6 |
| Average | 1.0 | 2.2 | 2.8 | 4.4 | 4.8 | 5.6 |

WIRAS Modeling– Platform Capacity Less Than 5,000 Gallons in the Northwest GACC

At this time, WIRAS is built to run only on the Northwest GACC. Results where several of the candidate future airtanker platforms are staffed are shown in Table 19. Alternative K1L1R2M1 staffs future generic airtankers as follows: 1-Klamath Falls, 1-LaGrande, 2-Redmond and 1-Moses Lake. The staffing for each candidate airtanker was the same as for alternative K1L1R2M1 replacing the generic future platform with the candidate platform.

Table 19 – C+NVC Difference Between Five Generic Airtankers and Five of Each Specified Platform

| Base | Example Airtanker Platforms | | | | | |
|------------|--------------------------------------|-------------------------------------|------------|--------------|--------------|--------------|
| | C-130H (Acquire from Military) | C-130H (Acquire Commercially) | BAe-146 | S-3 | Q-400 | Q-200 |
| Difference | \$3,877,965 | \$79,965 | -\$409,203 | -\$6,518,502 | -\$7,923,955 | -\$9,101,272 |
| Ordination | 1 | 2 | 3 | 4 | 5 | 6 |

Summary of Results - Platform Capacity Less Than 5,000 Gallons

The ordination of the example platforms analyzed is the same regardless of cruise speed. The platform ordination using WIRAS modeling is the same as the ordination using AutoAT4 (NFMAS) modeling.

In general, the C-130H (Acquire from Military), the C-130H (Commercial Purchase) and the BAe-146 are more economically efficient than the generic current fixed-wing airtanker. This indicates that staffing of these platforms would not decrease the suggested number of platforms documented earlier. However, the remaining three platforms are less economically efficient than the generic current fixed-wing airtanker and staffing of these would most likely result in a reduced number of platforms that can be justified using economic efficiency criteria. Two of the top three platforms do not assume the use of surplus military platforms and can be justified based on a positive benefit to cost ratio.

Table 20

| Ordination of Example Platforms Using AutoAT4 and WIRAS Modeling |
|--|
| 1. C-130H (Acquire from Military) |
| 2. C-130H (Commercial Purchase) |
| 3. BAe-146 (Commercial Purchase) |
| 4. S-3 (Acquire from Military) |
| 5. Q-400 (Commercial Purchase) |
| 6. Q-200 (Commercial Purchase) |

Summary of Results - Platform Capacity Greater Than 5000 Gallons - All GACCs

The two platforms proposed with capacity greater than 5,000 gallons of retardant or water was the DC-10 and the B-747-200B. Prototypes of both platforms have been developed and some testing has occurred (Figures 17 and 18).

Figure 17 – DC-10



Figure 18 – B-747-200B



The design of the National Type 1 and 2 fixed-wing airtanker fleet is to support primarily initial attack using an interchangeable, interoperable combination of aircraft platforms and airtanker bases.

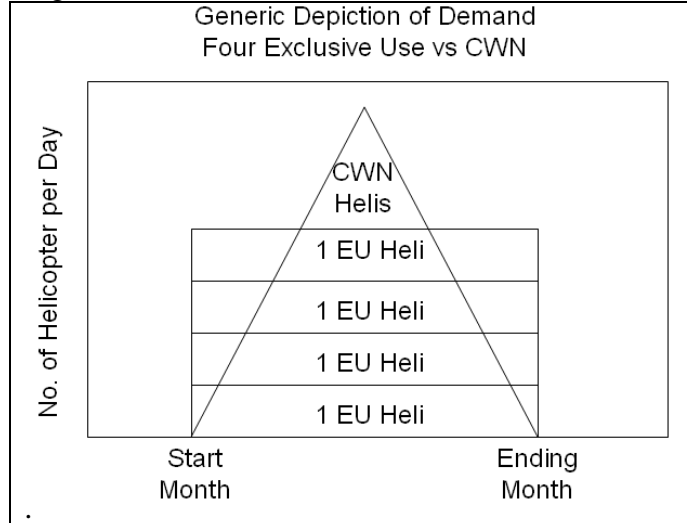
These the aircraft proposed can operate only from a very limited number of airtanker bases (12%) (Table 6). The developer of the B-747-200B has specifically developed a “turn-key” operation for the loading and deployment of the aircraft with retardant for defined airports (Table 8).

Operational guidelines for the use of this size of aircraft over incidents have not been explored or defined. Further study and analysis needs to occur beyond this report to define the operating conditions under which these aircraft might be used in a cost efficient setting.

Analysis of Phase 2 – Large Fire Support

The model for Phase 2 is the National Study of Type 1 and 2 Helicopters to Support Large Fire Suppression (1992) (NHeli1) (Figures 19). Initial staffing from the early 1990's through 2002 was for only Type 2 helicopters. Starting in 2003, additional Type 2 helicopters and some Type 1 helicopters were staffed when the large fixed-wing airtanker fleet was not fully operational. Some of this additional staffing was for initial attack purposes, but this additional staffing of exclusive-use helicopters satisfied large fire suppression support requirements.

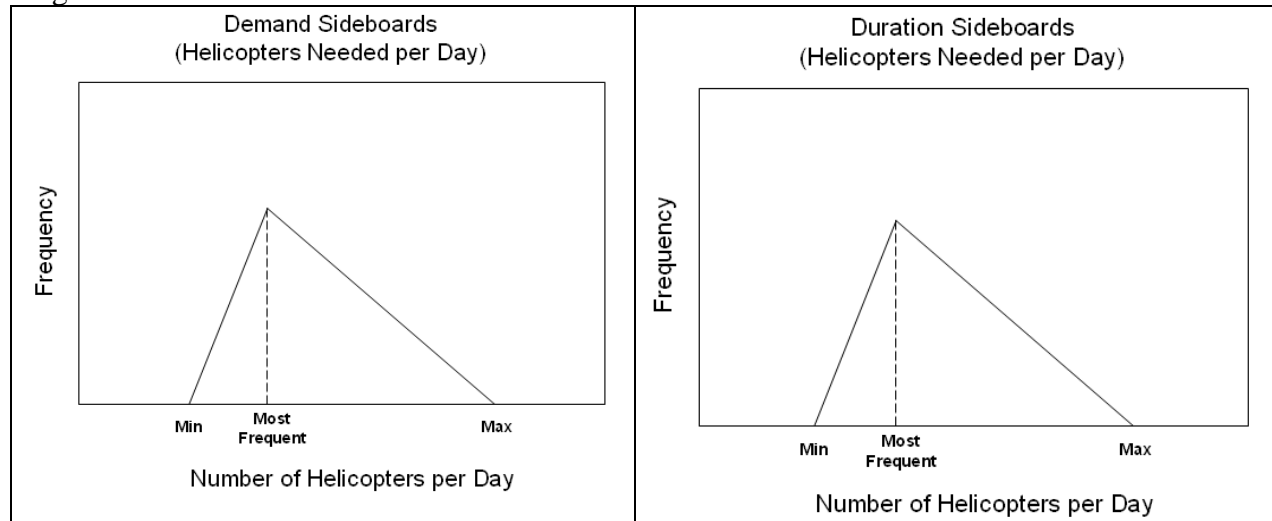
Figure 19



TriSim Analysis Model

Some innovative operations research and statistical analysis techniques were developed and used to examine the most efficient combination of CWN and exclusive-use helicopters. Two techniques were needed (Figure 20). One technique was used to perform statistical analysis on the demand profile produced for the past year's reports. Reference will be made to this "demand simulation model." A second technique was then used to examine the tradeoff in costs to fill this demand with CWN and exclusive-use contracts. Reference will be made to this "cost efficiency model."

Figure 20



Demand

Demand for Type 1 helicopters to support large fire suppression has significantly increased since the first study (NHeli1) (Table 21). Table 22 documented the recent demand for Type 2 helicopters.

Table 21 – Helicopters Days per Year for Type 1 Helicopters

| | | | | | | | | | | | | | | | |
|---------------|------|------|------|---------------|------|------|------|------|------|-----------------|------|------|------|------|--|
| 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | |
| 245 | 360 | 180 | N/A | 1530 | 2350 | 176 | 946 | 248 | N/A | 1060 | 2464 | 2059 | 3536 | 3130 | |
| Average = 262 | | | | Average = 775 | | | | | | Average = 2,450 | | | | | |

Demand for Type 1 or 2 helicopters to support large fire suppression can be described with two parameters, daily number of helicopters in use and number of days in duration. Each of these parameters can vary. To simulate this variance, the demand simulation model was built utilizing

Table 22 - Helicopters Days per Year for Type 2 Helicopters

| | | | | |
|-----------------|-------|-------|-------|-------|
| 1999 | 2000 | 2001 | 2002 | 2003 |
| 2,698 | 4,334 | 3,070 | 3,932 | 3,503 |
| Average = 3,507 | | | | |

Triangular Probability Distributions and random simulation theory.

The study committee documented demand for 1999 - 2003 and used their experience to determine the minimum, most frequent and maximum values for these two demand parameters. Graphs (Figures 22-31) shown in the report were used to estimate an aggregate demand for all GACCs in the lower 48 states. The white lines in the graphs are plotting anomalies from the plotting program.

The demand parameter “sideboards” were then used to do 2,000 random simulations of this demand. The result of the demand simulation model was a probability distribution of demand including the mean. The mean was examined by the committee and the experts comparing the results to the 1999-2003 demand. Adjustments were made in the minimum, most frequent and maximum values until the committee was satisfied that these values were valid. Demand simulation model results modified by committee consensus resulted in agreement to use the following annual helicopter days in the study.

Analysis Results – Type 1 Helicopters

To explain the modeling process, the Type 1, Category, Limited platform will be used. Table 23 defines the demand and duration parameters that were developed to simulate the five-year average of 2,405 helicopter days per year. Table 24 defines the cost assumptions assuming the exclusive-use contract was for 90 days. The daily use hours is based on data from the agency’s AMIS database for 1998 through 2003.

Table 23 – Demand and Duration Parameters – Type 1

| | Demand Profile* | |
|---------------------------------|-----------------|-------------------|
| | Duration (days) | Peak (number/day) |
| Minimum | 75 | 10 |
| Mode | 120 | 50 |
| Maximum | 155 | 60 |
| Average Helicopter days = 2,464 | | |

Table 24 – Cost Assumptions, Type 1, Category C. Limited. EU has a 90-day contract

| | Hourly Flight Rate | Daily Availability | Ave Daily Use (hrs) | Module Cost | Contract Cost | Daily Cost |
|------------------|--------------------|--------------------|---------------------|-------------|---------------|------------|
| Call-When-Needed | \$4,850 | \$29,399 | 4.0 | \$817 | N/A | \$54,578 |
| Exclusive-Use | \$4,947 | \$14,150 | 4.0 | \$65,821 | \$1,339,321 | \$19,788 |

Figure 21 displays the results of the tradeoff analysis. The optimum number of exclusive-use contracts is 27, which would result in an annual saving over the 100% staffing with CWN helicopters by \$34,932,793. A summary of the costs and benefits is documented in Table 25. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Figure 21 - Annual Expected Type 1 Limited Helicopter Costs for Alternative Levels of Contract Helicopters

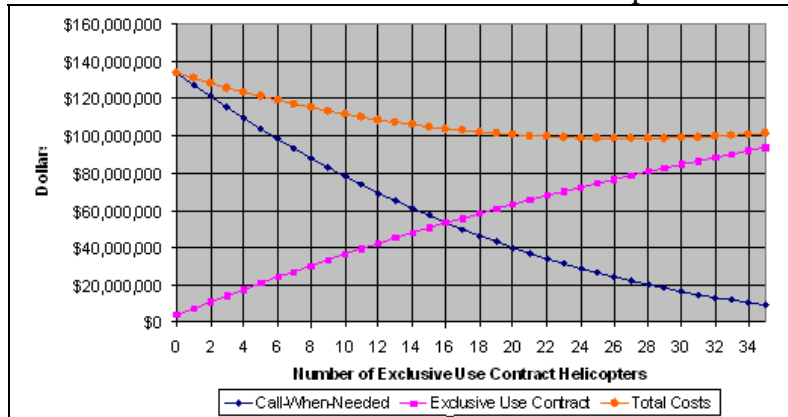


Table 25 – Summary of Cost & Savings -Type 1, Cat. C, Limited, EU 90 day contract.

| No EU Helis Staffed | CWN Cost | EU Cost | Total | Marginal Benefit | Approximate Cumulative Savings |
|---------------------|---------------------|---------------------|---------------------|------------------|--------------------------------|
| 0 | \$133,518,600 | \$0 | \$133,518,600 | | |
| 1 | \$127,226,342 | \$3,620,682 | \$130,847,023 | \$2,671,576 | \$2,671,576 |
| 2 | \$121,104,134 | \$7,179,709 | \$128,283,843 | \$2,563,180 | \$5,234,757 |
| 3 | \$115,151,977 | \$10,677,082 | \$125,829,059 | \$2,454,784 | \$7,689,541 |
| 4 | \$109,369,870 | \$14,112,800 | \$123,482,670 | \$2,346,389 | \$10,035,930 |
| 5 | \$103,757,814 | \$17,486,864 | \$121,244,678 | \$2,237,993 | \$12,273,922 |
| 6 | \$98,315,808 | \$20,799,273 | \$119,115,081 | \$2,129,597 | \$14,403,519 |
| 7 | \$93,043,852 | \$24,050,027 | \$117,093,880 | \$2,021,201 | \$16,424,720 |
| 8 | \$87,941,948 | \$27,239,127 | \$115,181,075 | \$1,912,805 | \$18,337,525 |
| 9 | \$83,010,093 | \$30,366,573 | \$113,376,666 | \$1,804,409 | \$20,141,934 |
| 10 | \$78,248,289 | \$33,432,363 | \$111,680,653 | \$1,696,013 | \$21,837,947 |
| 11 | \$73,656,536 | \$36,436,500 | \$110,093,036 | \$1,587,617 | \$23,425,564 |
| 12 | \$69,234,408 | \$39,379,135 | \$108,613,543 | \$1,479,493 | \$24,905,057 |
| 13 | \$64,980,928 | \$42,260,625 | \$107,241,553 | \$1,371,990 | \$26,277,047 |
| 14 | \$60,895,017 | \$45,081,360 | \$105,976,377 | \$1,265,176 | \$27,542,223 |
| 15 | \$56,975,065 | \$47,841,923 | \$104,816,988 | \$1,159,389 | \$28,701,612 |
| 16 | \$53,219,198 | \$50,542,995 | \$103,762,193 | \$1,054,795 | \$29,756,407 |
| 17 | \$49,625,156 | \$53,185,395 | \$102,810,551 | \$951,642 | \$30,708,049 |
| 18 | \$46,189,950 | \$55,770,206 | \$101,960,156 | \$850,395 | \$31,558,444 |
| 19 | \$42,910,982 | \$58,298,370 | \$101,209,352 | \$750,804 | \$32,309,247 |
| 20 | \$39,785,965 | \$60,770,717 | \$100,556,682 | \$652,670 | \$32,961,918 |
| 21 | \$36,812,490 | \$63,188,120 | \$100,000,610 | \$556,072 | \$33,517,990 |
| 22 | \$33,987,854 | \$65,551,559 | \$99,539,413 | \$461,197 | \$33,979,186 |
| 23 | \$31,309,258 | \$67,862,049 | \$99,171,307 | \$368,107 | \$34,347,293 |
| 24 | \$28,773,389 | \$70,120,790 | \$98,894,180 | \$277,127 | \$34,624,420 |
| 25 | \$26,376,749 | \$72,329,052 | \$98,705,801 | \$188,378 | \$34,812,798 |
| 26 | \$24,115,750 | \$74,488,135 | \$98,603,885 | \$101,916 | \$34,914,714 |
| 27 | \$21,986,275 | \$76,599,533 | \$98,585,807 | \$18,078 | \$34,932,793 |
| 28 | \$19,984,366 | \$78,664,678 | \$98,649,044 | -\$63,237 | |

Figure 22 – 1999 Lower 48 States Type 1 Helicopter Use

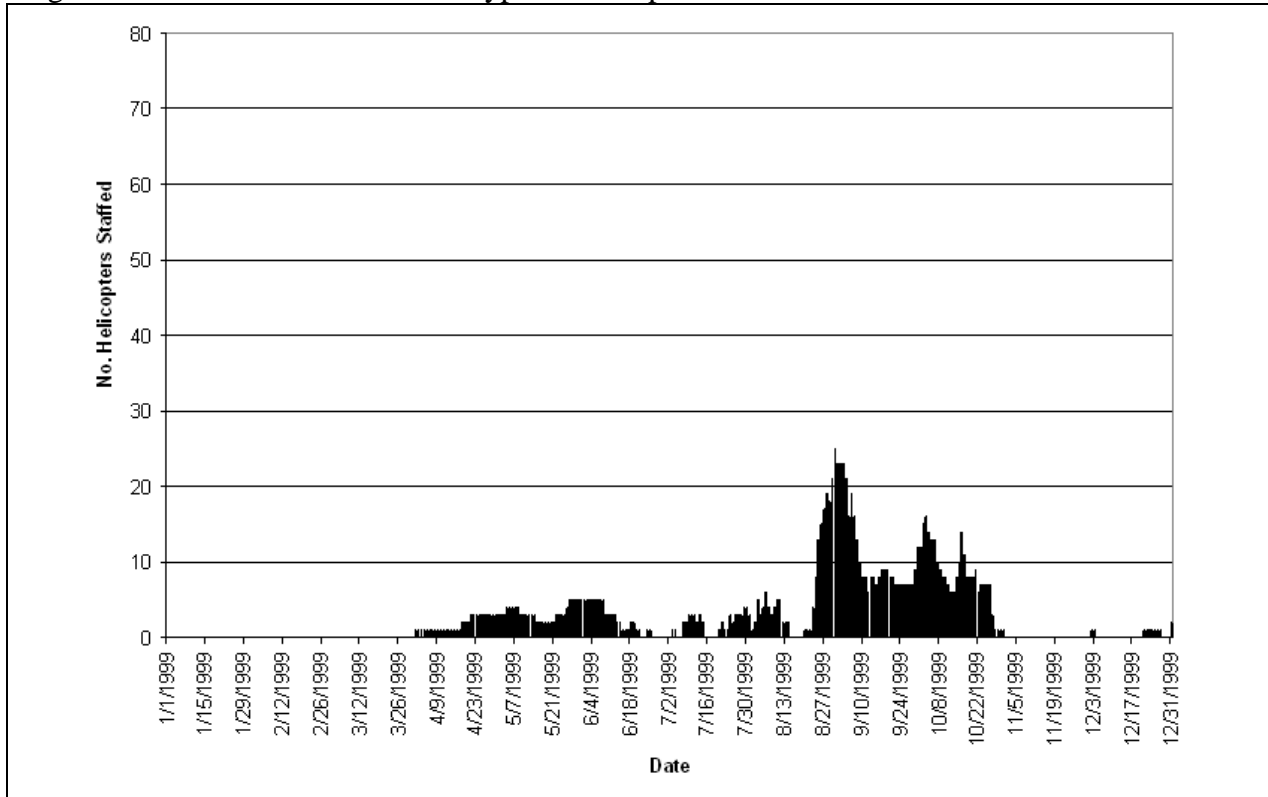


Figure 23 - 1999 Lower 48 States Type 2 Helicopter Use

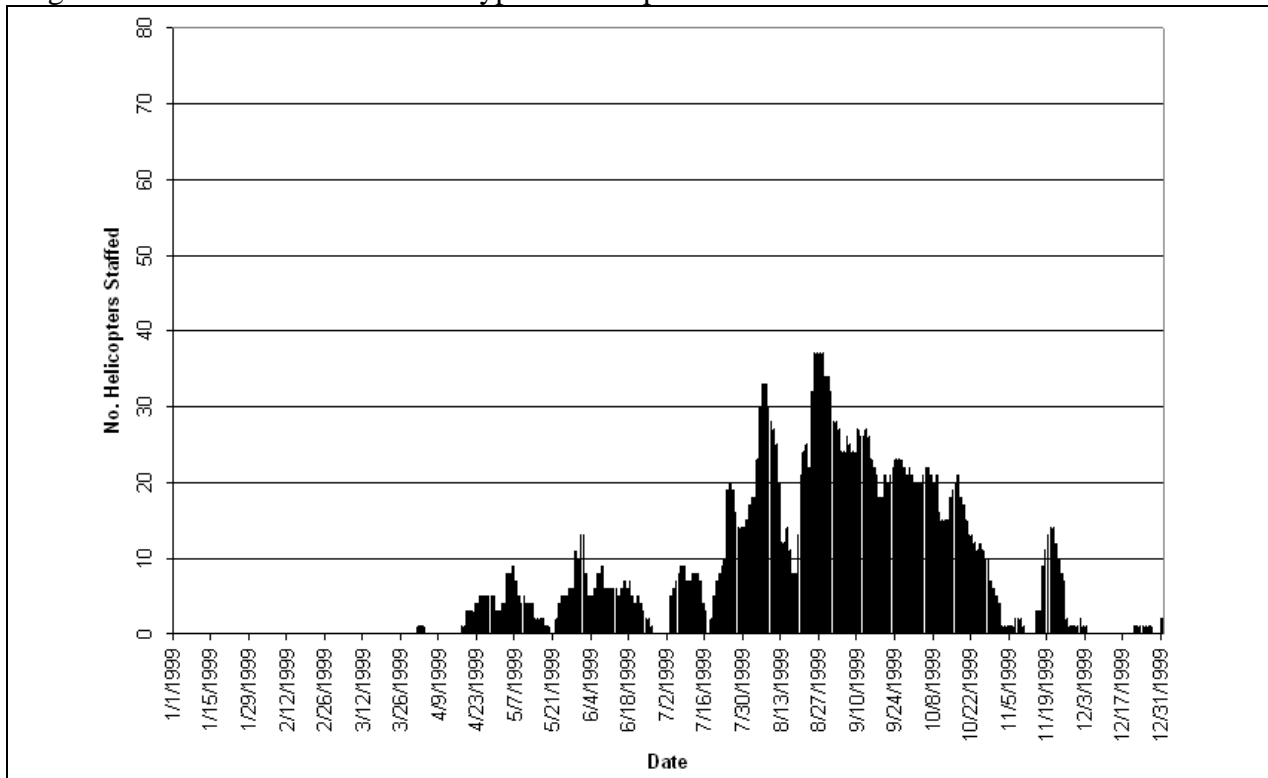


Figure 24 – 2000 Lower 48 States Type 1 Helicopter Use

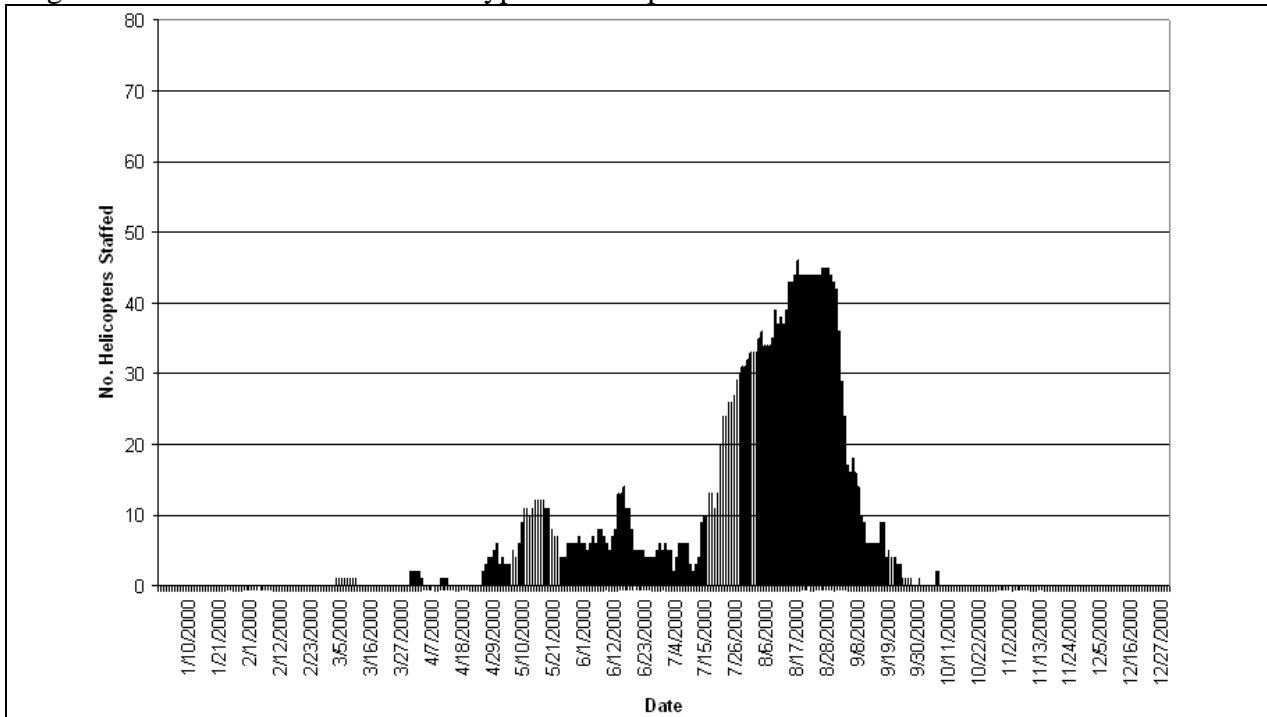


Figure 25 - 2000 Lower 48 States Type 2 Helicopter Use

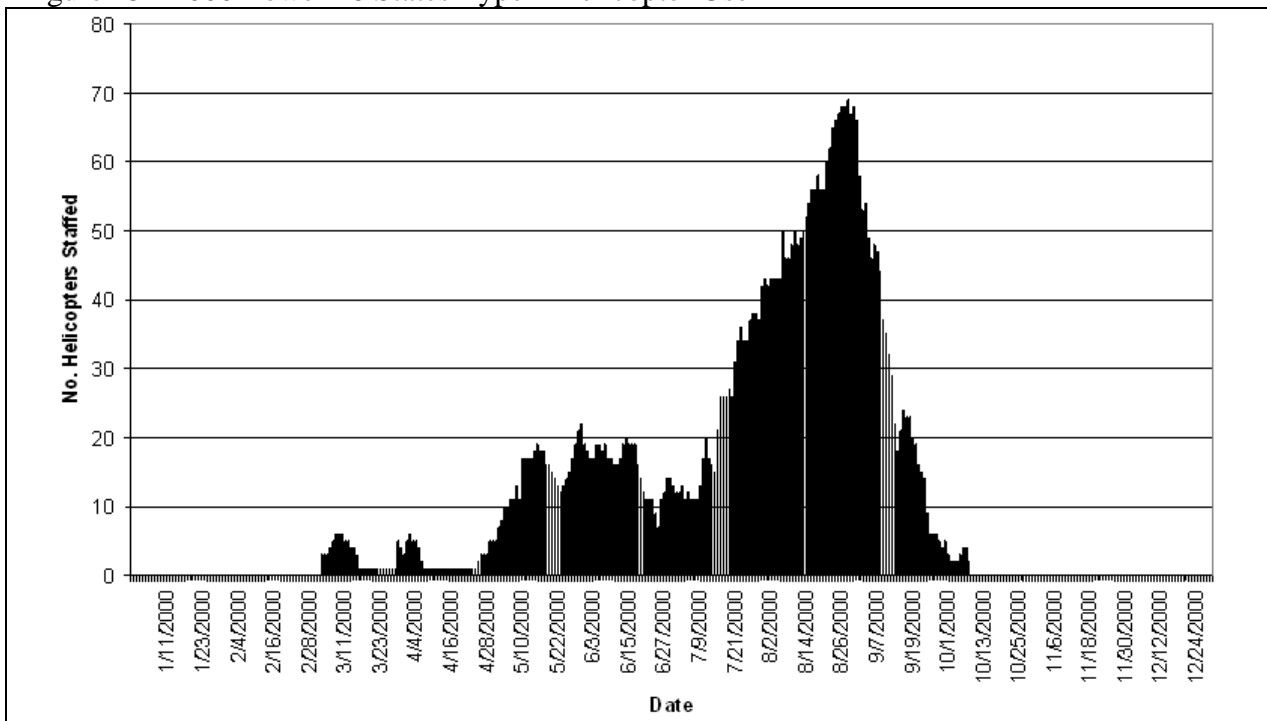


Figure 26 – 2001 Lower 48 States Type 1 Helicopter Use

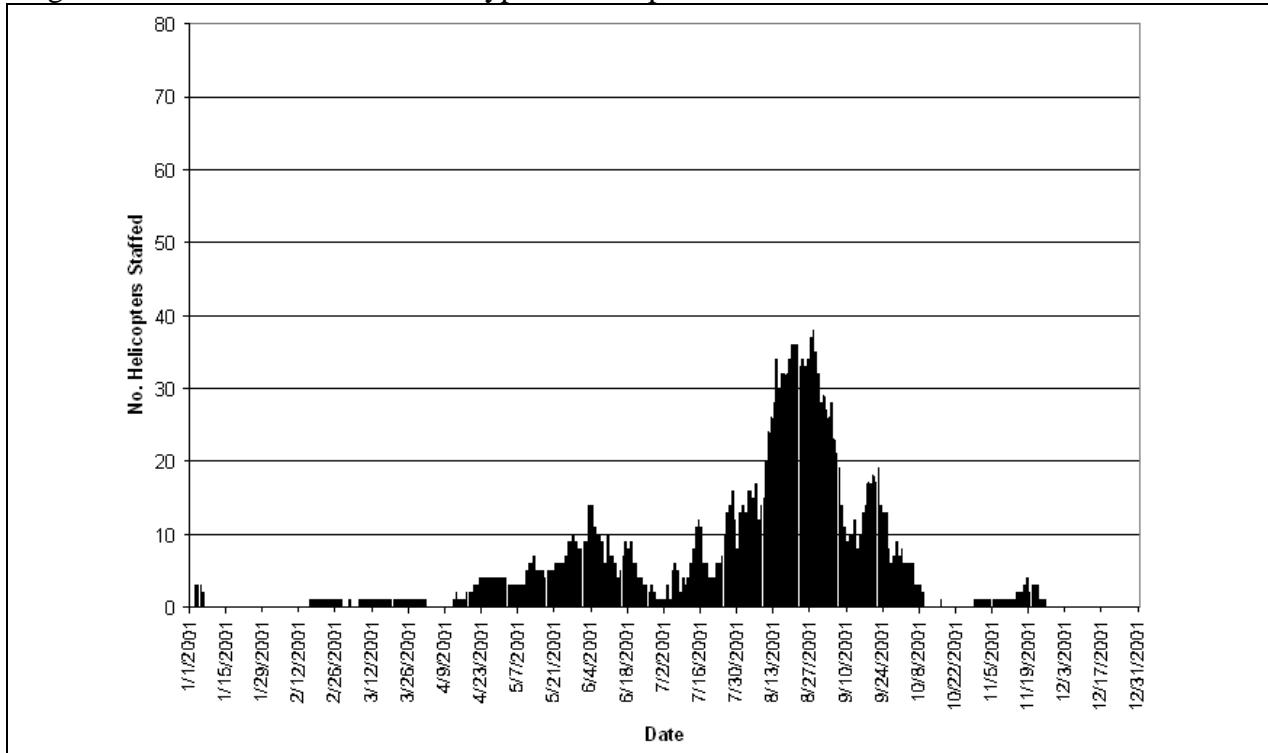


Figure 27 – 2001 Lower 48 States Type 2 Helicopter Use

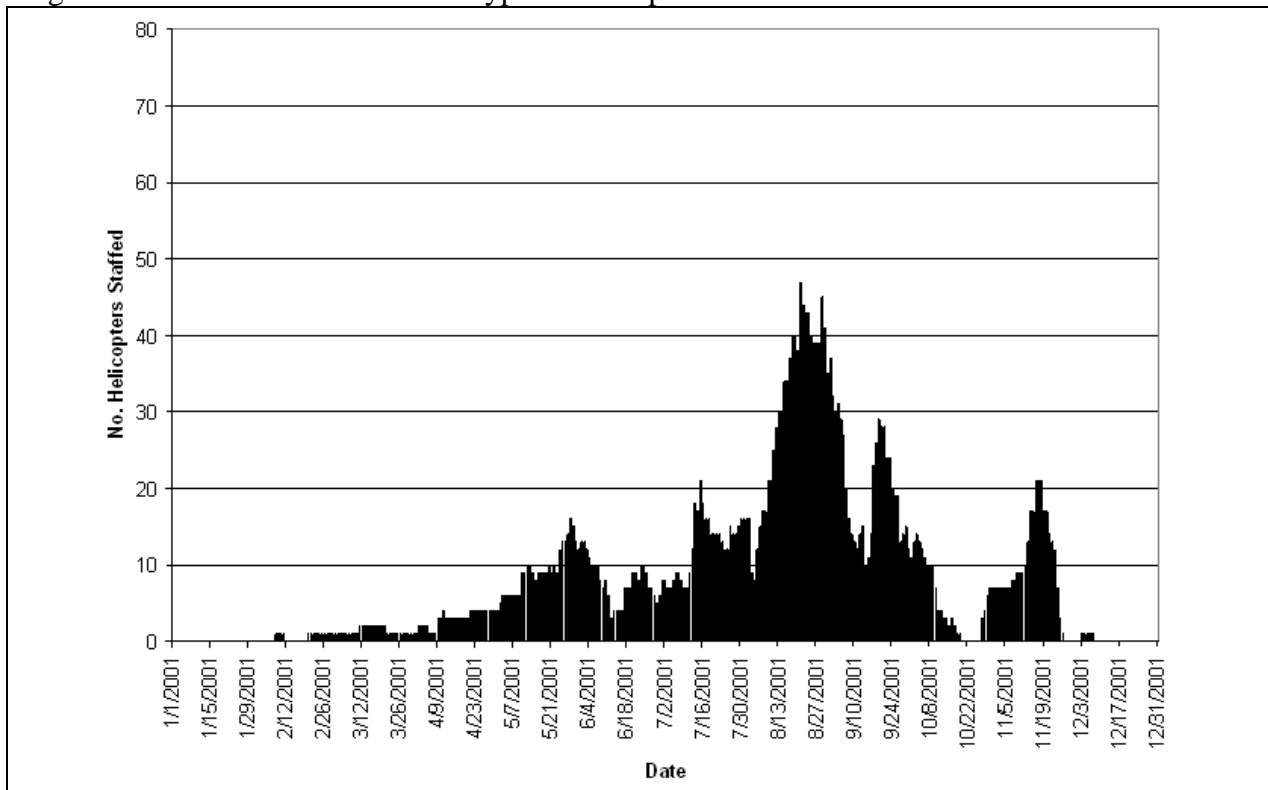


Figure 28 – 2002 Lower 48 States Type 1 Helicopter Use

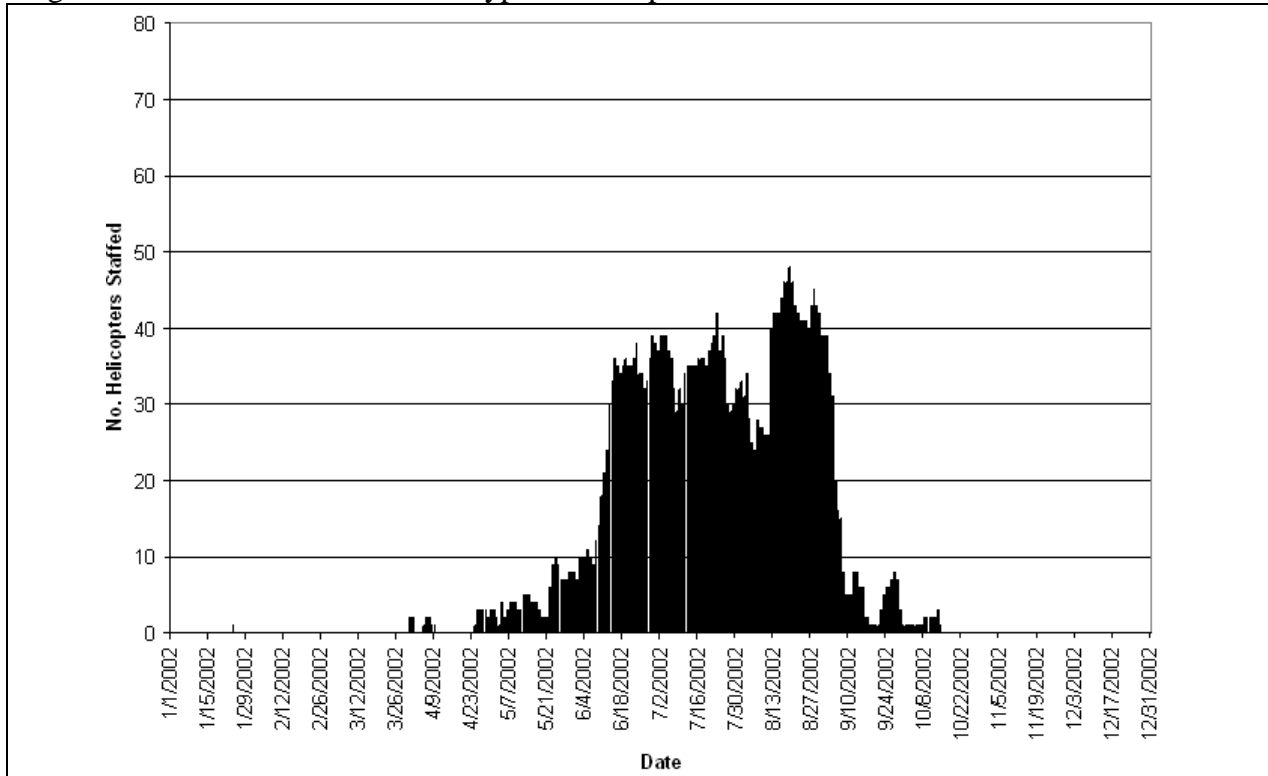


Figure 29 - 2002 Lower 48 States Type 2 Helicopter Use

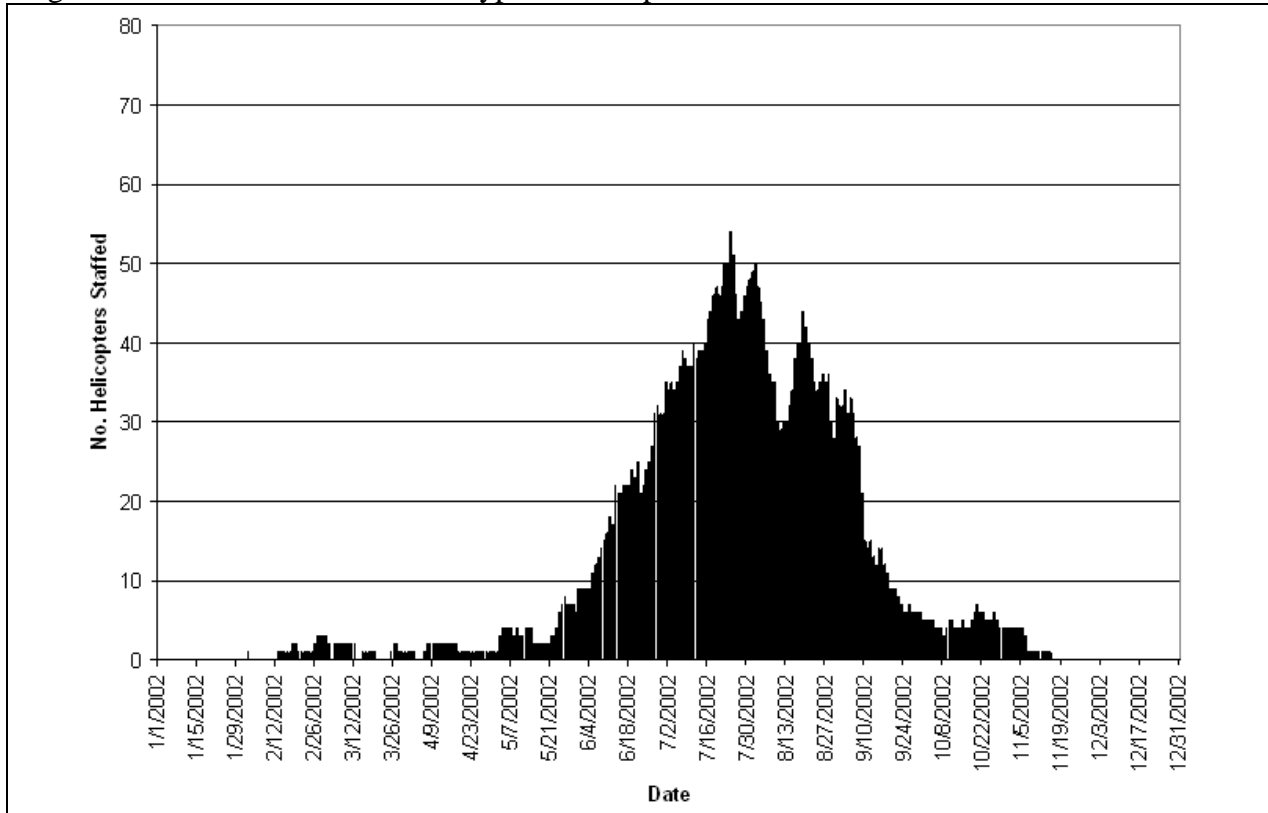


Figure 30 – 2003 Lower 48 States Type 1 Helicopter Use

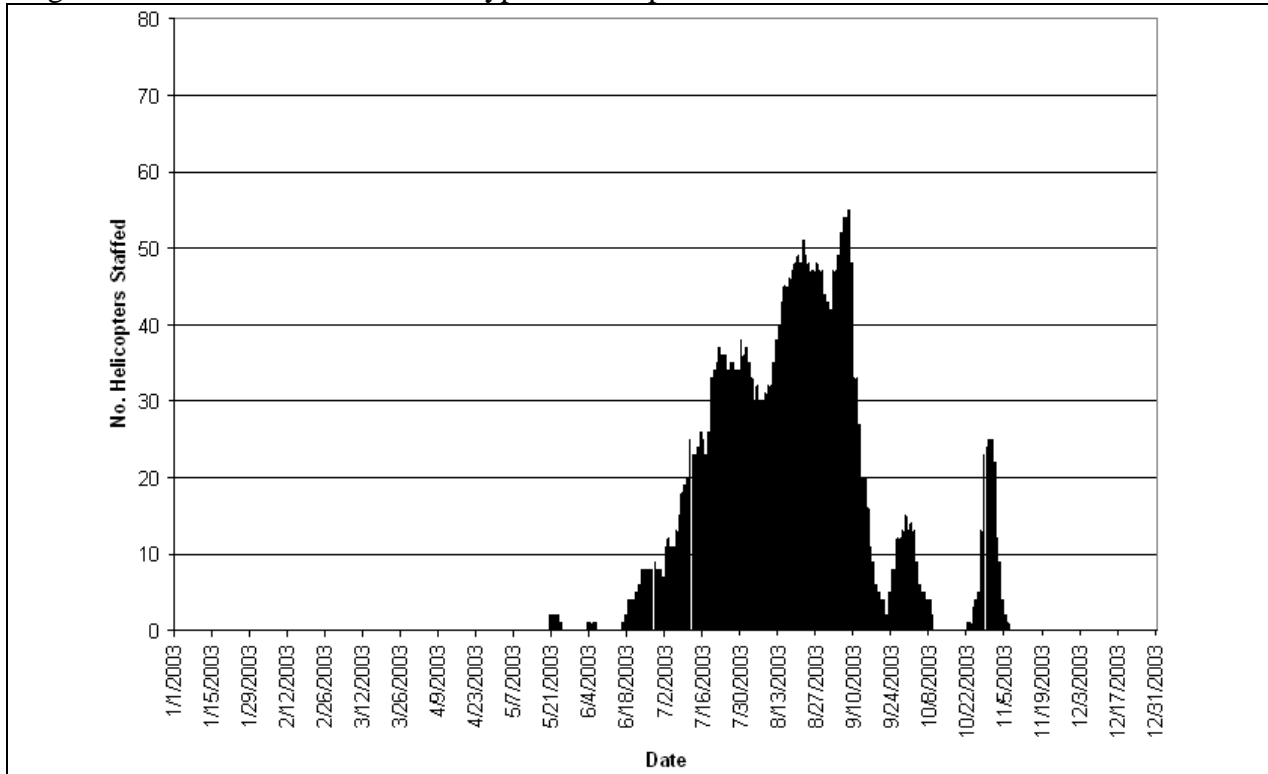


Figure 31 – 2003 Lower 48 States Type 2 Helicopter Use

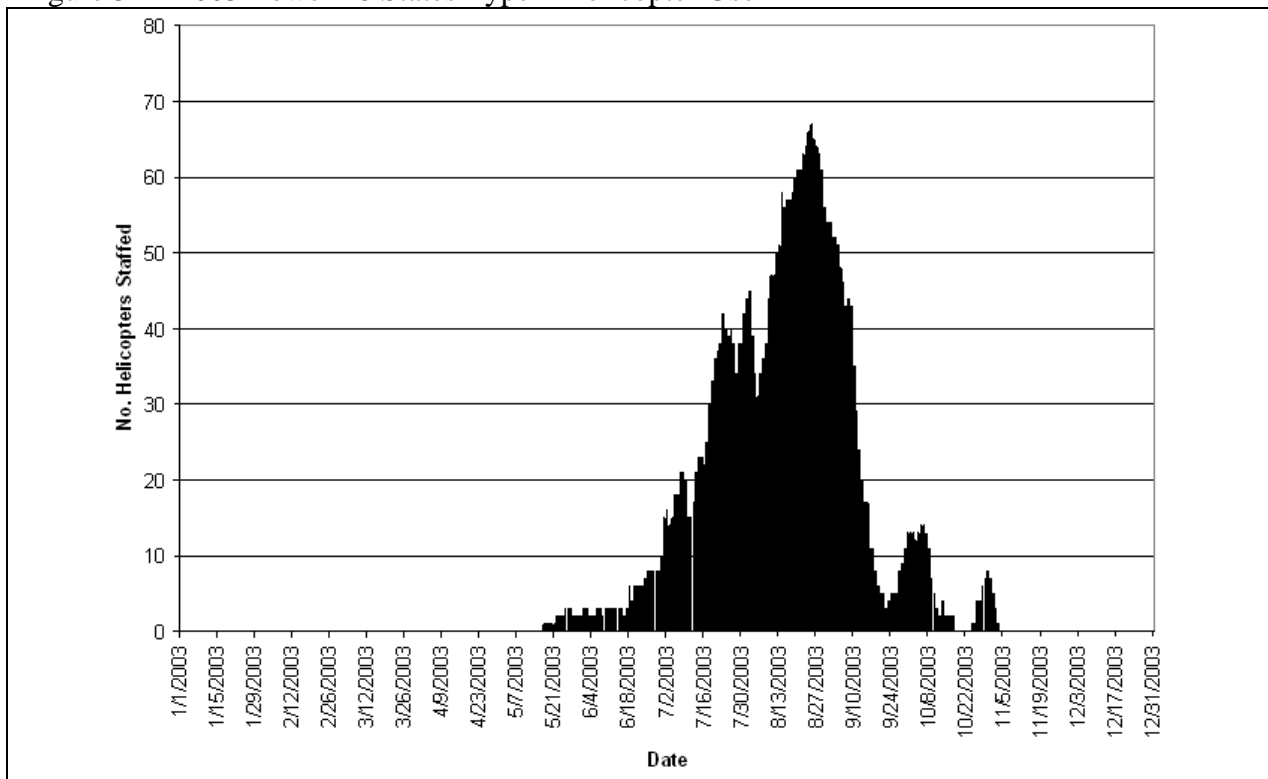


Table 26 contains a summary of the results of modeling for Type 1 helicopters. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Table 26 - Summary of the Results of Modeling for Type 1 Helicopters

| Helicopter Specs | % Demand* | No. EU Contracts Based on Economically Efficiency | Approximate Net Savings Over 100% CWN Staffing |
|----------------------------|------------|---|--|
| Limited, Category C | 100% | 27 | \$34,932,293 |
| Limited, Category B | 100% | 17 | \$6,011,090 |
| Limited, Category C | 34% | 9 | \$11,086,398 |
| Limited, Category B | 67% | 11 | \$5,376,400 |
| Standard, Category C | 100% | 26 | \$36,392,915 |
| Standard, Category B | 100% | 29 | \$19,333,064 |

* - Average annual demand is 2450 helicopter days

Table 27 displays the number of exclusive-use helicopters based on percent of total demand divided between Category B and C, Limited, Type 1 helicopters.

Table 27 – Summary of Optimum Number of Limited, Type 1 Exclusive-Use Contracts by Category Based on Economic Efficiency

| Cat. | Demand Level | | | | | | | | | | |
|------|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| C | 0 | 3 | 5 | 8 | 11 | 13 | 16 | 18 | 21 | 24 | 27 |
| | 100% | 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% | 0% |
| B | 17 | 15 | 14 | 12 | 10 | 8 | 7 | 5 | 3 | 2 | 0 |
| | 17 | 18 | 19 | 20 | 21 | 21 | 23 | 23 | 24 | 26 | 27 |

Table 28 displays the number of exclusive-use helicopters based on percent of total demand divided between Category B and C, Standard, Type 1 helicopters.

Table 28 – Summary of Optimum Number Standard Type 1 Exclusive-Use Contract by Category Based on Economic Efficiency

| Cat. | Demand Level | | | | | | | | | | |
|------|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | 0% | 10% | 20% | 30% | 40% | 50% | 60% | 70% | 80% | 90% | 100% |
| C | 0 | 2 | 5 | 8 | 10 | 13 | 16 | 18 | 21 | 22 | 26 |
| | 100% | 90% | 80% | 70% | 60% | 50% | 40% | 30% | 20% | 10% | 0% |
| B | 29 | 26 | 24 | 20 | 17 | 15 | 12 | 9 | 6 | 3 | 0 |
| | 29 | 28 | 19 | 28 | 27 | 28 | 28 | 27 | 27 | 25 | 26 |

Analysis Results – Type 2 Helicopters

To explain the modeling process, the Type 2, Category A, Limited platform will be used. Table 29 defines the demand and duration parameters that were developed to simulate the five-year average of 3,433 helicopter days per year. Table 30 defines the cost assumptions assuming the exclusive-use contract was for 90 days. The daily use hours is based on data from the agency’s AMIS database for 1998 through 2003.

Table 29 – Demand and Duration Parameters – Type 2

| | Demand Profile* | |
|---------------------------------|-----------------|-------------------|
| | Duration (days) | Peak (number/day) |
| Minimum | 75 | 10 |
| Mode | 130 | 68 |
| Maximum | 160 | 95 |
| Average Helicopter days = 3,468 | | |

Table 30 – Cost Assumptions, Type 2, Category A. Limited. EU has a 90 Day Contract

| | Hourly Flight Rate | Daily Availability | Ave Daily Use (hrs) | Module Cost | Contract Cost | Daily Cost |
|------------------|--------------------|--------------------|---------------------|-------------|---------------|------------|
| Call-When-Needed | \$1,196 | \$5,745 | 3.4 | \$817 | N/A | \$11,691 |
| Exclusive Use | \$1,159 | \$3,273 | 3.4 | \$65,821 | \$360,391 | \$3,941 |

Figure 32 displays the results of the tradeoff analysis. The optimum number of exclusive-use contracts is 33, which would result in an annual saving over the 100% staffing with CWN helicopters by \$9,033,228. A summary of the costs and benefits is documented in Table 31. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Figure 32 - Annual Expected Type 2, Category A, Limited Helicopter Costs for Alternative Levels of Contract Helicopters

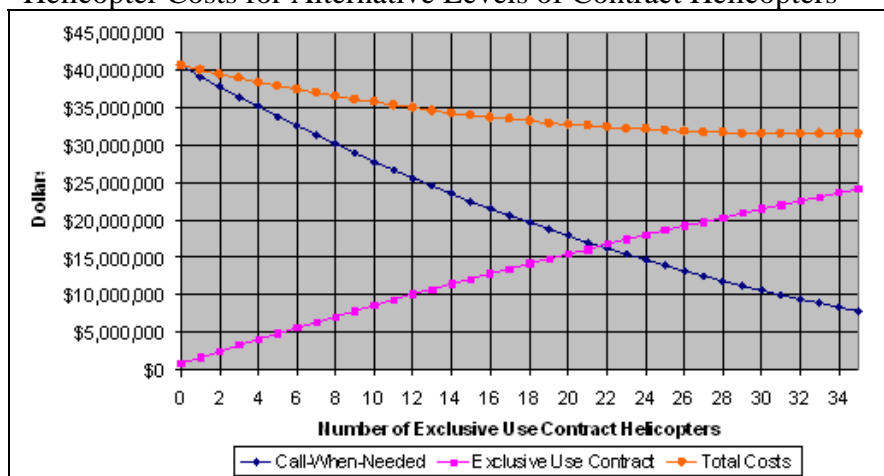


Table 31 – Summary of Cost and Savings for Type 2, Category A, Limited with EU 90 Day Contract.

| No EU Helis Staffed | CWN Cost | EU Cost | Total | Marginal Benefit | Approximate Cumulative Savings |
|---------------------|--------------|-------------|--------------|------------------|--------------------------------|
| 0 | \$40,545,498 | \$0 | \$40,545,498 | | |
| 1 | \$39,139,383 | \$834,330 | \$39,973,713 | \$571,785 | \$571,785 |
| 2 | \$37,762,103 | \$1,658,941 | \$39,421,045 | \$552,669 | \$1,124,453 |
| 3 | \$36,413,658 | \$2,473,833 | \$38,887,492 | \$533,553 | \$1,658,006 |
| 4 | \$35,094,049 | \$3,279,006 | \$38,373,055 | \$514,437 | \$2,172,443 |
| 5 | \$33,803,274 | \$4,074,461 | \$37,877,735 | \$495,321 | \$2,667,763 |
| 6 | \$32,541,334 | \$4,860,196 | \$37,401,530 | \$476,205 | \$3,143,968 |

Table 31 – Summary of Cost and Savings for Type 2, Category A, Limited with EU 90 Day Contract.

| No EU Helis Staffed | CWN Cost | EU Cost | Total | Marginal Benefit | Approximate Cumulative Savings |
|---------------------|--------------------|---------------------|---------------------|------------------|--------------------------------|
| 7 | \$31,308,230 | \$5,636,212 | \$36,944,441 | \$457,089 | \$3,601,057 |
| 8 | \$30,103,960 | \$6,402,509 | \$36,506,469 | \$437,973 | \$4,039,029 |
| 9 | \$28,928,526 | \$7,159,087 | \$36,087,612 | \$418,856 | \$4,457,885 |
| 10 | \$27,781,927 | \$7,905,946 | \$35,687,872 | \$399,740 | \$4,857,626 |
| 11 | \$26,664,162 | \$8,643,085 | \$35,307,248 | \$380,624 | \$5,238,250 |
| 12 | \$25,575,204 | \$9,370,516 | \$34,945,720 | \$361,527 | \$5,599,778 |
| 13 | \$24,514,949 | \$10,088,272 | \$34,603,221 | \$342,499 | \$5,942,277 |
| 14 | \$23,483,266 | \$10,796,398 | \$34,279,664 | \$323,557 | \$6,265,834 |
| 15 | \$22,479,960 | \$11,494,959 | \$33,974,919 | \$304,745 | \$6,570,579 |
| 16 | \$21,504,787 | \$12,184,038 | \$33,688,825 | \$286,094 | \$6,856,673 |
| 17 | \$20,557,468 | \$12,863,728 | \$33,421,196 | \$267,629 | \$7,124,302 |
| 18 | \$19,637,727 | \$13,534,123 | \$33,171,850 | \$249,346 | \$7,373,648 |
| 19 | \$18,745,203 | \$14,195,344 | \$32,940,547 | \$231,303 | \$7,604,951 |
| 20 | \$17,879,553 | \$14,847,508 | \$32,727,061 | \$213,487 | \$7,818,437 |
| 21 | \$17,040,544 | \$15,490,692 | \$32,531,236 | \$195,825 | \$8,014,262 |
| 22 | \$16,227,864 | \$16,125,001 | \$32,352,865 | \$178,370 | \$8,192,633 |
| 23 | \$15,441,134 | \$16,750,564 | \$32,191,698 | \$161,167 | \$8,353,800 |
| 24 | \$14,679,923 | \$17,367,526 | \$32,047,449 | \$144,249 | \$8,498,049 |
| 25 | \$13,943,904 | \$17,975,996 | \$31,919,900 | \$127,548 | \$8,625,598 |
| 26 | \$13,232,658 | \$18,576,117 | \$31,808,775 | \$111,126 | \$8,736,723 |
| 27 | \$12,545,713 | \$19,168,046 | \$31,713,759 | \$95,015 | \$8,831,739 |
| 28 | \$11,882,744 | \$19,751,895 | \$31,634,639 | \$79,121 | \$8,910,859 |
| 29 | \$11,243,351 | \$20,327,797 | \$31,571,148 | \$63,491 | \$8,974,350 |
| 30 | \$10,627,108 | \$20,895,896 | \$31,523,004 | \$48,143 | \$9,022,493 |
| 31 | \$10,033,665 | \$21,456,311 | \$31,489,975 | \$33,029 | \$9,055,523 |
| 32 | \$9,462,646 | \$22,009,167 | \$31,471,813 | \$18,163 | \$9,073,685 |
| 33 | \$8,913,680 | \$22,554,590 | \$31,468,270 | \$3,543 | \$9,077,228 |
| 34 | \$8,386,421 | \$23,092,697 | \$31,479,117 | -\$10,848 | |

Table 32 contains a summary of the results of modeling for Type 2 helicopters. Savings are approximate as the modeling is stochastic and the exact savings is dependent on specific demand assumptions per run.

Table 32 - Summary of the Results of Modeling for Type 2 Helicopters

| Helicopter Specs | % Demand* | No. EU Contracts Based on Economically Efficiency | Approximate Net Savings Over 100% CWN Staffing |
|--|-----------|---|--|
| Limited, Category A | 100% | 33 | \$9,077,228 |
| Standard, Category A | 100% | 28 | \$8,347,416 |
| * - Average annual demand is 3,433 helicopter days | | | |

Objective 2-3

Determine additional staffing requirements for Type 1 and 2 fixed-wing airtankers and Type 1 and 2 helicopters that were recommended for staffing in Phase 1 due to expected unavailability attributed to large fire suppression support needs.

Findings for Objective 2-3

Three additional Type 1 fixed-wing airtankers were added to the fleet in “NATS1” to support the draw down from large fire support. This conclusion remains reasonable for the foreseeable future. Phase 1 did not identify additional Type 1 and 2 helicopters to support large fires. Additionally, the Phase 2 analysis supports significant helicopter support for large fires. Hence, there are no further resources identified here.

Summary of Findings and Comments

Listed below is a summary of finding and comments based on lessons learned as this study was conducted.

1. Fixed-wing Type 1 and 2 airtankers are justified as an integral component of the initial attack resources for land management agencies.
2. Due to differences in speed, tank size, effectiveness of long term versus short term retardants and daily availability cost, Type 1 and 2 fixed-wing airtankers are significantly more efficient in fireline building capability than Type 1 Limited helitankers. Comparison of acres burned and cost plus net value change (C+NVC) results in a conclusion that the staffing of eight Type 1, Category C, Limited helitankers is equivalent to the staffing of one to two Type 1 generic airtankers.
3. The ability to locate helibases in close proximity to the large fire incidents and to provide long term retardant at these helibases favors the use of Type 1 and 2 helitankers over Type 1 and 2 fixed-wing airtankers for large fire support.
4. Future fixed-wing airtanker platforms can be procured in the private sector and developed into airtankers that provide service in a cost efficient manner. Use of excess military platforms is also an option but not a requirement.
5. Future fixed-wing airtanker platforms of 3,000 to 5,000 gallons continue to show significantly greater economic benefit over smaller capacity platforms.
6. Due to the proximity of fires to the currently staffed set of airtanker bases, there are few instances where it is more effective for fixed-wing airtankers to climb to above 10,000 feet MSL in transit to a fire. As such, speed capability when traveling above 10,000 feet MSL provides only a minor effect on economic efficiency.

7. Based on the collective results of analysis in example fixed-wing airtankers, desirable design specifications for a future fixed-wing airtanker platform are as follows:
- Is turbine-powered
 - Speed traveling under 10,000 feet is 250 KIAS
 - Speed traveling above 10,000 feet 350-400 KTAS is desirable
 - Retardant carrying capacity 4,000 to 5,000 gallons
 - Ability to operate from 80-90% of the existing airtanker bases

The analysis also shows a positive economic benefit given the costs that follow:

- Has a flight rate of \$6,000 per hour or less
 - Has daily availability of \$9,500 per day or less based on a 100-day contract
8. The modified analytical methods used in this study appropriately address the issues raised by reports critical of past National Studies (e.g. NATS1, NATS2, etc.) and provide supportable and confident results.
9. Significant savings in suppression costs for large fires can be achieved by the use of exclusive-use contracts for both Type 1 and Type 2 helicopters. The staffing of these contracts at locations where they can also support initial attack, when available, provides an added benefit.
10. The agencies should consider changes to the report keeping process at the National level to support the rapid attainment of the data needed to update this and other studies.
11. The TriSim model can be applied to study tradeoffs of alternative methods of procuring other fire management resources such as 20-person crews.
12. In the early 1990s, the Forest Service developed a report, which provides a blueprint for the conducting of National studies, includes an oversight group to manage the process. Revisiting that report and oversight process would provide timely guidance.

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Appendix A

Study Committee and Steering Committee Membership

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Appendix B

Daily Availability and Flight Rate for Exclusive-Use and Call-When-Needed Contract Helicopters

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Table B-1 – Exclusive-Use, Type 2, Category A

| Contract Length | Cat. | # A/C Cont. | | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|------|-------------|-------------|---------|---------|---------|--------|---------|
| Average | S | 48 | Daily Avail | \$3,218 | \$3,218 | \$3,205 | \$2911 | \$3,239 |
| | | | Flight Rate | \$1,119 | \$1,119 | \$1,119 | \$1404 | \$1,165 |

| | | | | | | | | |
|-----------------|---|----|-------------|---------|---------|-----------|----------|---------|
| 58 to 85 Days | S | 7 | Daily Avail | \$3,536 | \$3,536 | \$3,536 | \$2,677* | \$3,555 |
| | | | Flight Rate | \$1,043 | \$1,043 | \$1,043 | \$1,480* | \$1,084 |
| 89 to 118 Days | S | 30 | Daily Avail | \$3,246 | \$3,246 | \$3,246 | \$3,032 | \$3,273 |
| | | | Flight Rate | \$1,111 | \$1,111 | \$1,111 | \$1,392 | \$1,159 |
| 120 to 170 Days | S | 11 | Daily Avail | \$2,888 | \$2,888 | \$2,861** | \$2,585 | \$2,900 |
| | | | Flight Rate | \$1,201 | \$1,201 | \$1,199** | \$1,421 | \$1,243 |

- There was no data provided on any Limited Use Category A/Type 2 helicopter Contracts.

- Category S = Standard

* Indicates that only one contract was used to calculate that field.

** Data was provided on one additional aircraft not included in 2002-2003.

Table B-2 – Exclusive-Use, Type 1, Categories B and C

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| All Contracts | All | 31 | Daily Avail | \$11,696 | \$11,471 | \$11,246 | \$12,502 | \$11,638 |
| | | | Flight Rate | \$3,454 | \$3,388 | \$3,321 | \$5,387 | \$3,630 |
| | L | 27 | Daily Avail | \$12,545 | \$12,545 | \$12,545 | \$13,005 | \$12,605 |
| | | | Flight Rate | \$3,424 | \$3,424 | \$3,424 | \$4,951 | \$3,832 |
| | S | 4 | Daily Avail | \$6,271 | \$6,271 | \$6,271 | \$9,285 | \$6,979 |
| | | | Flight Rate | \$2,295 | \$2,295 | \$2,295 | \$5,497 | \$2,657 |

Table B-3 – Exclusive-Use, Type 1, Category B

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| All Contracts | All | 14 | Daily Avail | \$10,325 | \$10,325 | \$10,325 | \$12,645 | \$10,006 |
| | | | Flight Rate | \$2,024 | \$2,024 | \$2,024 | \$2,984 | \$2,004 |
| | L | 11 | Daily Avail | \$12,430 | \$12,430 | \$12,430 | \$12,645 | \$12,645 |
| | | | Flight Rate | \$2,193 | \$2,193 | \$2,193 | \$2,984 | \$2,317 |
| | S | 3 | Daily Avail | \$3,308 | \$3,308 | \$3,303 | None | \$2,530 |
| | | | Flight Rate | \$1,461 | \$1,461 | \$1,461 | None | \$2,004 |

Table B-4 – Exclusive-Use, Type 1, Category B by Contract Length and Limited or Standard

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|---------|---------|---------|---------|---------|
| 90 Days | L | 8 | Daily Avail | \$12300 | \$12300 | \$12300 | \$13907 | \$12666 |
| | | | Flight Rate | \$2469 | \$2469 | \$2469 | \$2995 | \$2564 |
| 108 to 140 Days | L | 3 | Daily Avail | \$12950 | \$12950 | \$12950 | \$8858* | \$12562 |
| | | | Flight Rate | \$1088 | \$1088 | \$1088 | \$2950* | \$1364 |
| 90 Days | S | 2 | Daily Avail | \$3415 | \$3415 | \$3415 | \$None | \$3483 |
| | | | Flight Rate | \$1463 | \$1463 | \$1463 | None | \$1492 |
| 108 to 140 Days | S | 2 | Daily Avail | \$3094* | \$3094* | \$3094* | None | \$3156 |
| | | | Flight Rate | \$1456* | \$1456* | \$1456* | None | \$1485 |

* Only one aircraft meet the definition and was used in the calculation.

Exclusive Use Category C (Type 1 Helicopters with a usable payload over 15,000 pounds.) These helicopters are not generally used for transporting passengers but they could be.

Table B-5 – Exclusive-Use, Type 1, Category C

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-------|-------------|-------------|----------|----------|----------|----------|----------|
| All Contracts | L & S | 17 | Daily Avail | \$12,887 | \$12,887 | \$12,887 | \$12,798 | \$12,879 |
| | | | Flight Rate | \$4,669 | \$4,669 | \$4,669 | \$5,716 | \$4,987 |

Note: Only 1 Helicopter is Standard and capable of transporting passengers

The next table displays the contract rates subdivided by contract length.

Table B-6 – Exclusive-Use, Type 1, Category C by Contract Length

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| 42 – 80 Days | L | 3 | Daily Avail | \$11,633 | \$11,633 | \$11,633 | None | \$11,866 |
| | | | Flight Rate | \$4,352 | \$4,352 | \$4,352 | None | \$4,972 |
| 81 to 93 Days | L | 10 | Daily Avail | \$14,350 | \$14,350 | \$14,350 | \$13,777 | \$14,150 |
| | | | Flight Rate | \$4,874 | \$4,874 | \$4,874 | \$5,738 | \$4,947 |
| 93 to 180 Days | L | 3 | Daily Avail | \$11,433 | \$11,433 | \$11,433 | \$7,500* | \$10,941 |
| | | | Flight Rate | \$4,843 | \$4,843 | \$4,843 | \$5,738* | \$5,064 |
| 90 Days | S | 1 | Daily Avail | \$15,161 | \$15,161 | \$15,161 | \$9,285 | \$13,873 |
| | | | Flight Rate | \$4,799 | \$4,799 | \$4,799 | \$5,497 | \$5,018 |

* Only one aircraft met the definition and was used in the calculation.

Tables B-7 through B-10 documents the findings for CWN contracts.

Table B-7 – Call-When-Needed, Type 2, Category A

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|---------|---------|---------|---------|---------|
| All | S | 200 | Daily Avail | \$5,732 | \$5,663 | \$5,803 | \$5,663 | \$5,745 |
| | | | Flight Rate | \$1,150 | \$1,128 | \$1,106 | \$1,411 | \$1,196 |

Table B-8 – Call-When- Needed, Type 1, Categories B and C

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| All | All | 152 | Daily Avail | \$20,973 | \$21,117 | \$21,391 | \$21,683 | \$21,321 |
| | | | Flight Rate | \$3,270 | \$3,207 | \$3,143 | \$3,984 | \$3,422 |
| | L | 127 | Daily Avail | \$22,348 | \$22,539 | \$22,738 | \$23,324 | \$22,763 |
| | | | Flight Rate | \$3,404 | \$3,338 | \$3,278 | \$4,137 | \$3,564 |
| | S | 25 | Daily Avail | \$11,585 | \$11,856 | \$12,144 | \$10,277 | \$11,477 |
| | | | Flight Rate | \$2,198 | \$2,155 | \$2,113 | \$2,604 | \$2,268 |

Table B-9 – Call-When-Needed, Type 1, Category B

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| All | All | 91 | Daily Avail | \$14,497 | \$14,747 | \$15,027 | \$13,945 | \$14,551 |
| | | | Flight Rate | \$2,210 | \$2,167 | \$2,125 | \$2,454 | \$2,239 |
| | L | 68 | Daily Avail | \$16,066 | \$16,311 | \$16,589 | \$16,204 | \$16,292 |
| | | | Flight Rate | \$2,277 | \$2,233 | \$2,189 | \$2,538 | \$2,311 |
| | S | 23 | Daily Avail | \$10,309 | \$10,577 | \$10,863 | \$7,769 | \$9,879 |
| | | | Flight Rate | \$2,032 | \$1,993 | \$1,954 | \$2,207 | \$2,044 |

Table B-10 – Call-When-Needed, Type 1, Category C

| Contract Length | Use | # A/C Cont. | Rate | 2002 | 2003 | 2004 | 2005 | Avg. |
|-----------------|-----|-------------|-------------|----------|----------|----------|----------|----------|
| All | All | 60 | Daily Avail | \$30,985 | \$31,112 | \$31,219 | \$30,411 | \$30,887 |
| | | | Flight Rate | \$4,914 | \$4,817 | \$4,721 | \$5,685 | \$5,090 |
| | L | 58 | Daily Avail | \$29,329 | \$29,460 | \$29,571 | \$29,281 | \$29,399 |
| | | | Flight Rate | \$4,656 | \$4,566 | \$4,477 | \$5,387 | \$4,850 |
| | S | 2 | Daily Avail | \$30,734 | \$31,048 | \$31,352 | \$29,086 | \$30,261 |
| | | | Flight Rate | \$4,687 | \$4,597 | \$4,507 | \$5,387 | \$4,913 |

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Appendix C
Documentation of Helicopter Module Costs

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MODULE COSTS

Assumptions

The Interagency Helicopter Operations Guide (IHOG) provides the following direction for the staffing of helicopters based on FAA Standard Transport Categories.

Chart 2-4: Minimum Daily Staffing Requirements For Fire Helicopters

| TYPE HELICOPTER | FAA STANDARD / TRANSPORT CATEGORY | FAA Standard Category Temporarily Designated for Limited Use | FAA Standard Category Permanently Designated for Limited Use* or FAA Restricted Category |
|---|---|--|--|
| 1 | Manager plus Four (4) Helicopter Crewmembers | Manager only | Manager only |
| 2 | Manager plus Three (3) Helicopter Crewmembers | Manager only | Manager only |
| 3 | Manager plus Two (2) Helicopter Crewmembers | | |
| CWN Helicopter and Module must mate up away from Incident(s) or Fire Operations | | | |

Costs were derived from the 2004 GSA Pay Schedule based on a Step 5 for each grade used. An additional 45% is added to the wages to cover benefits and other costs to generate a Cost to Government (CTG) for each grade. Salary reflects the CTG.

Regular days are based on an 8-hour work day. Overtime is based on a 13-hour work day.

Two pay periods are added to CWN modules to allow for training and travel, check-out/check-in of equipment, pay roll and other reporting in addition to fire assignments.

Analysis assumes that initial investments in bases and equipment have previously occurred. Estimates for miscellaneous items and reoccurring costs are included in the estimates.

Length of assignment for each FAA Transport Category was determined by averaging the length of assignment based on resource orders from NIFC.

| | 1999 | 2000 | 2001 | 2002 | 2003 | Average |
|---------|---------|------|------|------|------|---------|
| CWN 1 L | 9 | 17 | 8 | 14 | 15 | 13 |
| CWN 1 S | 14 | 21 | 8 | 10 | 14 | 14 |
| EU 1 L | | 34 | 19 | 8 | 15 | 19 |
| EU 1 S | No Data | | | | | |
| CWN 2 L | 4 | 14 | 9 | 13 | 14 | 11 |
| CWN 2 S | 10 | 17 | 12 | 16 | 17 | 13 |
| EU 2 L | No Data | | | | | |
| EU 2 S | 20 | 21 | 12 | 21 | 21 | 19 |

Two days are added for fire assignments to account for travel.

These estimates are used in determination of daily costs for each module.

Call-When-Needed Modules (CWN)

CWN Type 2 Standard Module 15 day assignment:

Regular Time (Pay Period)

GS 7 for 10 regular days @ \$1,878

GS 6 for 10 regular days @ \$1,690

GS 5 for 10 regular days @ \$1,516

GS 4 for 10 regular days @ \$1,355

Total = \$6,439 (This represents 10 days of regular time for 4 persons).

\$6,439 divided by 10 days = \$644 per day

\$644 per day x 11 days = \$7,084 per 15 day assignment.

Overtime Days

\$644 per day x 1.5 (OT Rate) = \$966 per day

\$966 per day x 4 days = \$3,864 per 15 day assignment

Overtime Hours

Based on a 13 hour day for each day worked (5 hours per day).

Daily overtime daily rate of \$966 divided by 8 hours per day = \$121 per hour

\$121 per hour x 5 hours x 15 days = \$9,075 per 15 day assignment

Pre and post season costs associated with training, travel, equipment check-out/check-in, payroll and other reporting:

\$6,439 per pay period x 2 pay periods = \$12,878

\$12,878 plus \$4975 (Per Diem, tuition and other miscellaneous costs) = \$17,878

Total Daily Cost CWN Type 2 Standard Module

| | |
|-------------------|-----------------|
| Regular time = | \$7,084 |
| Overtime days = | \$3,864 |
| Overtime hours = | \$9,075 |
| Pre/post season = | <u>\$17,878</u> |
| Total = | \$37,876 |

15 day assignment \$37,876 divided 15 days = \$2,525 per day

CWN Type 1 Standard Module 15 Day assignment

Regular Time (Pay Period)

| | |
|----------------------------|----------------|
| GS 7 for 10 regular days @ | \$1,878 |
| GS 6 for 10 regular days @ | \$1,690 |
| GS 5 for 10 regular days @ | \$1,516 |
| GS 4 for 10 regular days @ | \$1,354 |
| GS 4 for 10 regular days @ | <u>\$1,354</u> |
| Total = | \$7,794 |

(This represents 10 days of regular time for 5 persons).

| | |
|------------------------------|--------------------------------|
| \$7,794 divided by 10 days = | \$779 per day |
| \$779 per day x 11 days = | \$8,569 per 15 day assignment. |

Overtime Days

| | |
|---------------------------------|-------------------------------|
| \$779 per day x 1.5 (OT Rate) = | \$1,168 per day |
| \$1,168 per day x 4 days = | \$4,672 per 15 day assignment |

Overtime Hours

Based on a 13 hour day for each day worked (5 hours per day).

| | |
|---|--------------------------------|
| Daily overtime daily rate of \$1,168 divided by 8 hours per day = | \$146 per hour |
| \$146 per hour x 5 hours x 15 days = | \$10,950 per 15 day assignment |

Pre and post season costs associated with training, travel, equipment check-out/check-in, payroll and other reporting:

| | |
|---|----------|
| \$7,794 per pay period x 2 pay periods = | \$15,588 |
| \$15,588 plus \$4,880 (Per Diem, tuition and other miscellaneous costs) = | \$20,460 |

Total Daily Cost CWN Type 2 Standard Module

| | |
|-------------------|-----------------|
| Regular time = | \$8,570 |
| Overtime days = | \$4,670 |
| Overtime hours = | \$10,950 |
| Pre/post season = | <u>\$20,460</u> |
| Total = | \$44,650 |

15 day assignment \$44,650 divided 15 days = \$2,977 per day

CWN Type 1 and 2 Limited Module 15 Day Assignment

Regular Time (Pay Period)

GS 9 for 10 regular days @ \$2,220

Total = \$2,220 (This represents 10 days of regular time for 1 persons).

\$2,220 divided by 10 days = \$222 per day
\$222 per day x 11 days = \$2,440 per 15 day assignment.

Overtime Days

\$222 per day x 1.5 (OT Rate) = \$333 per day
\$333 per day x 4 days = \$1,330 per 15 day assignment

Overtime Hours

Based on a 13 hour day for each day worked (5 hours per day).

Daily overtime daily rate of \$333 divided by 8 hours per day = \$41 per hour
\$41 per hour x 5 hours x 15 days = \$3,070 per 15 day assignment

Pre and post season costs associated with training, travel, equipment check-out/check-in, payroll and other reporting:

\$2,220 per pay period x 2 pay periods = \$4,440
\$4,440 plus \$970 (Per Diem, tuition and other miscellaneous costs) = \$5,410

Total Daily Cost CWN Type 2 Standard Module

| | |
|-----------------|-------------------|
| Regular time | = \$ 2,440 |
| Overtime days | = \$ 1,330 |
| Overtime hours | = \$ 3,070 |
| Pre/post season | = <u>\$ 5,410</u> |
| Total | = \$12,250 |

15 day assignment \$12,250 divided 15 days = \$817 per day

Exclusive-Use Modules

Exclusive-Use Type 1 and 2 Limited Module 16 Day Assignment (Category B and C)

GS 9 PFT Annual Salary \$57,937

Overtime Days

\$42 per x 8 hours x 4 days = \$1,344 assignment

Overtime Hours

Based on a 13 hour day for each day worked (5 hours per day).

Hourly OT rate of \$42 x 5 hours x 16 days = \$3,360 per assignment

Pre and post season costs associated with training, travel, equipment check-out/check-in, payroll and other reporting:

Per Diem, tuition, equipment, space and other miscellaneous costs = \$3,190

Annual Module Cost EU Limited Use Helicopter Module

| | |
|-----------------|-------------------|
| Regular time | = \$57,937 |
| Overtime days | = \$ 1344 |
| Overtime hours | = \$ 3360 |
| Pre/post season | = <u>\$ 3,190</u> |
| Total | = \$65,821 |

Annual Costs with a 16 day assignment = \$65,821 per season

Exclusive-Use Type 1 and 2 Standard Module*
 (21-Day Assignment 90 Day Contract)

Base Salary

| | |
|----------------------------|------------------|
| GS-9 PFT Annual Salary = | \$ 57,937 |
| GS-8 PFT Annual Salary = | \$ 54,077 |
| GS-6 PSE 13/13 = | \$ 21,972 |
| GS-5 PSE 13/13 = | \$ 19,710 |
| GS-4 Temp 11 pay periods = | \$ 14,903 |
| GS-4 Temp 11 pay periods = | <u>\$ 14,903</u> |

Total Salary= \$183,502

Overtime Days (6)

| | |
|--------------------------------------|-----------------|
| GS-9 \$42/hour x 8 hours x 6 days = | \$ 2,010 |
| GS-8 \$39/hour x 8 hours x 6 days = | \$ 1,872 |
| GS-6 \$32/hour x 8 hours x 6 days = | \$ 1,521 |
| GS-5 \$28/hour x 8 hours x 6 days = | \$ 1,365 |
| GS-4 \$ 25/hour x 8 hours x 6 days = | \$ 1,220 |
| GS-4 \$ 25/hour x 8 hours x 6 days = | <u>\$ 1,220</u> |

Total OT Days = \$ 9,207

Overtime Hours (5 hours per day, 21 day assignment)

| | |
|--------------------------------------|-----------------|
| GS-9 \$42/hour x 5 hours x 16 days = | \$ 3,140 |
| GS-8 \$39/hour x 5 hours x 16 days = | \$ 2,925 |
| GS-6 \$32/hour x 5 hours x 16 days = | \$ 2,377 |
| GS-5 \$28/hour x 5 hours x 16 days = | \$ 2,132 |
| GS-4 \$25/hour x 5 hours x 16 days = | \$ 1,905 |
| GS-4 \$25/hour x 5 hours x 16 days = | <u>\$ 1,905</u> |

Total OT Hours (5) = \$ 9,207

| | |
|--------------------------------------|------------------|
| Misc. Cost, Vehicles and Equipment = | \$ 8,300 |
| Travel, Training, Per Diem = | \$ 7,500 |
| Supplies, Cell phones, Radios = | \$ 10,590 |
| Rents/Leases = | <u>\$ 25,100</u> |

Annual Cost with a 21 day assignment = \$258,587 per season

* - Incorporates information on module configuration contained in the April 25, 1995 Washington Office letter on National Type 2 Helicopters.

Appendix D

Initial Attack Analysis Assumptions and Rules

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Initial Attack Analysis Assumptions and Rules

1. All units will use MNIAAPC Version 4.88 as the Initial Attack model.
2. Use the Most Efficient budget level (MEL) from the unit's currently approved preferred NFMAS alternative. In the OST, label this budget level MEL. Alternative Cost for this study will not include the pre-suppression cost to staff the MEL organization as this is constant.
3. All representative fire locations will have a legal description (lat/long or T/R/S) and latitude/longitude. If this has not been done yet, use the airtanker attack times in the MRT to determine an appropriate legal description. This is needed to allow for calculation of attack times from alternative airtanker bases locations serving a representative fire.
4. All airtanker attack times and UMC costs will be calculated using the AutoAT4 program.
5. All money is expressed in 2004 dollars.
6. Retardant cost per gallon is assumed to be \$0.72.
7. Existing dispatch philosophy from preferred IAA alternative. Maintain this dispatch philosophy unless historic use does not depict the current situation.
8. When using airtanker loads from another geographic area in an alternative, assume these loads are available based on the staffing of the 1996 airtanker contract.
9. Fireline production using water or foam was calculated at 50% of the fireline production produced using long term retardant.

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Appendix E

Documentation of Initial Attack Analysis by GACC

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Table E-1 Northern GACC

| Alt. | Airtanker Bases * | | | | | | No. AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|------|-------------------|-----|-----|-----|-----|-----|--------|--------------|--------------|--------------|---------------------|--------------|
| | WYS | BIL | COE | HLN | MSO | FCA | | | | | | |
| A0 | | | | | | | 0 | 44,828 | \$19,239,265 | -\$2,868,760 | \$0 | \$22,108,025 |
| AA | 1 | | | | | | 1 | 32,738 | \$11,808,582 | -\$1,733,288 | \$650,000 | \$14,191,870 |
| AB | | 1 | | | | | 1 | 32,239 | \$11,868,144 | -\$1,518,238 | \$650,000 | \$14,036,382 |
| AC | | | 1 | | | | 1 | 33,686 | \$11,148,326 | -\$1,702,650 | \$650,000 | \$13,500,976 |
| AE | | | | 1 | | | 1 | 33,176 | \$11,406,353 | -\$1,695,432 | \$650,000 | \$13,751,785 |
| AF | | | | | 1 | | 1 | 33,483 | \$10,943,500 | -\$1,726,734 | \$650,000 | \$13,320,234 |
| AG | | | | | | 1 | 1 | 34,104 | \$11,550,967 | -\$1,750,484 | \$650,000 | \$13,951,451 |
| BA | 1 | | | | 1 | | 2 | 30,936 | \$10,554,123 | -\$1,344,849 | \$1,300,000 | \$13,198,972 |
| BB | | 1 | | | 1 | | 2 | 30,988 | \$10,596,536 | -\$1,346,201 | \$1,300,000 | \$13,242,737 |
| BC | | | 1 | | 1 | | 2 | 32,359 | \$10,379,228 | -\$1,449,707 | \$1,300,000 | \$13,128,935 |
| BE | | | | 1 | 1 | | 2 | 31,595 | \$10,470,716 | -\$1,362,535 | \$1,300,000 | \$13,133,251 |
| BF | | | | | 2 | | 2 | 32,183 | \$10,419,545 | -\$1,385,229 | \$1,300,000 | \$13,104,774 |
| BG | | | | | 1 | 1 | 2 | 32,359 | \$10,528,745 | -\$1,384,878 | \$1,300,000 | \$13,213,623 |
| CA | 1 | | | | 2 | | 3 | 30,738 | \$10,355,794 | -\$1,332,766 | \$1,950,000 | \$13,638,560 |
| CB | | 1 | | | 2 | | 3 | 30,721 | \$10,340,703 | -\$1,331,556 | \$1,950,000 | \$13,622,259 |
| CC | | | 1 | | 2 | | 3 | 32,168 | \$10,307,985 | -\$1,372,355 | \$1,950,000 | \$13,630,340 |
| CE | | | | 1 | 2 | | 3 | 31,403 | \$10,298,810 | -\$1,353,150 | \$1,950,000 | \$13,601,960 |
| CF | | | | | 3 | | 3 | 32,177 | \$10,403,378 | -\$1,380,355 | \$1,950,000 | \$13,733,733 |
| CG | | | | | 2 | 1 | 3 | 32,173 | \$10,382,602 | -\$1,379,271 | \$1,950,000 | \$13,711,873 |
| CK | | | 1 | 1 | 1 | | 3 | 31,396 | \$9,892,868 | -\$1,293,231 | \$1,950,000 | \$13,136,099 |
| DA | 1 | | | 1 | 2 | | 4 | 30,725 | \$10,279,964 | -\$1,330,615 | \$2,600,000 | \$14,210,579 |
| DB | | 1 | | 1 | 2 | | 4 | 30,716 | \$10,266,448 | -\$1,330,057 | \$2,600,000 | \$14,196,505 |
| DD | | | 1 | 1 | 2 | | 4 | 31,394 | \$10,201,124 | -\$1,344,757 | \$2,600,000 | \$14,145,881 |
| DE | | | | 2 | 2 | | 4 | 31,401 | \$10,291,180 | -\$1,352,727 | \$2,600,000 | \$14,243,907 |
| DF | | | | 1 | 2 | 1 | 4 | 31,401 | \$10,275,426 | -\$1,351,915 | \$2,600,000 | \$14,227,341 |
| EA | 1 | | 1 | 1 | 2 | | 5 | 30,716 | \$10,182,900 | -\$1,322,455 | \$3,250,000 | \$14,755,355 |
| EB | | 1 | 1 | 1 | 2 | | 5 | 30,707 | \$10,168,664 | -\$1,321,700 | \$3,250,000 | \$14,740,364 |
| ED | | | 2 | 1 | 2 | | 5 | 31,394 | \$10,195,316 | -\$1,344,659 | \$3,250,000 | \$14,789,975 |
| EE | | | 1 | 2 | 2 | | 5 | 31,392 | \$10,194,234 | -\$1,344,596 | \$3,250,000 | \$14,788,830 |
| EF | | | 1 | 1 | 2 | 1 | 5 | 31,393 | \$10,191,812 | -\$1,345,060 | \$3,250,000 | \$14,786,872 |

* - WYS, West Yellowstone; BIL, Billings; COE, Coeur d' Alene; HLN, Helena; MSO, Missoula; FCA, Kalispell;
** - Annual number of fires is 1,239.
*** - Airtanker staffing is for 100 days.

Table E-2 Rocky Mountain GACC

| Alt. | Airtanker Bases * | | | | | No. AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|------|-------------------|----|----|----|----|--------|--------------|-------------|--------------|---------------------|--------------|
| | WYS | JC | DU | GJ | RC | | | | | | |
| A0 | | | | | | 0 | 31,327 | \$9,303,568 | -\$7,579,171 | \$0 | \$16,882,739 |
| A1 | 1 | | | | | 1 | 19,027 | \$9,470,123 | -\$5,233,439 | \$552,500 | \$15,256,062 |
| A2 | | 1 | | | | 1 | 19,640 | \$8,718,615 | -\$5,023,430 | \$552,500 | \$14,294,545 |
| A3 | | | 1 | | | 1 | 18,261 | \$8,961,818 | -\$5,021,212 | \$552,500 | \$14,535,530 |
| A4 | | | | 1 | | 1 | 22,924 | \$8,523,325 | -\$5,563,020 | \$552,500 | \$14,638,845 |
| A5 | | | | | 1 | 1 | 19,997 | \$9,610,645 | -\$5,261,894 | \$552,500 | \$15,425,039 |
| BA | 1 | 1 | | | | 2 | 22,595 | \$8,739,476 | -\$5,461,576 | \$1,105,000 | \$15,306,052 |
| BB | | 2 | | | | 2 | 20,452 | \$8,495,934 | -\$5,196,255 | \$1,105,000 | \$14,797,189 |
| BC | | 1 | 1 | | | 2 | 20,758 | \$8,515,925 | -\$5,305,023 | \$1,105,000 | \$14,925,948 |
| BD | | 1 | | 1 | | 2 | 21,100 | \$8,193,013 | -\$5,240,275 | \$1,105,000 | \$14,538,288 |
| BE | | 1 | | | 1 | 2 | 21,984 | \$8,790,580 | -\$5,449,359 | \$1,105,000 | \$15,344,939 |
| CA | 1 | 1 | | 1 | | 3 | 21,073 | \$8,168,567 | -\$5,234,685 | \$1,657,500 | \$15,060,752 |
| CB | | 2 | | 1 | | 3 | 20,976 | \$8,149,864 | -\$5,198,290 | \$1,657,500 | \$15,005,654 |
| CC | | 1 | 1 | 1 | | 3 | 21,051 | \$8,168,383 | -\$5,235,047 | \$1,657,500 | \$15,060,930 |
| CD | | 1 | | 2 | | 3 | 16,106 | \$8,066,892 | -\$4,422,347 | \$1,657,500 | \$14,146,739 |
| CE | | | 1 | 1 | 1 | 3 | 20,962 | \$8,147,016 | -\$5,177,477 | \$1,657,500 | \$14,981,993 |
| DA | 1 | 1 | | 2 | | 4 | 16,084 | \$8,043,044 | -\$4,417,309 | \$2,210,000 | \$14,670,353 |
| DB | | 2 | | 2 | | 4 | 15,982 | \$8,023,743 | -\$4,380,362 | \$2,210,000 | \$14,614,105 |
| DC | | 1 | 1 | 2 | | 4 | 16,104 | \$8,051,631 | -\$4,421,953 | \$2,210,000 | \$14,683,584 |
| DD | | 1 | | 2 | 1 | 4 | 15,968 | \$8,020,895 | -\$4,359,549 | \$2,210,000 | \$14,590,444 |
| EA | 1 | 1 | | 2 | 1 | 5 | 15,952 | \$7,993,085 | -\$4,357,238 | \$2,762,500 | \$15,112,823 |
| EB | | 2 | | 2 | 1 | 5 | 15,938 | \$7,989,271 | -\$4,353,164 | \$2,762,500 | \$15,104,935 |
| EC | | 1 | 1 | 2 | 1 | 5 | 15,966 | \$8,005,671 | -\$4,359,155 | \$2,762,500 | \$15,127,326 |
| ED | | 1 | | 2 | 2 | 5 | 15,936 | \$7,988,163 | -\$4,344,961 | \$2,762,500 | \$15,095,624 |

* - WYS, West Yellowstone; JC, Jeffco; DU, Durango; GJ, Grand Junction; RC, Rapid City;
 ** - Annual number of fires is 1,009.
 *** - Airtanker staffing is for 85 days.

Table E-3 – Southwest GACC

| Alt. | Airtanker Bases * | | | | | | | | No AT | Acres Burned | FFF | NVC | AT Program Cost*** | C+NVC** |
|------|-------------------|-----|----|-----|-----|-----|----|----|-------|--------------|--------------|--------------|--------------------|--------------|
| | ALB | ALM | FH | PHX | PRE | ROS | SC | WI | | | | | | |
| A0 | | | | | | | | | 0 | 120,433 | \$64,421,041 | -\$8,937,119 | \$0 | \$73,358,160 |
| A1 | 1 | | | | | | | | 1 | 82,963 | \$48,283,391 | -\$7,621,600 | \$455,000 | \$56,359,991 |
| A2 | | 1 | | | | | | | 1 | 82,700 | \$48,527,122 | -\$7,652,142 | \$455,000 | \$56,634,264 |
| A2 | | | 1 | | | | | | 1 | 82,184 | \$48,329,938 | -\$7,559,592 | \$455,000 | \$56,344,530 |
| A4 | | | | 1 | | | | | 1 | 79,226 | \$46,855,933 | -\$7,374,591 | \$455,000 | \$54,685,524 |
| A4 | | | | | 1 | | | | 1 | 80,290 | \$47,148,510 | -\$7,484,240 | \$455,000 | \$55,087,750 |
| A6 | | | | | | 1 | | | 1 | 85,396 | \$49,196,052 | -\$7,777,420 | \$455,000 | \$57,428,472 |
| A7 | | | | | | | 1 | | 1 | 80,704 | \$47,183,614 | -\$7,487,921 | \$455,000 | \$55,126,535 |
| A8 | | | | | | | | 1 | 1 | 80,866 | \$47,214,993 | -\$7,432,046 | \$455,000 | \$55,102,039 |
| BA | 1 | | | 1 | | | | | 2 | 65,991 | \$40,296,486 | -\$4,851,841 | \$910,000 | \$46,058,327 |
| BB | | 1 | | 1 | | | | | 2 | 66,550 | \$41,307,607 | -\$5,275,670 | \$910,000 | \$47,493,277 |
| BC | | | 1 | 1 | | | | | 2 | 66,705 | \$40,766,938 | -\$5,037,187 | \$910,000 | \$46,714,125 |
| BD | | | | 2 | | | | | 2 | 64,390 | \$39,601,183 | -\$5,035,975 | \$910,000 | \$45,547,158 |
| BE | | | | 1 | 1 | | | | 2 | 64,120 | \$39,287,658 | -\$5,051,181 | \$910,000 | \$45,248,839 |
| BF | | | | 1 | | 1 | | | 2 | 68,127 | \$41,652,270 | -\$5,316,308 | \$910,000 | \$47,878,578 |
| BG | | | | 1 | | | 1 | | 2 | 65,693 | \$40,205,982 | -\$4,838,983 | \$910,000 | \$45,954,965 |
| BH | | | | 1 | | | | 1 | 2 | 64,266 | \$39,170,114 | -\$4,996,290 | \$910,000 | \$45,076,404 |
| CA | 1 | | | 1 | | | | 1 | 3 | 61,247 | \$36,758,213 | -\$4,787,797 | \$1,365,000 | \$42,911,010 |
| CB | | 1 | | 1 | | | | 1 | 3 | 59,780 | \$36,664,567 | -\$4,757,038 | \$1,365,000 | \$42,786,605 |
| CC | | | 1 | 1 | | | | 1 | 3 | 61,550 | \$37,602,669 | -\$4,737,155 | \$1,365,000 | \$43,704,824 |
| CD | | | | 2 | | | | 1 | 3 | 61,640 | \$37,554,511 | -\$4,800,069 | \$1,365,000 | \$43,719,580 |
| CE | | | | 1 | 1 | | | 1 | 3 | 61,228 | \$37,330,467 | -\$4,816,819 | \$1,365,000 | \$43,512,286 |
| CF | | | | 1 | | 1 | | 1 | 3 | 62,283 | \$37,728,336 | -\$4,812,811 | \$1,365,000 | \$43,906,147 |
| CG | | | | 1 | | | 1 | 1 | 3 | 59,252 | \$35,316,853 | -\$4,740,822 | \$1,365,000 | \$41,422,675 |
| CH | | | | 1 | | | | 2 | 3 | 61,449 | \$37,188,893 | -\$4,791,484 | \$1,365,000 | \$43,345,377 |
| DA | 1 | | | 1 | | | 1 | 1 | 4 | 54,571 | \$30,382,930 | -\$4,603,357 | \$1,820,000 | \$36,806,287 |
| DB | | 1 | | 1 | | | 1 | 1 | 4 | 53,158 | \$30,384,538 | -\$4,573,625 | \$1,820,000 | \$36,778,163 |
| DC | | | 1 | 1 | | | 1 | 1 | 4 | 56,062 | \$32,768,536 | -\$4,606,169 | \$1,820,000 | \$39,194,705 |
| DD | | | | 2 | | | 1 | 1 | 4 | 58,890 | \$34,909,134 | -\$4,730,747 | \$1,820,000 | \$41,459,881 |
| DE | | | | 1 | 1 | | 1 | 1 | 4 | 58,259 | \$34,399,384 | -\$4,743,428 | \$1,820,000 | \$40,962,812 |
| DF | | | | 1 | | 1 | 1 | 1 | 4 | 57,262 | \$32,688,098 | -\$4,663,585 | \$1,820,000 | \$39,171,683 |
| DG | | | | 1 | | | 2 | 1 | 4 | 54,330 | \$31,030,788 | -\$4,630,249 | \$1,820,000 | \$37,481,037 |
| DH | | | | 1 | | | 1 | 2 | 4 | 58,582 | \$34,420,556 | -\$4,721,752 | \$1,820,000 | \$40,962,308 |

Table E-3 – Southwest GACC

| Alt. | Airtanker Bases * | | | | | | | | No AT | Acres Burned | FFF | NVC | AT Program Cost*** | C+NVC** |
|------|-------------------|-----|----|-----|-----|-----|----|----|-------|--------------|--------------|--------------|--------------------|--------------|
| | ALB | ALM | FH | PHX | PRE | ROS | SC | WI | | | | | | |
| EA | 1 | 1 | | 1 | | | 1 | 1 | 5 | 50,683 | \$28,223,655 | -\$4,515,066 | \$2,275,000 | \$35,013,721 |
| EB | | 2 | | 1 | | | 1 | 1 | 5 | 51,988 | \$29,423,981 | -\$4,548,358 | \$2,275,000 | \$36,247,339 |
| EC | | 1 | 1 | 1 | | | 1 | 1 | 5 | 51,373 | \$29,006,356 | -\$4,470,622 | \$2,275,000 | \$35,751,978 |
| ED | | 1 | | 2 | | | 1 | 1 | 5 | 52,797 | \$29,979,882 | -\$4,563,622 | \$2,275,000 | \$36,818,504 |
| EE | | 1 | | 1 | 1 | | 1 | 1 | 5 | 52,392 | \$29,756,966 | -\$4,581,034 | \$2,275,000 | \$36,613,000 |
| EF | | 1 | | 1 | | 1 | 1 | 1 | 5 | 52,900 | \$30,101,622 | -\$4,566,103 | \$2,275,000 | \$36,942,725 |
| EG | | 1 | | 1 | | | 2 | 1 | 5 | 50,700 | \$28,431,583 | -\$4,518,178 | \$2,275,000 | \$35,224,761 |
| EH | | 1 | | 1 | | | 1 | 2 | 5 | 53,107 | \$30,301,043 | -\$4,567,554 | \$2,275,000 | \$37,143,597 |
| FA | 2 | 1 | | 1 | | | 1 | 1 | 6 | 50,503 | \$27,942,726 | -\$4,507,170 | \$2,730,000 | \$35,179,896 |
| FB | 1 | 2 | | 1 | | | 1 | 1 | 6 | 50,536 | \$28,095,164 | -\$4,512,908 | \$2,730,000 | \$35,338,072 |
| FC | 1 | 1 | 1 | 1 | | | 1 | 1 | 6 | 50,242 | \$27,913,550 | -\$4,442,272 | \$2,730,000 | \$35,085,822 |
| FD | 1 | 1 | | 2 | | | 1 | 1 | 6 | 50,322 | \$27,818,999 | -\$4,505,063 | \$2,730,000 | \$35,054,062 |
| FE | 1 | 1 | | 1 | 1 | | 1 | 1 | 6 | 49,917 | \$27,596,083 | -\$4,522,475 | \$2,730,000 | \$34,848,558 |
| FF | 1 | 1 | | 1 | | 1 | 1 | 1 | 6 | 50,535 | \$28,096,793 | -\$4,512,900 | \$2,730,000 | \$35,339,693 |
| FG | 1 | 1 | | 1 | | | 2 | 1 | 6 | 50,588 | \$28,159,712 | -\$4,512,786 | \$2,730,000 | \$35,402,498 |
| FH | 1 | 1 | | 1 | | | 1 | 2 | 6 | 50,632 | \$28,141,120 | -\$4,508,995 | \$2,730,000 | \$35,380,115 |
| GA | 2 | 1 | | 1 | 1 | | 1 | 1 | 7 | 49,737 | \$27,315,154 | -\$4,514,579 | \$3,185,000 | \$35,014,733 |
| GB | 1 | 2 | | 1 | 1 | | 1 | 1 | 7 | 49,770 | \$27,467,592 | -\$4,520,317 | \$3,185,000 | \$35,172,909 |
| GC | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 7 | 49,482 | \$27,289,958 | -\$4,450,166 | \$3,185,000 | \$34,925,124 |
| GD | 1 | 1 | | 2 | 1 | | 1 | 1 | 7 | 49,888 | \$27,536,764 | -\$4,520,075 | \$3,185,000 | \$35,241,839 |
| GE | 1 | 1 | | 1 | 2 | | 1 | 1 | 7 | 49,913 | \$27,591,224 | -\$4,522,535 | \$3,185,000 | \$35,298,759 |
| GF | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 7 | 49,769 | \$27,469,221 | -\$4,520,309 | \$3,185,000 | \$35,174,530 |
| GG | 1 | 1 | | 1 | 1 | | 2 | 1 | 7 | 49,822 | \$27,532,170 | -\$4,520,195 | \$3,185,000 | \$35,237,365 |
| GH | 1 | 1 | | 1 | 1 | | 1 | 2 | 7 | 49,917 | \$27,592,222 | -\$4,522,462 | \$3,185,000 | \$35,299,684 |

* - ALB, Albuquerque; ALM, Alalamogordo; FH, Fort Huachuca; PHX, Phoenix area; PRE, Prescott; ROS, Roswell; SC, Silver City; WI, Winslow;
 ** - Annual number of fires is 2,370.
 *** - Airtanker staffing is for 70 days.

Table E-4 – Great Basin (EGB and WGB GACCs)

| Alts | Airtanker Bases * | | | | | | | | No AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|------|-------------------|----|----|----|----|----|----|----|-------|--------------|---------------|---------------|---------------------|---------------|
| | WYS | BM | BO | CC | HI | MC | MI | SD | | | | | | |
| A0 | | | | | | | | | 0 | 358,966 | \$106,912,194 | -\$50,771,288 | \$0 | \$157,683,482 |
| AA | 1 | | | | | | | | 1 | 318,039 | \$84,820,288 | -\$45,916,572 | \$650,000 | \$131,386,860 |
| AB | | 1 | | | | | | | 1 | 323,192 | \$84,725,586 | -\$46,335,531 | \$650,000 | \$131,711,117 |
| AC | | | 1 | | | | | | 1 | 317,339 | \$82,969,757 | -\$45,867,264 | \$650,000 | \$129,487,021 |
| AD | | | | 1 | | | | | 1 | 324,747 | \$87,743,713 | -\$46,846,972 | \$650,000 | \$135,240,685 |
| AE | | | | | 1 | | | | 1 | 321,345 | \$85,635,722 | -\$45,868,747 | \$650,000 | \$132,154,469 |
| AF | | | | | | 1 | | | 1 | 315,800 | \$82,048,853 | -\$45,608,159 | \$650,000 | \$128,307,012 |
| AG | | | | | | | 1 | | 1 | 324,671 | \$87,061,663 | -\$47,002,757 | \$650,000 | \$134,714,420 |
| AH | | | | | | | | 1 | 1 | 324,633 | \$87,195,385 | -\$46,672,934 | \$650,000 | \$134,518,319 |
| | | | | | | | | | | | | | | |
| BA | 1 | | | | | 1 | | | 2 | 307,896 | \$77,501,895 | -\$44,814,097 | \$1,300,000 | \$123,615,992 |
| BB | | 1 | | | | 1 | | | 2 | 308,679 | \$75,634,238 | -\$44,819,907 | \$1,300,000 | \$121,754,145 |
| BC | | | 1 | | | 1 | | | 2 | 304,571 | \$75,383,879 | -\$44,696,102 | \$1,300,000 | \$121,379,981 |
| BD | | | | 1 | | 1 | | | 2 | 309,754 | \$77,795,936 | -\$44,856,928 | \$1,300,000 | \$123,952,864 |
| BE | | | | | 1 | 1 | | | 2 | 309,491 | \$76,753,008 | -\$44,715,450 | \$1,300,000 | \$122,768,458 |
| BF | | | | | | 2 | | | 2 | 303,071 | \$75,250,496 | -\$44,684,975 | \$1,300,000 | \$121,235,471 |
| BG | | | | | | 1 | 1 | | 2 | 309,699 | \$78,777,934 | -\$44,992,632 | \$1,300,000 | \$125,070,566 |
| BH | | | | | | 1 | | 1 | 2 | 309,844 | \$77,390,696 | -\$44,983,971 | \$1,300,000 | \$123,674,667 |
| | | | | | | | | | | | | | | |
| CA | 1 | | 1 | | | 1 | | | 3 | 304,292 | \$75,179,546 | -\$44,671,224 | \$1,950,000 | \$121,800,770 |
| CB | | 1 | 1 | | | 1 | | | 3 | 303,437 | \$68,815,259 | -\$44,630,495 | \$1,950,000 | \$115,395,754 |
| CC | | | 2 | | | 1 | | | 3 | 304,137 | \$73,892,423 | -\$44,689,291 | \$1,950,000 | \$120,531,714 |
| CD | | | 1 | 1 | | 1 | | | 3 | 303,467 | \$71,519,624 | -\$44,564,262 | \$1,950,000 | \$118,033,886 |
| CE | | | 1 | | 1 | 1 | | | 3 | 303,280 | \$71,112,365 | -\$44,464,089 | \$1,950,000 | \$117,526,454 |
| CF | | | 1 | | | 2 | | | 3 | 302,206 | \$74,428,249 | -\$44,652,036 | \$1,950,000 | \$121,030,285 |
| CG | | | 1 | | | 1 | 1 | | 3 | 303,367 | \$71,062,616 | -\$44,694,165 | \$1,950,000 | \$117,706,781 |
| CH | | | 1 | | | 1 | | 1 | 3 | 303,581 | \$71,238,742 | -\$44,694,420 | \$1,950,000 | \$117,883,162 |
| | | | | | | | | | | | | | | |
| DA | 1 | 1 | 1 | | | 1 | | | 4 | 303,273 | \$68,643,716 | -\$44,614,600 | \$2,600,000 | \$115,858,316 |
| DB | | 2 | 1 | | | 1 | | | 4 | 302,584 | \$67,892,209 | -\$44,624,480 | \$2,600,000 | \$115,116,689 |
| DC | | 1 | 2 | | | 1 | | | 4 | 303,309 | \$68,784,918 | -\$44,629,925 | \$2,600,000 | \$116,014,843 |
| DD | | 1 | 1 | 1 | | 1 | | | 4 | 301,641 | \$67,685,632 | -\$44,524,533 | \$2,600,000 | \$114,810,165 |
| DE | | 1 | 1 | | 1 | 1 | | | 4 | 302,299 | \$67,718,911 | -\$44,426,765 | \$2,600,000 | \$114,745,676 |
| DF | | 1 | 1 | | | 2 | | | 4 | 301,122 | \$67,880,398 | -\$44,581,132 | \$2,600,000 | \$115,061,530 |
| DG | | 1 | 1 | | | 1 | 1 | | 4 | 301,938 | \$67,703,774 | -\$44,622,376 | \$2,600,000 | \$114,926,150 |
| DH | | 1 | 1 | | | 1 | | 1 | 4 | 302,133 | \$68,093,980 | -\$44,623,802 | \$2,600,000 | \$115,317,782 |

Table E-4 – Great Basin (EGB and WGB GACCs)

| Alts | Airtanker Bases * | | | | | | | | No AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|------|-------------------|----|----|----|----|----|----|----|-------|--------------|--------------|---------------|---------------------|---------------|
| | WYS | BM | BO | CC | HI | MC | MI | SD | | | | | | |
| EA | 1 | 1 | 1 | 1 | | 1 | | | 5 | 301,522 | \$67,527,010 | -\$44,528,355 | \$3,250,000 | \$115,305,365 |
| EB | | 2 | 1 | 1 | | 1 | | | 5 | 301,602 | \$67,200,069 | -\$44,523,417 | \$3,250,000 | \$114,973,486 |
| EC | | 1 | 2 | 1 | | 1 | | | 5 | 301,550 | \$67,655,518 | -\$44,524,303 | \$3,250,000 | \$115,429,821 |
| ED | | 1 | 1 | 2 | | 1 | | | 5 | 299,706 | \$67,011,773 | -\$44,001,162 | \$3,250,000 | \$114,262,935 |
| EE | | 1 | 1 | 1 | 1 | 1 | | | 5 | 300,753 | \$66,784,314 | -\$44,366,782 | \$3,250,000 | \$114,401,096 |
| EF | | 1 | 1 | 1 | | 2 | | | 5 | 299,326 | \$66,750,771 | -\$44,475,170 | \$3,250,000 | \$114,475,941 |
| EG | | 1 | 1 | 1 | | 1 | 1 | | 5 | 300,876 | \$66,950,489 | -\$44,519,583 | \$3,250,000 | \$114,720,072 |
| EH | | 1 | 1 | 1 | | 1 | | 1 | 5 | 301,064 | \$67,322,077 | -\$44,518,925 | \$3,250,000 | \$115,091,002 |
| FA | 1 | 1 | 1 | 1 | 1 | 1 | | | 6 | 299,134 | \$66,510,623 | -\$44,305,015 | \$3,900,000 | \$114,715,638 |
| FB | | 2 | 1 | 1 | 1 | 1 | | | 6 | 300,714 | \$66,298,751 | -\$44,365,666 | \$3,900,000 | \$114,564,417 |
| FC | | 1 | 2 | 1 | 1 | 1 | | | 6 | 300,675 | \$66,766,770 | -\$44,364,919 | \$3,900,000 | \$115,031,689 |
| FD | | 1 | 1 | 2 | 1 | 1 | | | 6 | 299,116 | \$66,378,270 | -\$43,878,621 | \$3,900,000 | \$114,156,891 |
| FE | | 1 | 1 | 1 | 2 | 1 | | | 6 | 298,283 | \$66,044,742 | -\$43,311,352 | \$3,900,000 | \$113,256,094 |
| FF | | 1 | 1 | 1 | 1 | 2 | | | 6 | 298,451 | \$65,850,724 | -\$44,315,604 | \$3,900,000 | \$114,066,328 |
| FG | | 1 | 1 | 1 | 1 | 1 | 1 | | 6 | 299,988 | \$66,049,171 | -\$44,361,832 | \$3,900,000 | \$114,311,003 |
| FH | | 1 | 1 | 1 | 1 | 1 | | 1 | 6 | 300,176 | \$66,420,759 | -\$44,361,174 | \$3,900,000 | \$114,681,933 |
| GA | 1 | 1 | 1 | 1 | 2 | 1 | | | 7 | 297,412 | \$65,882,235 | -\$43,288,532 | \$4,550,000 | \$113,720,767 |
| GB | | 2 | 1 | 1 | 2 | 1 | | | 7 | 298,244 | \$65,559,179 | -\$43,310,236 | \$4,550,000 | \$113,419,415 |
| GC | | 1 | 2 | 1 | 2 | 1 | | | 7 | 298,205 | \$66,027,198 | -\$43,309,489 | \$4,550,000 | \$113,886,687 |
| GD | | 1 | 1 | 2 | 2 | 1 | | | 7 | 296,646 | \$65,638,698 | -\$42,823,191 | \$4,550,000 | \$113,011,889 |
| GF | | 1 | 1 | 1 | 2 | 2 | | | 7 | 295,981 | \$65,111,152 | -\$43,260,174 | \$4,550,000 | \$112,921,326 |
| GG | | 1 | 1 | 1 | 2 | 1 | 1 | | 7 | 297,518 | \$65,309,599 | -\$43,306,402 | \$4,550,000 | \$113,166,001 |
| GH | | 1 | 1 | 1 | 2 | 1 | | 1 | 7 | 297,706 | \$65,681,187 | -\$43,305,744 | \$4,550,000 | \$113,536,931 |
| HA | 1 | 1 | 1 | 1 | 2 | 2 | | | 8 | 295,182 | \$64,959,076 | -\$43,227,310 | \$5,200,000 | \$113,386,386 |
| HB | | 2 | 1 | 1 | 2 | 2 | | | 8 | 295,942 | \$64,625,589 | -\$43,259,058 | \$5,200,000 | \$113,084,647 |
| HC | | 1 | 2 | 1 | 2 | 2 | | | 8 | 295,947 | \$65,098,428 | -\$43,252,290 | \$5,200,000 | \$113,550,718 |
| HD | | 1 | 1 | 2 | 2 | 2 | | | 8 | 294,344 | \$64,705,108 | -\$42,772,013 | \$5,200,000 | \$112,677,121 |
| HG | | 1 | 1 | 1 | 2 | 2 | 1 | | 8 | 295,216 | \$64,376,009 | -\$43,255,224 | \$5,200,000 | \$112,831,233 |
| HH | | 1 | 1 | 1 | 2 | 2 | | 1 | 8 | 295,404 | \$64,747,597 | -\$43,254,566 | \$5,200,000 | \$113,202,163 |
| IA | 1 | 1 | 1 | 2 | 2 | 2 | | | 9 | 293,545 | \$64,553,032 | -\$42,739,149 | \$5,850,000 | \$113,142,181 |
| IB | | 2 | 1 | 2 | 2 | 2 | | | 9 | 294,305 | \$64,219,545 | -\$42,770,897 | \$5,850,000 | \$112,840,442 |
| IC | | 1 | 2 | 2 | 2 | 2 | | | 9 | 294,310 | \$64,692,384 | -\$42,764,129 | \$5,850,000 | \$113,306,513 |
| IG | | 1 | 1 | 2 | 2 | 2 | 1 | | 9 | 293,579 | \$63,969,965 | -\$42,767,063 | \$5,850,000 | \$112,587,028 |
| IH | | 1 | 1 | 2 | 2 | 2 | | 1 | 9 | 293,767 | \$64,341,553 | -\$42,766,405 | \$5,850,000 | \$112,957,958 |

Table E-4 – Great Basin (EGB and WGB GACCs)

| Alts | Airtanker Bases * | | | | | | | | No AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|------|-------------------|----|----|----|----|----|----|----|-------|--------------|-----|-----|---------------------|----------|
| | WYS | BM | BO | CC | HI | MC | MI | SD | | | | | | |

| | | | | | | | | | | | | | | |
|----|---|---|---|---|---|---|---|---|----|---------|--------------|---------------|-------------|---------------|
| JA | 1 | 1 | 1 | 2 | 2 | 2 | 1 | | 10 | 292,780 | \$63,817,889 | -\$42,734,199 | \$6,500,000 | \$113,052,088 |
| JB | | 2 | 1 | 2 | 2 | 2 | 1 | | 10 | 293,557 | \$63,527,470 | -\$42,766,314 | \$6,500,000 | \$112,793,784 |
| JC | | 1 | 2 | 2 | 2 | 2 | 1 | | 10 | 293,545 | \$63,957,491 | -\$42,759,179 | \$6,500,000 | \$113,216,670 |
| JG | | 1 | 1 | 2 | 2 | 2 | 2 | | 10 | 293,541 | \$63,879,683 | -\$42,766,604 | \$6,500,000 | \$113,146,287 |
| JH | | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 10 | 293,548 | \$63,929,067 | -\$42,766,264 | \$6,500,000 | \$113,195,331 |

* - WYS, West Yellowstone; BM, Battle Mountain; BO, Boise; CC, Cedar City; HI, Hill; MC, McCall; MI, Minden; SD, Stead;

** - Annual number of fires is 2,730.

*** - Airtanker staffing is for 100 days.

Table E-5 – California (No. and So. Ops)

| Alt | Airtanker Bases * | | | | | | | | | | | | No. AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|-----|-------------------|----|----|----|----|----|----|----|----|----|----|--|--------|--------------|---------------|----------------|---------------------|---------------|
| | C1 | CH | FF | FR | MO | NO | PV | RE | RM | SB | SK | | | | | | | |
| A0 | | | | | | | | | | | | | 0 | 114,815 | \$129,543,498 | -\$107,526,840 | \$0 | \$237,070,338 |
| AA | 1 | | | | | | | | | | | | 1 | 60,476 | \$70,611,859 | -\$66,614,103 | \$650,000 | \$137,875,962 |
| AB | | 1 | | | | | | | | | | | 1 | 60,441 | \$70,416,127 | -\$66,572,187 | \$650,000 | \$137,638,314 |
| AC | | | 1 | | | | | | | | | | 1 | 63,295 | \$75,002,444 | -\$75,274,882 | \$650,000 | \$150,927,326 |
| AD | | | | 1 | | | | | | | | | 1 | 60,715 | \$71,420,255 | -\$68,744,070 | \$650,000 | \$140,814,325 |
| AE | | | | | | 1 | | | | | | | 1 | 70,963 | \$81,278,945 | -\$81,708,368 | \$650,000 | \$163,637,313 |
| AF | | | | | | | 1 | | | | | | 1 | 61,231 | \$72,839,390 | -\$70,025,584 | \$650,000 | \$143,514,974 |
| AG | | | | | | | | 1 | | | | | 1 | 60,525 | \$70,688,264 | -\$66,718,690 | \$650,000 | \$138,056,954 |
| AH | | | | | | | | | 1 | | | | 1 | 74,699 | \$85,692,855 | -\$92,654,963 | \$650,000 | \$178,997,818 |
| AI | | | | | | | | | | 1 | | | 1 | 63,688 | \$75,760,615 | -\$75,122,805 | \$650,000 | \$151,533,420 |
| AJ | | | | | | | | | | | 1 | | 1 | 61,229 | \$71,739,661 | -\$68,685,632 | \$650,000 | \$141,075,293 |
| AK | | | | | 1 | | | | | | | | | 64,834 | \$76,793,444 | -\$76,793,444 | \$650,000 | \$154,236,888 |
| BA | 1 | 1 | | | | | | | | | | | 2 | 57,553 | \$66,972,618 | -\$65,709,825 | \$1,300,000 | \$133,982,443 |
| BB | | 1 | 1 | | | | | | | | | | 2 | 57,344 | \$66,706,300 | -\$65,264,853 | \$1,300,000 | \$133,271,153 |
| BC | | 1 | | 1 | | | | | | | | | 2 | 56,442 | \$66,221,202 | -\$65,028,366 | \$1,300,000 | \$132,549,568 |
| BD | | 1 | | | | 1 | | | | | | | 2 | 57,621 | \$66,950,339 | -\$65,416,337 | \$1,300,000 | \$133,666,676 |
| BE | | 1 | | | | | 1 | | | | | | 2 | 57,467 | \$66,729,765 | -\$65,153,062 | \$1,300,000 | \$133,182,827 |
| BF | | 1 | | | | | | 1 | | | | | 2 | 57,767 | \$67,108,534 | -\$65,494,176 | \$1,300,000 | \$133,902,710 |
| BG | | 1 | | | | | | | 1 | | | | 2 | 58,196 | \$67,870,936 | -\$65,768,888 | \$1,300,000 | \$134,939,824 |
| BH | | 1 | | | | | | | | 1 | | | 2 | 57,815 | \$67,293,093 | -\$65,373,188 | \$1,300,000 | \$133,966,281 |
| BI | | 1 | | | | | | | | | 1 | | 2 | 56,804 | \$66,587,934 | -\$65,230,452 | \$1,300,000 | \$133,118,386 |
| CA | 1 | 1 | | 1 | | | | | | | | | 3 | 56,351 | \$65,445,711 | -\$65,265,264 | \$1,950,000 | \$132,660,975 |
| CB | | 1 | 1 | 1 | | | | | | | | | 3 | 56,620 | \$65,971,355 | -\$64,979,396 | \$1,950,000 | \$132,900,751 |
| CC | | 1 | | 1 | | 1 | | | | | | | 3 | 55,781 | \$65,374,839 | -\$64,856,259 | \$1,950,000 | \$132,181,098 |
| CD | | 1 | | 1 | | | 1 | | | | | | 3 | 55,783 | \$65,524,483 | -\$64,812,042 | \$1,950,000 | \$132,286,525 |
| CE | | 1 | | 1 | | | | 1 | | | | | 3 | 56,102 | \$65,028,862 | -\$65,023,326 | \$1,950,000 | \$132,002,188 |
| CF | | 1 | | 1 | | | | | 1 | | | | 3 | 55,933 | \$65,602,216 | -\$64,880,443 | \$1,950,000 | \$132,432,659 |
| CG | | 1 | | 1 | | | | | | 1 | | | 3 | 55,902 | \$65,654,214 | -\$64,893,504 | \$1,950,000 | \$132,497,718 |
| CH | | 1 | | 1 | | | | | | | 1 | | 3 | 56,276 | \$65,894,859 | -\$65,010,667 | \$1,950,000 | \$132,855,526 |
| DA | 1 | 1 | | 1 | | | | 1 | | | | | 4 | 53,103 | \$62,032,080 | -\$60,590,255 | \$2,600,000 | \$125,222,335 |
| DB | | 1 | 1 | 1 | | | | 1 | | | | | 4 | 55,429 | \$64,185,421 | -\$64,836,913 | \$2,600,000 | \$131,622,334 |
| DC | | 1 | | 1 | | 1 | | 1 | | | | | 4 | 55,442 | \$64,179,711 | -\$64,851,442 | \$2,600,000 | \$131,631,153 |
| DD | | 1 | | 1 | | | 1 | 1 | | | | | 4 | 55,444 | \$64,329,355 | -\$64,807,225 | \$2,600,000 | \$131,736,580 |
| DE | | 1 | | 1 | | | | 1 | 1 | | | | 4 | 55,594 | \$64,407,088 | -\$64,875,626 | \$2,600,000 | \$131,882,714 |
| DF | | 1 | | 1 | | | | 1 | | 1 | | | 4 | 55,563 | \$64,459,086 | -\$64,888,687 | \$2,600,000 | \$131,947,773 |
| DG | | 1 | | 1 | | | | 1 | | | 1 | | 4 | 55,942 | \$64,780,789 | -\$64,901,778 | \$2,600,000 | \$132,282,567 |
| DH | | 1 | | | | 1 | 1 | 1 | | | | | 4 | 55,421 | \$64,338,954 | -\$64,856,659 | \$2,600,000 | \$131,795,613 |

Table E-5 – California (No. and So. Ops)

| Alt | Airtanker Bases * | | | | | | | | | | | No. AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|---|-------------------|----|----|----|----|----|----|----|----|----|----|--------|--------------|--------------|---------------|---------------------|---------------|
| | C1 | CH | FF | FR | MO | NO | PV | RE | RM | SB | SK | | | | | | |
| EA | 1 | 1 | 1 | 1 | | | | 1 | | | | 5 | 52,432 | \$61,187,021 | -\$60,404,575 | \$3,250,000 | \$124,841,596 |
| EB | 1 | 1 | | 1 | | 1 | | 1 | | | | 5 | 52,445 | \$61,178,014 | -\$60,418,737 | \$3,250,000 | \$124,846,751 |
| EC | 1 | 1 | | 1 | | | 1 | 1 | | | | 5 | 52,447 | \$61,332,163 | -\$60,375,458 | \$3,250,000 | \$124,957,621 |
| ED | 1 | 1 | | 1 | | | | 1 | 1 | | | 5 | 52,596 | \$61,405,317 | -\$60,442,886 | \$3,250,000 | \$125,098,203 |
| EE | 1 | 1 | | 1 | | | | 1 | | 1 | | 5 | 52,566 | \$61,460,610 | -\$60,456,339 | \$3,250,000 | \$125,166,949 |
| EG | 1 | 1 | | 1 | | | | 1 | | | 1 | 5 | 52,948 | \$61,804,985 | -\$60,470,908 | \$3,250,000 | \$125,525,893 |
| FA | 1 | 1 | | 1 | 1 | 1 | | 1 | | | | 6 | 52,382 | \$60,870,987 | -\$60,282,305 | \$3,900,000 | \$125,053,292 |
| FB | 1 | 1 | | 2 | | 1 | | 1 | | | | 6 | 52,309 | \$60,987,972 | -\$60,316,906 | \$3,900,000 | \$125,204,878 |
| FC | 1 | 1 | | 1 | | 2 | | 1 | | | | 6 | 52,380 | \$61,022,129 | -\$60,385,707 | \$3,900,000 | \$125,307,836 |
| FD | 1 | 1 | | 1 | | 1 | 1 | 1 | | | | 6 | 52,287 | \$60,929,250 | -\$60,322,290 | \$3,900,000 | \$125,151,540 |
| FE | 1 | 1 | | 1 | | 1 | | 2 | | | | 6 | 52,441 | \$61,103,533 | -\$60,412,863 | \$3,900,000 | \$125,416,396 |
| FF | 1 | 1 | | 1 | | 1 | | 1 | | 1 | | 6 | 52,397 | \$60,994,087 | -\$60,401,932 | \$3,900,000 | \$125,296,019 |
| GA | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | | | 7 | 52,224 | \$60,622,223 | -\$60,185,858 | \$4,550,000 | \$125,358,081 |
| GB | 2 | 1 | | 1 | 1 | 1 | | 1 | | | | 7 | 52,382 | \$60,870,913 | -\$60,282,305 | \$4,550,000 | \$125,703,218 |
| GC | 1 | 2 | | 1 | 1 | 1 | | 1 | | | | 7 | 52,381 | \$60,863,343 | -\$60,281,954 | \$4,550,000 | \$125,695,297 |
| GD | 1 | 1 | | 2 | 1 | 1 | | 1 | | | | 7 | 52,246 | \$60,680,945 | -\$60,180,474 | \$4,550,000 | \$125,411,419 |
| GE | 1 | 1 | | 1 | 2 | 1 | | 1 | | | | 7 | 52,375 | \$60,843,697 | -\$60,279,787 | \$4,550,000 | \$125,673,484 |
| GF | 1 | 1 | | 1 | 1 | 2 | | 1 | | | | 7 | 52,317 | \$60,715,102 | -\$60,249,275 | \$4,550,000 | \$125,514,377 |
| GG | 1 | 1 | | 1 | 1 | 1 | | 2 | | | | 7 | 52,380 | \$60,810,851 | -\$60,279,978 | \$4,550,000 | \$125,640,829 |
| GH | 1 | 1 | | 1 | 1 | 1 | | 1 | | 1 | | 7 | 52,334 | \$60,687,060 | -\$60,265,500 | \$4,550,000 | \$125,502,560 |
| HA | 2 | 1 | | 1 | 1 | 1 | 1 | 1 | | | | 8 | 52,224 | \$60,622,149 | -\$60,185,858 | \$5,200,000 | \$126,008,007 |
| HB | 1 | 2 | | 1 | 1 | 1 | 1 | 1 | | | | 8 | 52,223 | \$60,614,579 | -\$60,185,507 | \$5,200,000 | \$126,000,086 |
| HC | 1 | 1 | | 2 | 1 | 1 | 1 | 1 | | | | 8 | 52,224 | \$60,622,223 | -\$60,185,858 | \$5,200,000 | \$126,008,081 |
| HD | 1 | 1 | | 1 | 2 | 1 | 1 | 1 | | | | 8 | 52,217 | \$60,594,933 | -\$60,183,340 | \$5,200,000 | \$125,978,273 |
| HE | 1 | 1 | | 1 | 1 | 2 | 1 | 1 | | | | 8 | 52,173 | \$60,463,110 | -\$60,159,602 | \$5,200,000 | \$125,822,712 |
| HF | 1 | 1 | | 1 | 1 | 1 | 2 | 1 | | | | 8 | 52,181 | \$60,606,273 | -\$60,185,168 | \$5,200,000 | \$125,991,441 |
| HG | 1 | 1 | | 1 | 1 | 1 | 1 | 2 | | | | 8 | 52,222 | \$60,562,087 | -\$60,183,531 | \$5,200,000 | \$125,945,618 |
| HI | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 | | 8 | 52,207 | \$60,489,804 | -\$60,180,952 | \$5,200,000 | \$125,870,756 |
| * - C1, Chico; CH, Chester; FF, Fox Field (Lancaster); MO, Monteague; NO, Norton (San Bernardino); PV, Porterville; RE, Redding; RM, Ramona; SB, Santa Barbara; SK, Stockton; ** - Annual number of fires is 2,363. *** - Airtanker staffing is for 100 days. | | | | | | | | | | | | | | | | | |

Table E-6 Southern GACC

| Alt. | Airtanker Bases * | | | | No. AT | Acres Burned | FFF | NVC | AT Program Cost *** | C+NVC ** |
|---|-------------------|----|----|----|--------|--------------|--------------|--------------|---------------------|--------------|
| | FV | CH | SH | LC | | | | | | |
| A0 | | | | | 0 | 31,683 | \$10,132,460 | -\$4,532,963 | \$0 | \$14,665,423 |
| AA | 1 | | | | 1 | 9,062 | \$8,183,281 | -\$1,385,513 | \$455,000 | \$10,023,794 |
| AB | | 1 | | | 1 | 8,796 | \$9,092,708 | -\$2,658,712 | \$455,000 | \$12,206,420 |
| AC | | | 1 | | 1 | 10,347 | \$10,434,430 | -\$3,014,304 | \$455,000 | \$13,903,734 |
| AD | | | | 1 | 1 | 11,499 | \$9,693,946 | -\$3,026,499 | \$455,000 | \$13,175,445 |
| BA | 2 | | | | 2 | 7,496 | \$8,730,361 | -\$1,270,629 | \$910,000 | \$10,910,990 |
| BB | 1 | 1 | | | 2 | 6,361 | \$8,381,881 | -\$1,125,026 | \$910,000 | \$10,416,907 |
| BC | 1 | | 1 | | 2 | 6,812 | \$9,258,680 | -\$1,226,374 | \$910,000 | \$11,395,054 |
| BD | 1 | | | 1 | 2 | 7,185 | \$8,813,847 | -\$1,246,285 | \$910,000 | \$10,970,132 |
| CA | 2 | 1 | | | 3 | 6,323 | \$8,374,035 | -\$1,099,885 | \$1,365,000 | \$10,838,920 |
| CB | 1 | 2 | | | 3 | 5,595 | \$7,735,577 | -\$998,345 | \$1,365,000 | \$10,098,922 |
| CC | 1 | 1 | 1 | | 3 | 5,399 | \$7,741,974 | -\$967,826 | \$1,365,000 | \$10,074,800 |
| CD | 1 | 1 | | 1 | 3 | 6,070 | \$8,256,526 | -\$1,092,078 | \$1,365,000 | \$10,713,604 |
| DA | 2 | 1 | 1 | | 4 | 6,046 | \$8,246,722 | -\$1,078,031 | \$1,820,000 | \$11,144,753 |
| DB | 1 | 2 | 1 | | 4 | 5,295 | \$7,716,395 | -\$933,489 | \$1,820,000 | \$10,469,884 |
| DC | 1 | 1 | 2 | | 4 | 5,232 | \$7,723,832 | -\$938,962 | \$1,820,000 | \$10,482,794 |
| DD | 1 | 1 | 1 | 1 | 4 | 5,282 | \$7,754,895 | -\$945,482 | \$1,820,000 | \$10,520,377 |
| * - FV, Fayetteville; CH, Chattanooga; SH, Shenandoah Valley; LC, Lake City; ** - Annual number of fires is 1,060. *** - Airtanker staffing is for 70 days. | | | | | | | | | | |

Appendix F

Documentation of Helitanker Alternatives to Support Initial Attack by GACC

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Table F-1 – Northern GACC

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|----------------------------|--------|--------------|--------------|--------------|--------------|--------------|-------------------------|
| No. AT or Helis | 44,828 | \$19,239,265 | -\$2,868,760 | \$22,108,025 | \$0 | \$22,108,025 | |
| 1 AT @ Coeur d' Alene | 33,686 | \$11,148,326 | -\$1,702,650 | \$12,850,976 | \$650,000 | \$13,500,976 | \$1,445,505 |
| 1-TI Heli @ Coeur d' Alene | 34,924 | \$11,458,219 | -\$2,007,441 | \$13,465,660 | \$1,480,821 | \$14,946,481 | |
| 1 AT @ Helena | 33,176 | \$11,406,353 | -\$1,695,432 | \$13,101,785 | \$650,000 | \$13,751,785 | \$1,036,565 |
| 1-TI Heli @ Helena | 34,673 | \$11,496,359 | -\$1,811,170 | \$13,307,529 | \$1,480,821 | \$14,788,350 | |
| 1 AT @ Missoula | 33,483 | \$10,943,500 | -\$1,726,734 | \$12,670,234 | \$650,000 | \$13,320,234 | \$416,015 |
| 1-TI Heli @ Missoula | 34,285 | \$10,500,691 | -\$1,754,737 | \$12,255,428 | \$1,480,821 | \$13,736,249 | |
| 1 AT @ Kalispell | 34,104 | \$11,550,967 | -\$1,750,484 | \$13,301,451 | \$650,000 | \$13,951,451 | \$559,726 |
| 1-TI Heli @ Kalispell | 35,006 | \$11,208,007 | -\$1,822,349 | \$13,030,356 | \$1,480,821 | \$14,511,177 | |
| Average ATs = | | | | | | \$13,631,112 | |
| Average T-1s = | | | | | | \$14,495,564 | |
| Average Difference = | | | | | | | \$864,453 |
| 1-TI Heli @ Hamilton | 34,261 | \$10,380,983 | -\$1,782,898 | \$12,163,881 | \$1,480,821 | \$13,644,702 | |
| 1-TI Heli @ Dillon | 35,006 | \$11,896,753 | -\$2,004,431 | \$13,901,184 | \$1,480,821 | \$15,382,005 | |
| 1-TI Heli @ Grangeville | 34,647 | \$11,026,553 | -\$1,821,964 | \$12,848,517 | \$1,480,821 | \$14,329,338 | |
| 1 AT @ CDL, MSO, Hel | 31,396 | \$9,892,868 | -\$1,293,231 | \$11,186,099 | \$1,950,000 | \$13,136,099 | \$2,927,502 |
| 1 T-1 Heli @ CDL, MSO, Hel | 33,390 | \$10,036,394 | -\$1,584,744 | \$11,621,138 | \$4,442,463 | \$16,063,601 | |

Table F-2 – Rocky Mountain GACC

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|----------------------------|--------|-------------|--------------|--------------|--------------|--------------|-------------------------|
| No. AT or Helis | 31,327 | \$9,303,568 | -\$7,579,171 | \$16,882,739 | \$0 | \$16,882,739 | |
| 1 AT @ Jeffco | 19,640 | \$8,718,615 | -\$5,023,430 | \$13,742,045 | \$652,500 | \$14,394,545 | \$1,539,179 |
| 1-TI Heli @ Jeffco | 20,167 | \$9,395,428 | -\$5,279,598 | \$14,675,026 | \$1,258,698 | \$15,933,724 | |
| 1 AT @ Durango | 18,261 | \$8,961,818 | -\$5,021,212 | \$13,983,030 | \$552,500 | \$14,535,530 | \$2,096,928 |
| 1-TI Heli @ Durango | 21,399 | \$9,847,399 | -\$5,526,361 | \$15,373,760 | \$1,258,698 | \$16,632,458 | |
| 1 AT @ Grand Junction | 22,924 | \$8,523,325 | -\$5,563,020 | \$14,086,345 | \$652,500 | \$14,738,845 | \$144,200 |
| 1-TI Heli @ Grand Junction | 19,239 | \$9,186,808 | -\$5,143,737 | \$14,330,545 | \$552,500 | \$14,883,045 | |
| 1 AT @ Rapid City | 19,997 | \$9,610,645 | -\$5,261,894 | \$14,872,539 | \$652,500 | \$15,525,039 | \$1,831,662 |
| 1-TI Heli @ Rapid City | 29,529 | \$9,779,324 | -\$7,024,877 | \$16,804,201 | \$552,500 | \$17,356,701 | |
| Average ATs = | | | | | | \$14,798,490 | |
| Average T-1s = | | | | | | \$16,201,482 | |
| Average Difference = | | | | | | \$1,402,992 | |
| 1-TI Heli @ Lake George | 20,689 | \$9,410,913 | -\$5,318,603 | \$14,729,516 | \$1,258,698 | \$15,988,214 | |
| 1-TI Heli @ Pueblo | 31,327 | \$9,303,568 | -\$7,579,171 | \$16,882,739 | \$1,258,698 | \$18,141,437 | |
| 1-TI Heli @ Rifle | 19,119 | \$9,103,136 | -\$5,137,508 | \$14,240,644 | \$1,258,698 | \$15,499,342 | |
| 1-TI Heli @ Craig | 18,320 | \$9,054,647 | -\$5,095,226 | \$14,149,873 | \$1,258,698 | \$15,408,571 | |
| 1-TI Heli @ Casper | 27,384 | \$9,978,464 | -\$6,492,025 | \$16,470,489 | \$1,258,698 | \$17,729,187 | |
| Average = | | | | | | \$16,553,350 | |
| 1 AT @ JC, GJ, DU | 21,051 | \$8,168,383 | -\$5,235,047 | \$13,403,430 | \$1,957,500 | \$15,360,930 | \$2,479,569 |
| 1-TI Heli @ JC, GJ, DU | 18,238 | \$9,037,025 | -\$5,027,380 | \$14,064,405 | \$3,776,094 | \$17,840,499 | |

Table F-3 – Southwest GACC

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|-------------------------------|---------|--------------|--------------|--------------|--------------|--------------|-------------------------|
| No. AT or Helis | 120,433 | \$64,421,041 | -\$8,937,119 | \$73,358,160 | \$0 | \$73,358,160 | |
| 1 AT @ Albuquerque | 82,963 | \$48,283,391 | -\$7,621,600 | \$55,904,991 | \$455,000 | \$56,359,991 | \$14,321,116 |
| 1 T1 Heli @ Albuquerque | 112,432 | \$61,144,762 | -\$8,499,770 | \$69,644,532 | \$1,036,575 | \$70,681,107 | |
| 1 AT @ Prescott | 80,290 | \$47,148,510 | -\$7,484,240 | \$54,632,750 | \$455,000 | \$55,087,750 | \$9,722,259 |
| 1 T1 Heli @ Prescott | 97,069 | \$55,336,546 | -\$8,436,888 | \$63,773,434 | \$1,036,575 | \$64,810,009 | |
| 1 AT @ Tucson | 81,485 | \$47,994,214 | -\$7,425,745 | \$55,419,959 | \$455,000 | \$55,874,959 | \$5,331,784 |
| 1 T1- Heli @ Tucson | 92,635 | \$51,785,394 | -\$8,384,774 | \$60,170,168 | \$1,036,575 | \$61,206,743 | |
| Average ATs = | | | | | | \$55,774,233 | |
| Average T-1s = | | | | | | \$65,565,953 | |
| Average Difference = | | | | | | | \$9,791,719 |
| 1 AT @ AB AL PH PR SC WI | 59,252 | \$35,316,853 | -\$4,740,822 | \$40,057,675 | \$1,365,000 | \$41,422,675 | \$12,039,662 |
| 1 T1 Heli @ AB AL PH PR SC WI | 69,205 | \$42,250,950 | -\$4,991,937 | \$47,242,887 | \$6,219,450 | \$53,462,337 | |
| 1 AT @ AB, PR, and TU | 62,182 | \$37,710,104 | -\$4,784,078 | \$42,494,182 | \$1,365,000 | \$43,859,182 | \$9,721,499 |
| 1 T1 Heli @ AB, PR and TU | 75,125 | \$44,640,487 | -\$5,830,469 | \$50,470,956 | \$3,109,725 | \$53,580,681 | |

Table F-4 – Great Basin (East and West Basin GACCs)

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|------------------------------------|---------|---------------|---------------|---------------|--------------|---------------|-------------------------|
| No. AT or Helis | 358,966 | \$106,912,194 | -\$50,771,288 | \$157,683,482 | \$0 | \$157,683,482 | |
| 1 AT @ Battle Mountain | 323,192 | \$84,725,586 | -\$46,335,531 | \$131,061,117 | \$650,000 | \$131,711,117 | \$12,365,596 |
| 1 T1 Heli @ Battle Mountain | 333,849 | \$94,099,895 | -\$48,495,997 | \$142,595,892 | \$1,480,821 | \$144,076,713 | |
| 1 AT @ Boise | 317,339 | \$82,969,757 | -\$45,867,264 | \$128,837,021 | \$650,000 | \$129,487,021 | \$17,758,690 |
| 1 T1 Heli @ Boise | 335,560 | \$98,368,635 | -\$47,396,255 | \$145,764,890 | \$1,480,821 | \$147,245,711 | |
| 1 AT @ Cedar City | 324,747 | \$87,743,713 | -\$46,846,972 | \$134,590,685 | \$650,000 | \$135,240,685 | \$12,915,229 |
| 1 T1 Heli @ Cedar City | 336,857 | \$97,644,290 | -\$49,030,803 | \$146,675,093 | \$1,480,821 | \$148,155,914 | |
| 1 AT @ Hill | 321,345 | \$85,635,722 | -\$45,868,747 | \$131,504,469 | \$650,000 | \$132,154,469 | \$14,046,903 |
| 1 T1 Heli @ Hill | 332,137 | \$97,229,208 | -\$47,491,343 | \$144,720,551 | \$1,480,821 | \$146,201,372 | |
| 1 AT @ McCall | 315,800 | \$82,048,853 | -\$45,608,159 | \$127,657,012 | \$650,000 | \$128,307,012 | \$20,693,930 |
| 1 T1 Heli @ McCall | 346,361 | \$99,404,867 | -\$48,115,254 | \$147,520,121 | \$1,480,821 | \$149,000,942 | |
| 1 AT @ Minden | 324,671 | \$87,061,663 | -\$47,002,757 | \$134,064,420 | \$650,000 | \$134,714,420 | \$14,286,522 |
| 1 T1 Heli @ Minden | 346,361 | \$99,404,867 | -\$48,115,254 | \$147,520,121 | \$1,480,821 | \$149,000,942 | |
| Average ATs = | | | | | | \$131,935,787 | |
| Average T-1s = | | | | | | \$147,280,266 | |
| Average Difference = | | | | | | \$15,344,478 | |
| 1 T1 Heli @ Salmon | 341,341 | \$99,249,867 | -\$47,688,643 | \$146,938,510 | \$1,480,821 | \$148,419,331 | |
| 1 AT @ BM, BO, CC, HI, MC, MI | 299,988 | \$66,049,171 | -\$44,361,832 | \$110,411,003 | \$3,900,000 | \$114,311,003 | \$23,078,926 |
| 1 T1 Heli @ BM, BO, CC, HI, MC, MI | 316,814 | \$82,853,770 | -\$45,651,233 | \$128,505,003 | \$8,884,926 | \$137,389,929 | |

Table F-5 – California (No. and So. Ops GACCs)

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|------------------------------------|---------|---------------|----------------|---------------|--------------|---------------|-------------------------|
| No. AT or Helis | 114,815 | \$129,543,498 | -\$107,526,840 | \$237,070,338 | \$0 | \$237,070,338 | |
| 1 AT @ Chico | 60,476 | \$70,611,859 | -\$66,614,103 | \$137,225,962 | \$650,000 | \$137,875,962 | \$19,005,852 |
| 1 T1 Heli @ Chico | 67,635 | \$82,610,292 | -\$72,790,701 | \$155,400,993 | \$1,480,821 | \$156,881,814 | |
| 1 AT @ Chester | 60,441 | \$70,416,127 | -\$66,572,187 | \$136,988,314 | \$650,000 | \$137,638,314 | \$19,630,936 |
| 1 T1 Heli @ Chester | 68,493 | \$82,953,470 | -\$72,834,959 | \$155,788,429 | \$1,480,821 | \$157,269,250 | |
| 1 AT @ Montague | 64,834 | \$76,793,444 | -\$76,793,444 | \$153,586,888 | \$650,000 | \$154,236,888 | \$9,118,484 |
| 1 T1- Heli @ Montique | 69,673 | \$86,606,370 | -\$75,268,181 | \$161,874,551 | \$1,480,821 | \$163,355,372 | |
| 1 AT @ Norton | 70,963 | \$81,278,945 | -\$81,708,368 | \$162,987,313 | \$650,000 | \$163,637,313 | \$57,201,234 |
| 1 T1- Heli @ Norton | 95,721 | \$117,352,663 | -\$102,005,063 | \$219,357,726 | \$1,480,821 | \$220,838,547 | |
| 1 AT @ Redding | 60,525 | \$70,688,264 | -\$66,718,690 | \$137,406,954 | \$650,000 | \$138,056,954 | \$17,711,058 |
| 1 T-1 Heli @ Redding | 67,737 | \$82,515,469 | -\$71,771,722 | \$154,287,191 | \$1,480,821 | \$155,768,012 | |
| 1 AT @ Santa Barbara | 63,688 | \$75,760,615 | -\$75,122,805 | \$150,883,420 | \$650,000 | \$151,533,420 | \$66,930,259 |
| 1 T1 Heli @ Santa Barbara | 94,176 | \$115,650,616 | -\$101,332,242 | \$216,982,858 | \$1,480,821 | \$218,463,679 | |
| Average ATs = | | | | | | \$147,163,142 | |
| Average T-1s = | | | | | | \$178,762,779 | |
| Average Difference = | | | | | | \$31,599,637 | |
| 1 T1 Heli @ Quincy | 66,330 | \$79,891,223 | -\$65,920,740 | \$145,811,963 | \$1,480,821 | \$147,292,784 | |
| 1 T1 Heli @ Van Nuys | 94,252 | \$116,134,445 | -\$101,770,942 | \$217,905,387 | \$1,480,821 | \$219,386,208 | |
| 1 T1 Heli @ Mariposa | 91,207 | \$107,518,417 | -\$88,735,319 | \$196,253,736 | \$1,480,821 | \$197,734,557 | |
| 1 T1 Heli @ Hemet | 96,040 | \$117,457,265 | -\$102,483,181 | \$219,940,446 | \$1,480,821 | \$221,421,267 | |
| 1 T1 Heli @ Casitas | 95,301 | \$116,892,643 | -\$101,938,303 | \$218,830,946 | \$1,480,821 | \$220,311,767 | |
| 1 T1 Heli @ Bighill | 69,201 | \$83,414,967 | -\$68,202,301 | \$151,617,268 | \$1,480,821 | \$153,098,089 | |
| Average = | | | | | | \$193,207,445 | |
| 1 AT @ C1, CH, FR, MO, RD, NO | 52,382 | \$60,870,987 | -\$60,282,305 | \$121,153,292 | \$3,900,000 | \$125,053,292 | \$13,947,192 |
| 1 T1 Heli @ C1, CH, FR, MO, RD, NO | 57,221 | \$70,519,457 | -\$59,596,101 | \$130,115,558 | \$8,884,926 | \$139,000,484 | |

Table F-6 – Northwest GACC

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|--|--------|--------------|---------------|---------------|--------------|---------------|-------------------------|
| No. AT or Helis | 61,496 | \$58,814,963 | -\$62,072,265 | \$120,887,228 | \$0 | \$120,887,228 | |
| 1 AT @ Redmond | 51,771 | \$45,254,997 | -\$51,017,138 | \$96,272,135 | \$650,000 | \$96,922,135 | \$11,413,936 |
| 1-TI Heli @ Redmond | 56,426 | \$51,063,391 | -\$55,791,859 | \$106,855,250 | \$1,480,821 | \$108,336,071 | |
| 1 AT @ Moses Lake | 51,412 | \$46,141,776 | -\$52,115,170 | \$98,256,946 | \$650,000 | \$98,906,946 | \$13,851,670 |
| 1-TI Heli @ Lake Chelan | 56,581 | \$53,703,086 | -\$57,574,709 | \$111,277,795 | \$1,480,821 | \$112,758,616 | |
| 1 AT @ LaGrande | 47,370 | \$42,639,981 | -\$50,512,621 | \$93,152,602 | \$650,000 | \$93,802,602 | \$15,017,105 |
| 1-TI Heli @ LaGrande | 54,078 | \$51,723,785 | -\$55,615,101 | \$107,338,886 | \$1,480,821 | \$108,819,707 | |
| 1 AT @ Klamath Falls | 52,867 | \$46,994,193 | -\$52,158,683 | \$99,152,876 | \$650,000 | \$99,802,876 | \$13,150,899 |
| 1-TI Heli @ Klamath Falls | 58,514 | \$53,051,305 | -\$58,421,649 | \$111,472,954 | \$1,480,821 | \$112,953,775 | |
| 1 AT @ Medford | 53,270 | \$47,522,152 | -\$52,421,563 | \$99,943,715 | \$650,000 | \$100,593,715 | \$12,893,254 |
| 1-TI Heli @ Medford | 58,826 | \$53,434,950 | -\$58,571,198 | \$112,006,148 | \$1,480,821 | \$113,486,969 | |
| Average ATs = | | | | | | \$98,005,655 | |
| Average T-1s = | | | | | | \$111,271,028 | |
| Average Difference = | | | | | | | \$13,265,373 |
| 1-TI Heli @ John Day | 55,188 | \$51,833,275 | -\$55,421,050 | \$107,254,325 | \$1,480,821 | \$108,735,146 | |
| 1-TI Heli @ Oakridge | 57,715 | \$52,130,364 | -\$56,674,822 | \$108,805,186 | \$1,480,821 | \$110,286,007 | |
| 1-TI Heli @ Roseburg | 60,670 | \$56,925,320 | -\$61,455,914 | \$118,381,234 | \$1,480,821 | \$119,862,055 | |
| Average = | | | | | | \$112,538,559 | |
| 2 Each AT @ KF, LaG, RD, and MS | 31,259 | \$27,692,439 | -\$35,593,099 | \$63,285,538 | \$5,200,000 | \$68,485,538 | \$25,208,127 |
| 1 T-1 Heli @ LC, KF, JD, LaG, OR, RD, RO, WE | 45,921 | \$38,294,482 | -\$43,552,615 | \$81,847,097 | \$11,846,568 | \$93,693,665 | |

Table F-7 – Southern GACC

| Description | Acres | FFF | NVC | FFF+NVC | Program Cost | C+NVC | Diff. Between AT & Heli |
|-------------------------------|--------|--------------|--------------|--------------|--------------|--------------|-------------------------|
| No. AT or Helis | 31,683 | \$10,132,460 | -\$4,532,963 | \$14,665,423 | \$0 | \$14,665,423 | |
| 1 AT @ Fayetteville | 9,062 | \$8,183,281 | -\$1,385,513 | \$9,568,794 | \$455,000 | \$10,023,794 | \$4,429,115 |
| 1-TI Heli @ Fayetteville | 28,144 | \$9,919,266 | -\$3,497,083 | \$13,416,349 | \$1,036,560 | \$14,452,909 | |
| 1 AT @ Chattanooga | 8,796 | \$9,092,708 | -\$2,658,712 | \$11,751,420 | \$455,000 | \$12,206,420 | \$3,631,857 |
| 1-TI Heli @ Chattanooga | 12,650 | \$10,813,973 | -\$3,987,744 | \$14,801,717 | \$1,036,560 | \$15,838,277 | |
| 1 AT @ Shenandoah Valley | 10,347 | \$10,434,430 | -\$3,014,304 | \$13,448,734 | \$455,000 | \$13,903,734 | \$2,265,767 |
| 1-TI Heli @ Shenandoah Valley | 31,561 | \$10,517,882 | -\$4,615,059 | \$15,132,941 | \$1,036,560 | \$16,169,501 | |
| 1 AT @ Lake City | 11,499 | \$9,693,946 | -\$3,026,499 | \$12,720,445 | \$455,000 | \$13,175,445 | \$2,922,962 |
| 1-TI Heli @ Lake City | 31,717 | \$10,403,643 | -\$4,658,204 | \$15,061,847 | \$1,036,560 | \$16,098,407 | |
| Average ATs = | | | | | | \$12,327,348 | |
| Average T-1s = | | | | | | \$15,639,774 | |
| Average Difference = | | | | | | | \$3,312,425 |
| 1 AT @ FV, CH, SV | 5,399 | \$7,741,974 | -\$967,826 | \$8,709,800 | \$1,365,000 | \$10,074,800 | \$6,212,582 |
| 1 T-1 Heli @ FV, CH, SV | 8,865 | \$10,441,680 | -\$2,736,022 | \$13,177,702 | \$3,109,680 | \$16,287,382 | |

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Appendix G

Documentation of Analysis of Example Fixed-Wing Airtanker Platforms

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**Albuquerque Service Area –
NF (Carson, Cibola, Gila, Lincoln, Santa Fe) Blm - (Albuquerque)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|----------------------|-------------|---------------|---------------------|-------------------------------|-------------------------|--------------------------------------|---------------------|----------------------------|
| TA GEN AT | AB | 17 | 73 | \$46,457 | -\$2,164 | | \$48,621 | |
| | G2 | 37 | 176 | \$374,319 | -\$17,017 | | \$391,336 | |
| | G3 | 111 | 408 | \$542,074 | -\$8,382 | | \$550,456 | |
| | G6 | 261 | 15,311 | \$14,008,960 | -\$1,082,479 | | \$15,091,439 | |
| | G8 | 59 | 904 | \$554,008 | -\$15,178 | | \$569,186 | |
| | H0 | 143 | 671 | \$1,696,526 | -\$28,258 | | \$1,724,784 | |
| | | | | Daily Availability | \$6,500 | \$1,300,000 | | |
| Totals | 628 | 17,543 | \$17,222,344 | -\$1,153,478 | \$1,300,000 | \$19,675,822 | \$0 | |
| TB Q200 | AB | 17 | 73 | \$45,355 | -\$2,164 | | \$47,519 | |
| | G2 | 37 | 111 | \$274,082 | -\$7,723 | | \$281,805 | |
| | G3 | 111 | 415 | \$527,253 | -\$9,037 | | \$536,290 | |
| | G6 | 261 | 15,422 | \$14,094,337 | -\$1,083,292 | | \$15,177,629 | |
| | G8 | 59 | 1,815 | \$761,763 | -\$227,687 | | \$989,450 | |
| | H0 | 143 | 2,838 | \$4,696,219 | -\$105,255 | | \$4,801,474 | |
| | | | | Daily Availability | \$7,507 | \$1,501,400 | | |
| Totals | 628 | 20,674 | \$20,399,009 | \$1,501,400 | \$1,501,400 | \$23,335,567 | -\$3,659,745 | |
| TC Q400 | AB | 17 | 73 | \$46,484 | -\$2,164 | | \$48,648 | |
| | G2 | 37 | 176 | \$374,720 | -\$17,021 | | \$391,741 | |
| | G3 | 111 | 408 | \$544,066 | -\$8,382 | | \$552,448 | |
| | G6 | 261 | 15,309 | \$14,009,421 | -\$1,082,417 | | \$15,091,838 | |
| | G8 | 59 | 972 | \$624,312 | -\$17,651 | | \$641,963 | |
| | H0 | 143 | 847 | \$1,943,922 | -\$36,035 | | \$1,979,957 | |
| | | | | Daily Availability | \$18,226 | \$3,645,200 | | |
| Totals | 628 | 17,785 | \$17,542,925 | \$3,645,200 | \$3,645,200 | \$22,351,795 | -\$2,675,973 | |

**Albuquerque Service Area –
NF (Carson, Cibola, Gila, Lincoln, Santa Fe) Blm - (Albuquerque)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------------------------|------------|---------------|---------------------|------------------------|--------------------|-------------------------------|---------------------|---------------------|
| TD BAE 146 | AB | 17 | 73 | \$47,762 | -\$2,164 | | \$49,926 | |
| | G2 | 37 | 111 | \$290,607 | -\$7,699 | | \$298,306 | |
| | G3 | 111 | 408 | \$585,379 | -\$8,382 | | \$593,761 | |
| | G6 | 261 | 15,311 | \$14,089,990 | -\$1,082,886 | | \$15,172,876 | |
| | G8 | 59 | 897 | \$596,605 | -\$14,956 | | \$611,561 | |
| | H0 | 143 | 285 | \$1,158,841 | -\$5,235 | | \$1,164,076 | |
| | | | | Daily Availability | \$8,107 | \$1,621,400 | | |
| Totals | 628 | 17,085 | \$16,769,184 | \$1,621,400 | \$1,621,400 | \$19,511,906 | \$163,916 | |
| TG C130 E Military | AB | 17 | 73 | \$47,829 | -\$2,164 | | \$49,993 | |
| | G2 | 37 | 111 | \$289,779 | -\$7,692 | | \$297,471 | |
| | G3 | 111 | 408 | \$588,681 | -\$8,382 | | \$597,063 | |
| | G6 | 261 | 10,625 | \$10,366,854 | -\$977,928 | | \$11,344,782 | |
| | G8 | 59 | 654 | \$425,979 | -\$10,568 | | \$436,547 | |
| | H0 | 143 | 284 | \$1,153,189 | -\$5,227 | | \$1,158,416 | |
| | | | | Daily Availability | \$6,797 | \$1,359,400 | | |
| Totals | 628 | 12,155 | \$12,872,311 | \$1,359,400 | \$1,359,400 | \$15,243,672 | \$4,432,150 | |
| TH C130 E Comm | AB | 17 | 73 | \$47,829 | -\$2,164 | | \$49,993 | |
| | G2 | 37 | 111 | \$289,779 | -\$7,692 | | \$297,471 | |
| | G3 | 111 | 408 | \$588,681 | -\$8,382 | | \$597,063 | |
| | G6 | 261 | 10,625 | \$10,366,854 | -\$977,928 | | \$11,344,782 | |
| | G8 | 59 | 654 | \$425,979 | -\$10,568 | | \$436,547 | |
| | H0 | 143 | 284 | \$1,153,189 | -\$5,227 | | \$1,158,416 | |
| | | | | Daily Availability | \$14,393 | \$2,878,600 | | |
| Totals | 628 | 12,155 | \$12,872,311 | \$2,878,600 | \$2,878,600 | \$16,762,872 | \$2,912,950 | |
| TI S3 | AB | 17 | 73 | \$45,825 | -\$2,164 | | \$47,989 | |
| | G2 | 37 | 111 | \$278,487 | -\$7,707 | | \$286,194 | |
| | G3 | 111 | 408 | \$529,198 | -\$8,382 | | \$537,580 | |
| | G6 | 261 | 15,317 | \$13,988,856 | -\$1,082,752 | | \$15,071,608 | |
| | G8 | 59 | 1,643 | \$737,101 | -\$222,089 | | \$959,190 | |
| | H0 | 143 | 2,607 | \$4,381,166 | -\$100,372 | | \$4,481,538 | |
| | | | | Daily Availability | \$5,052 | \$1,010,400 | | |
| Totals | 628 | 20,159 | \$19,960,633 | -\$1,423,466 | \$1,010,400 | \$22,394,499 | -\$2,718,677 | |

**Boise Service Area –
NF (Boise, Humboldt, Salmon, Sawtooth)
BLM - (Boise, Burley, Elko, Idaho Falls, Shoshone, Winnamuca)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------------|------------|----------------|---------------------|------------------------|--------------------|-------------------------------|---------------------|---------------------|
| TA Generic | BO | 117 | 31,535 | \$1,864,909 | -\$4,085,607 | | \$5,950,516 | |
| | BU | 39 | 12,408 | \$500,318 | -\$3,299,657 | | \$3,799,975 | |
| | EK | 97 | 28,555 | \$1,325,726 | -\$785,121 | | \$2,110,847 | |
| | IF | 58 | 8,281 | \$1,032,381 | -\$2,297,603 | | \$3,329,984 | |
| | J2 | 130 | 3,493 | \$2,654,430 | -\$3,708,708 | | \$6,363,138 | |
| | J9 | 23 | 6,063 | \$853,134 | -\$256,310 | | \$1,109,444 | |
| | K3 | 109 | 10,705 | \$6,932,464 | -\$372,416 | | \$7,304,880 | |
| | K4 | 53 | 2,247 | \$1,973,452 | -\$586,608 | | \$2,560,060 | |
| | SH | 62 | 36,093 | \$996,777 | -\$8,488,697 | | \$9,485,474 | |
| | WI | 73 | 14,715 | \$862,864 | -\$299,140 | | \$1,162,004 | |
| | | | | Daily Availability | \$6,500 | \$1,300,000 | | |
| Totals | 761 | 154,095 | \$18,996,455 | -\$24,179,867 | \$1,300,000 | \$44,476,322 | \$0 | |
| TB Q200 | BO | 117 | 33,770 | \$1,794,512 | -\$4,279,261 | | \$6,073,773 | |
| | BU | 39 | 12,466 | \$493,352 | -\$3,311,384 | | \$3,804,736 | |
| | EK | 97 | 28,739 | \$1,142,707 | -\$788,512 | | \$1,931,219 | |
| | IF | 58 | 8,379 | \$1,002,926 | -\$2,323,041 | | \$3,325,967 | |
| | J2 | 130 | 3,717 | \$2,924,305 | -\$3,797,057 | | \$6,721,362 | |
| | J9 | 23 | 6,781 | \$918,814 | -\$284,154 | | \$1,202,968 | |
| | K3 | 109 | 12,726 | \$7,912,218 | -\$455,499 | | \$8,367,717 | |
| | K4 | 53 | 2,464 | \$2,113,116 | -\$658,731 | | \$2,771,847 | |
| | SH | 62 | 36,093 | \$993,610 | -\$8,488,697 | | \$9,482,307 | |
| | WI | 73 | 14,736 | \$833,708 | -\$299,495 | | \$1,133,203 | |
| | | | | Daily Availability | \$7,507 | \$1,501,400 | | |
| Totals | 761 | 159,871 | \$20,129,268 | -\$24,685,831 | \$1,501,400 | \$46,316,499 | -\$1,840,177 | |

**Boise Service Area –
NF (Boise, Humboldt, Salmon, Sawtooth)
BLM - (Boise, Burley, Elko, Idaho Falls, Shoshone, Winnamucca)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------------|------------|----------------|---------------------|------------------------|----------------------|-------------------------------|---------------------|---------------------|
| TC Q400 | BO | 117 | 31,578 | \$1,869,289 | -\$4,090,162 | | \$5,959,451 | |
| | BU | 39 | 12,408 | \$500,953 | -\$3,299,548 | | \$3,800,501 | |
| | EK | 97 | 28,664 | \$1,276,986 | -\$787,124 | | \$2,064,110 | |
| | IF | 58 | 8,284 | \$1,027,696 | -\$2,298,407 | | \$3,326,103 | |
| | J2 | 130 | 3,554 | \$2,717,373 | -\$3,710,163 | | \$6,427,536 | |
| | J9 | 23 | 6,071 | \$855,730 | -\$256,554 | | \$1,112,284 | |
| | K3 | 109 | 11,178 | \$7,127,128 | -\$389,769 | | \$7,516,897 | |
| | K4 | 53 | 2,266 | \$1,984,952 | -\$592,511 | | \$2,577,463 | |
| | SH | 62 | 36,093 | \$996,926 | -\$8,488,697 | | \$9,485,623 | |
| | WI | 73 | 14,724 | \$854,914 | -\$299,312 | | \$1,154,226 | |
| | | | | Daily Availability | \$18,226 | \$3,645,200 | | |
| Totals | 761 | 154,820 | \$19,211,947 | | -\$24,212,247 | \$3,645,200 | \$47,069,394 | -\$2,593,072 |
| TD BAE 146 | BO | 117 | 32,086 | \$1,855,581 | -\$4,165,165 | | \$6,020,746 | |
| | BU | 39 | 12,404 | \$513,129 | -\$3,298,253 | | \$3,811,382 | |
| | EK | 97 | 28,627 | \$1,422,987 | -\$786,421 | | \$2,209,408 | |
| | IF | 58 | 8,245 | \$1,097,001 | -\$2,288,475 | | \$3,385,476 | |
| | J2 | 130 | 3,386 | \$2,625,768 | -\$3,706,676 | | \$6,332,444 | |
| | J9 | 23 | 6,246 | \$901,248 | -\$261,873 | | \$1,163,121 | |
| | K3 | 109 | 8,394 | \$5,937,203 | -\$304,009 | | \$6,241,212 | |
| | K4 | 53 | 2,247 | \$1,984,609 | -\$585,702 | | \$2,570,311 | |
| | SH | 62 | 36,093 | \$1,000,598 | -\$8,488,697 | | \$9,489,295 | |
| | WI | 73 | 14,718 | \$887,748 | -\$299,214 | | \$1,186,962 | |
| | | | | Daily Availability | \$8,107 | \$1,621,400 | | |
| Totals | 761 | 152,446 | \$18,225,872 | | -\$24,184,485 | \$1,621,400 | \$44,031,757 | \$444,565 |

**Boise Service Area –
NF (Boise, Humboldt, Salmon, Sawtooth)
BLM - (Boise, Burley, Elko, Idaho Falls, Shoshone, Winnamucca)
100 = Days of Availability for 1st Air Tanker
100 = Days of Availability for 2nd Air Tanker**

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|--------------------|-------------|----------------|---------------------|-------------------------------|-------------------------|--------------------------------------|--------------------|----------------------------|
| TG | BO | 117 | 31,957 | \$1,832,443 | -\$4,134,075 | | \$5,966,518 | |
| C 130 E | BU | 39 | 12,815 | \$492,567 | -\$3,421,849 | | \$3,914,416 | |
| Military | EK | 97 | 28,648 | \$1,158,951 | -\$787,583 | | \$1,946,534 | |
| | IF | 58 | 8,330 | \$1,005,549 | -\$2,310,148 | | \$3,315,697 | |
| | J2 | 130 | 3,521 | \$2,715,181 | -\$3,752,439 | | \$6,467,620 | |
| | J9 | 23 | 7,547 | \$971,854 | -\$317,011 | | \$1,288,865 | |
| | K3 | 109 | 7,447 | \$5,530,624 | -\$263,126 | | \$5,793,750 | |
| | K4 | 53 | 1,970 | \$1,802,574 | -\$522,762 | | \$2,325,336 | |
| | SH | 62 | 36,093 | \$988,764 | -\$8,488,697 | | \$9,477,461 | |
| | WI | 73 | 14,701 | \$876,490 | -\$298,968 | | \$1,175,458 | |
| | | | | | | | Daily Availability | \$6,797 |
| Totals | 761 | 153,029 | \$17,374,997 | -\$24,296,658 | \$1,359,400 | \$43,031,055 | \$1,445,267 | |
| TH | BO | 117 | 31,957 | \$1,832,443 | -\$4,134,075 | | \$5,966,518 | |
| C 130 E | BU | 39 | 12,815 | \$492,567 | -\$3,421,849 | | \$3,914,416 | |
| Comm | EK | 97 | 28,648 | \$1,158,951 | -\$787,583 | | \$1,946,534 | |
| | IF | 58 | 8,330 | \$1,005,549 | -\$2,310,148 | | \$3,315,697 | |
| | J2 | 130 | 3,521 | \$2,715,181 | -\$3,752,439 | | \$6,467,620 | |
| | J9 | 23 | 7,547 | \$971,854 | -\$317,011 | | \$1,288,865 | |
| | K3 | 109 | 7,447 | \$5,530,624 | -\$263,126 | | \$5,793,750 | |
| | K4 | 53 | 1,970 | \$1,802,574 | -\$522,762 | | \$2,325,336 | |
| | SH | 62 | 36,093 | \$988,764 | -\$8,488,697 | | \$9,477,461 | |
| | WI | 73 | 14,701 | \$876,490 | -\$298,968 | | \$1,175,458 | |
| | | | | | | | Daily Availability | \$14,393 |
| Totals | 761 | 153,029 | \$17,374,997 | -\$24,296,658 | \$2,878,600 | \$44,550,255 | -\$73,933 | |

**Boise Service Area –
 NF (Boise, Humboldt, Salmon, Sawtooth)
 BLM - (Boise, Burley, Elko, Idaho Falls, Shoshone, Winnamuca)
 100 = Days of Availability for 1st Air Tanker
 100 = Days of Availability for 2nd Air Tanker**

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|--------------------|-------------|----------------|---------------------|-------------------------------|-------------------------|--------------------------------------|---------------------|----------------------------|
| TI | BO | 117 | 32,796 | \$1,851,574 | -\$4,205,059 | | \$6,056,633 | |
| S3 | BU | 39 | 12,426 | \$496,041 | -\$3,303,945 | | \$3,799,986 | |
| | EK | 97 | 28,736 | \$1,215,924 | -\$788,437 | | \$2,004,361 | |
| | IF | 58 | 8,360 | \$1,024,190 | -\$2,318,111 | | \$3,342,301 | |
| | J2 | 130 | 3,695 | \$2,872,745 | -\$3,796,644 | | \$6,669,389 | |
| | J9 | 23 | 6,275 | \$876,127 | -\$262,728 | | \$1,138,855 | |
| | K3 | 109 | 12,677 | \$7,882,284 | -\$442,330 | | \$8,324,614 | |
| | K4 | 53 | 2,311 | \$2,030,053 | -\$604,875 | | \$2,634,928 | |
| | SH | 62 | 36,093 | \$995,033 | -\$8,488,697 | | \$9,483,730 | |
| | WI | 73 | 14,731 | \$844,132 | -\$299,420 | | \$1,143,552 | |
| | | | | Daily Availability | \$5,052 | \$1,010,400 | | |
| Totals | 761 | 158,100 | \$20,088,103 | -\$24,510,246 | \$1,010,400 | \$45,608,749 | -\$1,132,427 | |

**Klamath Falls Service Area –
 NF (Klamath, Modoc, Shasta-Trinity, Deschutes, Fremont, Rogue River, Umpqua, Winema)
 BLM - (Lakeview, Susanville)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------------|---------------|-------------|---------------------|-------------------------------|-------------------------|--------------------------------------|---------------------|----------------------------|
| TA Generic | LA | 64 | 4,352 | \$467,451 | -\$66,093 | | \$533,544 | |
| | M5 | 166 | 10,314 | \$13,299,161 | -\$17,674,878 | | \$30,974,039 | |
| | M9 | 113 | 3,763 | \$2,861,202 | -\$2,461,512 | | \$5,322,714 | |
| | N4 | 200 | 2,873 | \$8,094,768 | -\$5,853,650 | | \$13,948,418 | |
| | P1 | 190 | 1,077 | \$1,096,416 | -\$990,562 | | \$2,086,978 | |
| | P2 | 87 | 1,537 | \$2,765,710 | -\$1,710,283 | | \$4,475,993 | |
| | Q0 | 74 | 30 | \$293,138 | -\$29,633 | | \$322,771 | |
| | Q5 | 98 | 420 | \$1,398,676 | -\$2,033,476 | | \$3,432,152 | |
| | R0 | 84 | 2,677 | \$1,786,764 | -\$3,287,737 | | \$5,074,501 | |
| | SU | 61 | 4,238 | \$387,245 | -\$480,887 | | \$868,132 | |
| | | | | | \$6,500 | \$1,300,000 | | |
| | Totals | 1137 | 31,281 | \$32,450,531 | -\$34,588,711 | \$1,300,000 | \$68,339,242 | \$0 |
| TB Q200 | LA | 64 | 7,822 | \$578,801 | -\$93,836 | | \$672,637 | |
| | M5 | 166 | 10,644 | \$13,669,648 | -\$17,694,518 | | \$31,364,166 | |
| | M9 | 113 | 4,863 | \$3,839,620 | -\$2,837,069 | | \$6,676,689 | |
| | N4 | 200 | 2,992 | \$8,433,253 | -\$6,095,145 | | \$14,528,398 | |
| | P1 | 190 | 1,145 | \$1,212,094 | -\$1,043,935 | | \$2,256,029 | |
| | P2 | 87 | 1,652 | \$3,178,819 | -\$1,793,338 | | \$4,972,157 | |
| | Q0 | 74 | 30 | \$240,780 | -\$29,801 | | \$270,581 | |
| | Q5 | 98 | 531 | \$1,693,398 | -\$2,686,528 | | \$4,379,926 | |
| | R0 | 84 | 2,694 | \$1,835,601 | -\$3,303,416 | | \$5,139,017 | |
| | SU | 61 | 4,264 | \$385,657 | -\$483,294 | | \$868,951 | |
| | | | | | \$7,507 | \$1,501,400 | | |
| | Totals | 1137 | 36,637 | \$35,067,671 | -\$36,060,880 | \$1,501,400 | \$72,629,951 | -\$4,290,709 |

**Klamath Falls Service Area –
 NF (Klamath, Modoc, Shasta-Trinity, Deschutes, Fremont, Rogue River, Umpqua, Winema)
 BLM - (Lakeview, Susanville)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------------|---------------|-------------|---------------|------------------------|----------------------|-------------------------------|---------------------|---------------------|
| TC Q400 | LA | 64 | 5,056 | \$487,201 | -\$72,054 | | \$559,255 | |
| | M5 | 166 | 10,315 | \$13,302,157 | -\$17,675,985 | | \$30,978,142 | |
| | M9 | 113 | 3,764 | \$2,870,086 | -\$2,461,741 | | \$5,331,827 | |
| | N4 | 200 | 2,875 | \$8,148,914 | -\$5,856,427 | | \$14,005,341 | |
| | P1 | 190 | 1,118 | \$1,189,794 | -\$1,029,631 | | \$2,219,425 | |
| | P2 | 87 | 1,539 | \$2,767,756 | -\$1,711,518 | | \$4,479,274 | |
| | Q0 | 74 | 31 | \$298,209 | -\$30,028 | | \$328,237 | |
| | Q5 | 98 | 423 | \$1,409,235 | -\$2,051,540 | | \$3,460,775 | |
| | R0 | 84 | 2,677 | \$1,789,493 | -\$3,288,476 | | \$5,077,969 | |
| | SU | 61 | 4,241 | \$389,576 | -\$481,169 | | \$870,745 | |
| | | | | | | \$18,226 | \$3,645,200 | |
| | Totals | 1137 | 32,039 | \$32,652,421 | -\$34,658,569 | \$3,645,200 | \$70,956,190 | -\$2,616,948 |
| TD BAE-146 | LA | 64 | 3,675 | \$459,756 | -\$62,259 | | \$522,015 | |
| | M5 | 166 | 10,305 | \$13,275,835 | -\$17,657,762 | | \$30,933,597 | |
| | M9 | 113 | 3,495 | \$2,652,469 | -\$2,181,398 | | \$4,833,867 | |
| | N4 | 200 | 2,847 | \$8,358,757 | -\$5,801,920 | | \$14,160,677 | |
| | P1 | 190 | 1,070 | \$1,117,075 | -\$984,566 | | \$2,101,641 | |
| | P2 | 87 | 1,506 | \$2,710,658 | -\$1,689,218 | | \$4,399,876 | |
| | Q0 | 74 | 31 | \$362,618 | -\$29,947 | | \$392,565 | |
| | Q5 | 98 | 286 | \$1,019,911 | -\$1,226,898 | | \$2,246,809 | |
| | R0 | 84 | 2,671 | \$1,778,897 | -\$3,282,091 | | \$5,060,988 | |
| | SU | 61 | 4,247 | \$394,285 | -\$481,764 | | \$876,049 | |
| | | | | | | \$8,107 | \$1,621,400 | |
| | Totals | 1137 | 30,133 | \$32,130,261 | -\$33,397,823 | \$1,621,400 | \$67,149,484 | \$1,189,758 |

**Klamath Falls Service Area –
 NF (Klamath, Modoc, Shasta-Trinity, Deschutes, Fremont, Rogue River, Umpqua, Winema)
 BLM - (Lakeview, Susanville)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|-----------------|---------------|-------------|---------------|------------------------|----------------------|-------------------------------|---------------------|---------------------|
| TG | LA | 64 | 5,068 | \$503,667 | -\$69,883 | | \$573,550 | |
| C130 E | M5 | 166 | 6,599 | \$9,673,954 | -\$13,078,085 | | \$22,752,039 | |
| Military | M9 | 113 | 2,690 | \$2,204,546 | -\$1,866,622 | | \$4,071,168 | |
| | N4 | 200 | 1,934 | \$7,042,932 | -\$3,854,455 | | \$10,897,387 | |
| | P1 | 190 | 1,040 | \$1,030,869 | -\$955,762 | | \$1,986,631 | |
| | P2 | 87 | 1,434 | \$2,564,435 | -\$1,653,735 | | \$4,218,170 | |
| | Q0 | 74 | 30 | \$363,492 | -\$29,633 | | \$393,125 | |
| | Q5 | 98 | 194 | \$838,443 | -\$699,673 | | \$1,538,116 | |
| | R0 | 84 | 2,649 | \$1,710,790 | -\$3,264,664 | | \$4,975,454 | |
| | SU | 61 | 4,233 | \$387,895 | -\$480,380 | | \$868,275 | |
| | | | | | \$6,797 | \$679,700 | | |
| | Totals | 1137 | 25,871 | \$26,321,023 | -\$25,952,892 | \$679,700 | \$52,953,615 | \$15,385,627 |
| TH | LA | 64 | 5,068 | \$503,667 | -\$69,883 | | \$573,550 | |
| C 130 E | M5 | 166 | 6,599 | \$9,673,954 | -\$13,078,085 | | \$22,752,039 | |
| Comm | M9 | 113 | 2,690 | \$2,204,546 | -\$1,866,622 | | \$4,071,168 | |
| | N4 | 200 | 1,934 | \$7,042,932 | -\$3,854,455 | | \$10,897,387 | |
| | P1 | 190 | 1,040 | \$1,030,869 | -\$955,762 | | \$1,986,631 | |
| | P2 | 87 | 1,434 | \$2,564,435 | -\$1,653,735 | | \$4,218,170 | |
| | Q0 | 74 | 30 | \$363,492 | -\$29,633 | | \$393,125 | |
| | Q5 | 98 | 194 | \$838,443 | -\$699,673 | | \$1,538,116 | |
| | R0 | 84 | 2,649 | \$1,710,790 | -\$3,264,664 | | \$4,975,454 | |
| | SU | 61 | 4,233 | \$387,895 | -\$480,380 | | \$868,275 | |
| | | | | | \$14,393 | \$2,878,600 | | |
| | Totals | 1137 | 25,871 | \$26,321,023 | -\$25,952,892 | \$2,878,600 | \$55,152,515 | \$13,186,727 |

**Klamath Falls Service Area –
 NF (Klamath, Modoc, Shasta-Trinity, Deschutes, Fremont, Rogue River, Umpqua, Winema)
 BLM - (Lakeview, Susanville)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|--------------------|-------------|---------------|---------------------|-------------------------------|-------------------------|--------------------------------------|---------------------|----------------------------|
| TI S3 | LA | 64 | 7,771 | \$583,056 | -\$93,557 | | \$676,613 | |
| | M5 | 166 | 10,321 | \$13,340,501 | -\$17,681,300 | | \$31,021,801 | |
| | M9 | 113 | 4,827 | \$3,727,801 | -\$2,799,366 | | \$6,527,167 | |
| | N4 | 200 | 2,951 | \$8,371,439 | -\$6,006,309 | | \$14,377,748 | |
| | P1 | 190 | 1,124 | \$1,217,438 | -\$1,043,733 | | \$2,261,171 | |
| | P2 | 87 | 1,623 | \$3,087,218 | -\$1,769,722 | | \$4,856,940 | |
| | Q0 | 74 | 31 | \$266,243 | -\$30,083 | | \$296,326 | |
| | Q5 | 98 | 470 | \$1,506,510 | -\$2,320,942 | | \$3,827,452 | |
| | R0 | 84 | 2,688 | \$1,827,666 | -\$3,300,731 | | \$5,128,397 | |
| | SU | 61 | 4,256 | \$388,257 | -\$482,528 | | \$870,785 | |
| | | | | | \$5,052 | \$1,010,400 | | |
| Totals | 1137 | 36,062 | \$34,316,129 | -\$35,528,271 | \$1,010,400 | \$70,854,800 | -\$2,515,558 | |

**Phoenix Service Area –
NF (Apache-Sitgraves, Coconino, Coronado, Gila, Prescott, Tonto) BLM - (Phoenix)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|----------------------|-------------|---------------|---------------------|------------------------|--------------------|-------------------------------|---------------------|---------------------|
| TA GEN AT | G1 | 267 | 2,461 | \$2,888,623 | -\$1,351,458 | | \$4,240,081 | |
| | G4 | 510 | 1,274 | \$2,529,683 | -\$895,453 | | \$3,425,136 | |
| | G5 | 128 | 4,035 | \$2,860,308 | -\$376,996 | | \$3,237,304 | |
| | G6 | 261 | 15,331 | \$14,070,943 | -\$1,083,072 | | \$15,154,015 | |
| | G9 | 71 | 2,213 | \$1,476,296 | \$31,166 | | \$1,507,462 | |
| | H2 | 329 | 12,707 | \$6,802,623 | -\$406,590 | | \$7,209,213 | |
| | PH | 56 | 758 | \$160,736 | -\$14,151 | | \$174,887 | |
| | | | | | \$6,500 | \$1,300,000 | | |
| Totals | 1622 | 38,779 | \$30,789,212 | -\$4,096,554 | \$1,300,000 | \$36,185,766 | \$0 | |
| TB Q200 | G1 | 267 | 4,280 | \$3,857,987 | -\$1,396,306 | | \$5,254,293 | |
| | G4 | 510 | 1,354 | \$2,564,176 | -\$985,848 | | \$3,550,024 | |
| | G5 | 128 | 5,695 | \$3,591,674 | -\$470,402 | | \$4,062,076 | |
| | G6 | 261 | 17,217 | \$15,605,194 | -\$1,089,519 | | \$16,694,713 | |
| | G9 | 71 | 3,127 | \$1,996,958 | \$49,980 | | \$2,046,938 | |
| | H2 | 329 | 17,966 | \$9,562,780 | -\$912,324 | | \$10,475,104 | |
| | PH | 56 | 1,109 | \$180,235 | -\$25,554 | | \$205,789 | |
| | | | | | \$7,507 | \$1,501,400 | | |
| Totals | 1622 | 50,748 | \$37,359,004 | -\$4,829,973 | \$1,501,400 | \$43,690,377 | -\$7,504,611 | |
| TC Q400 | G1 | 267 | 2,461 | \$2,893,533 | -\$1,351,243 | | \$4,244,776 | |
| | G4 | 510 | 1,277 | \$2,538,124 | -\$897,601 | | \$3,435,725 | |
| | G5 | 128 | 4,208 | \$2,966,863 | -\$407,192 | | \$3,374,055 | |
| | G6 | 261 | 15,330 | \$14,074,084 | -\$1,083,076 | | \$15,157,160 | |
| | G9 | 71 | 2,343 | \$1,557,878 | \$29,993 | | \$1,587,871 | |
| | H2 | 329 | 12,749 | \$6,882,126 | -\$408,193 | | \$7,290,319 | |
| | PH | 56 | 761 | \$162,277 | -\$14,188 | | \$176,465 | |
| | | | | | \$18,226 | \$3,645,200 | | |
| Totals | 1622 | 39,129 | \$31,074,885 | -\$4,131,500 | \$3,645,200 | \$38,851,585 | -\$2,665,819 | |

**Phoenix Service Area –
NF (Apache-Sitgraves, Coconino, Coronado, Gila, Prescott, Tonto) BLM - (Phoenix)**

100 = Days of Availability for 1st Air Tanker
100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|------------------------------------|-------------|---------------|---------------------|------------------------|------------------|-------------------------------|---------------------|---------------------|
| TD Bae 146 | G1 | 267 | 2,386 | \$2,891,809 | -\$1,360,179 | | \$4,251,988 | |
| | G4 | 510 | 1,229 | \$2,465,675 | -\$872,405 | | \$3,338,080 | |
| | G5 | 128 | 3,693 | \$2,746,635 | -\$314,270 | | \$3,060,905 | |
| | G6 | 261 | 15,322 | \$14,127,347 | -\$1,082,889 | | \$15,210,236 | |
| | G9 | 71 | 1,672 | \$1,204,609 | \$9,981 | | \$1,214,590 | |
| | H2 | 329 | 12,720 | \$7,094,060 | -\$404,416 | | \$7,498,476 | |
| | PH | 56 | 746 | \$194,786 | -\$13,919 | | \$208,705 | |
| | | | | | \$8,107 | | \$1,621,400 | |
| Totals | 1622 | 37,768 | \$30,724,921 | -\$4,038,097 | | \$1,621,400 | \$36,384,418 | -\$198,652 |
| TG C 130 E Military | G1 | 267 | 2,245 | \$2,779,933 | -\$1,345,163 | | \$4,125,096 | |
| | G4 | 510 | 1,246 | \$2,473,555 | -\$890,483 | | \$3,364,038 | |
| | G5 | 128 | 2,175 | \$2,016,337 | -\$305,383 | | \$2,321,720 | |
| | G6 | 261 | 14,331 | \$13,344,065 | -\$1,061,378 | | \$14,405,443 | |
| | G9 | 71 | 1,540 | \$1,134,525 | \$11,255 | | \$1,145,780 | |
| | H2 | 329 | 12,208 | \$6,477,699 | -\$387,273 | | \$6,864,972 | |
| | PH | 56 | 884 | \$191,216 | -\$22,308 | | \$213,524 | |
| | | | | | \$6,797 | | \$1,359,400 | |
| Totals | 1622 | 34,629 | \$28,417,330 | -\$4,000,733 | | \$1,359,400 | \$33,777,463 | \$2,408,303 |
| TH C 130 E Comm | G1 | 267 | 2,245 | \$2,779,933 | -\$1,345,163 | | \$4,125,096 | |
| | G4 | 510 | 1,246 | \$2,473,555 | -\$890,483 | | \$3,364,038 | |
| | G5 | 128 | 2,175 | \$2,016,337 | -\$305,383 | | \$2,321,720 | |
| | G6 | 261 | 14,331 | \$13,344,065 | -\$1,061,378 | | \$14,405,443 | |
| | G9 | 71 | 1,540 | \$1,134,525 | \$11,255 | | \$1,145,780 | |
| | H2 | 329 | 12,208 | \$6,477,699 | -\$387,273 | | \$6,864,972 | |
| | PH | 56 | 884 | \$191,216 | -\$22,308 | | \$213,524 | |
| | | | | | \$14,393 | | \$2,878,600 | |
| Totals | 1622 | 34,629 | \$28,417,330 | -\$4,000,733 | | \$2,878,600 | \$35,296,663 | \$889,103 |

**Phoenix Service Area –
NF (Apache-Sitgraves, Coconino, Coronado, Gila, Prescott, Tonto) BLM - (Phoenix)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic |
|--------------------|-------------|-------------|-------------------------|---------------------------------------|-----------------------------|--|-----------------------|------------------------------------|
| TI | G1 | 267 | 4,238 | \$3,858,885 | -\$1,395,117 | | \$5,254,002 | |
| S3 | G4 | 510 | 1,303 | \$2,587,575 | -\$904,570 | | \$3,492,145 | |
| | G5 | 128 | 4,687 | \$3,204,108 | -\$450,928 | | \$3,655,036 | |
| | G6 | 261 | 15,455 | \$14,162,205 | -\$1,086,061 | | \$15,248,266 | |
| | G9 | 71 | 2,664 | \$1,784,946 | \$32,811 | | \$1,817,757 | |
| | H2 | 329 | 16,027 | \$8,742,286 | -\$872,484 | | \$9,614,770 | |
| | PH | 56 | 1,069 | \$196,006 | -\$24,680 | | \$220,686 | |
| | | | | | \$5,052 | \$1,010,400 | | |
| Totals | | 1622 | 45,443 | \$34,536,011 | -\$4,701,029 | \$1,010,400 | \$40,247,440 | -\$4,061,674 |

**Redding Service Area –
NF (Klamath, Lassen, Mendocino, Modoc, Six Rivers, Plumas, Shasta-Trinity)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic | Alternative | Unit |
|-----------------------|--------------------|---------------|---------------------|------------------------|---------------------|-------------------------------|--------------------|---------------------|-------------|---------------------|
| TA Generic | M5 | 166 | 10,314 | \$11,584,671 | \$1,714,490 | \$13,299,161 | -\$17,674,878 | | | \$30,974,039 |
| | M6 | 112 | 2,087 | \$1,869,883 | \$518,104 | \$2,387,987 | -\$1,556,246 | | | \$3,944,233 |
| | M8 | 46 | 872 | \$1,026,973 | \$199,319 | \$1,226,292 | -\$2,355,207 | | | \$3,581,499 |
| | M9 | 113 | 3,763 | \$2,522,028 | \$339,174 | \$2,861,202 | -\$2,461,512 | | | \$5,322,714 |
| | N0 | 85 | 2,290 | \$8,821,115 | \$298,634 | \$9,119,749 | -\$5,082,985 | | | \$14,202,734 |
| | N1 | 191 | 781 | \$2,162,282 | \$1,189,722 | \$3,352,004 | -\$5,040,279 | | | \$8,392,283 |
| | N4 | 200 | 2,873 | \$5,199,026 | \$2,895,742 | \$8,094,768 | -\$5,853,650 | | | \$13,948,418 |
| | Daily Availability | | | | | | | \$6,500 | \$1,300,000 | |
| Totals | 913 | 22,980 | \$33,185,978 | \$7,155,185 | \$40,341,163 | -\$40,024,757 | \$1,300,000 | \$81,665,920 | | \$0 |
| TB Q200 | M5 | 166 | 10,644 | \$11,952,810 | \$1,716,838 | \$13,669,648 | -\$17,694,518 | | | \$31,364,166 |
| | M6 | 112 | 2,096 | \$1,897,158 | \$511,061 | \$2,408,219 | -\$1,565,105 | | | \$3,973,324 |
| | M8 | 46 | 1,020 | \$1,182,058 | \$190,292 | \$1,372,350 | -\$2,577,171 | | | \$3,949,521 |
| | M9 | 113 | 4,863 | \$3,418,589 | \$421,031 | \$3,839,620 | -\$2,837,069 | | | \$6,676,689 |
| | N0 | 85 | 2,290 | \$8,819,972 | \$299,777 | \$9,119,749 | -\$5,082,985 | | | \$14,202,734 |
| | N1 | 191 | 818 | \$2,399,395 | \$1,015,820 | \$3,415,215 | -\$5,169,707 | | | \$8,584,922 |
| | N4 | 200 | 2,992 | \$5,538,621 | \$2,894,632 | \$8,433,253 | -\$6,095,145 | | | \$14,528,398 |
| | Daily Availability | | | | | | | \$7,507 | \$1,501,400 | |
| Totals | 913 | 24,723 | \$35,208,603 | \$7,049,451 | \$42,258,054 | -\$41,021,700 | \$1,501,400 | \$84,781,154 | | -\$3,115,234 |
| TC Q400 | M5 | 166 | 10,315 | \$11,586,571 | \$1,715,586 | \$13,302,157 | -\$17,675,985 | | | \$30,978,142 |
| | M6 | 112 | 2,087 | \$1,865,764 | \$522,448 | \$2,388,212 | -\$1,556,164 | | | \$3,944,376 |
| | M8 | 46 | 873 | \$1,043,860 | \$200,898 | \$1,244,758 | -\$2,355,729 | | | \$3,600,487 |
| | M9 | 113 | 3,764 | \$2,522,900 | \$347,186 | \$2,870,086 | -\$2,461,741 | | | \$5,331,827 |
| | N0 | 85 | 2,290 | \$8,820,951 | \$298,798 | \$9,119,749 | -\$5,082,985 | | | \$14,202,734 |
| | N1 | 191 | 787 | \$2,214,199 | \$1,205,308 | \$3,419,507 | -\$5,060,007 | | | \$8,479,514 |
| | N4 | 200 | 2,875 | \$5,178,047 | \$2,970,867 | \$8,148,914 | -\$5,856,427 | | | \$14,005,341 |
| | Daily Availability | | | | | | | \$18,226 | \$3,645,200 | |
| Totals | 913 | 22,991 | \$33,232,292 | \$7,261,091 | \$40,493,383 | -\$40,049,038 | \$3,645,200 | \$84,187,621 | | -\$2,521,701 |

**Redding Service Area –
NF (Klamath, Lassen, Mendocino, Modoc, Six Rivers, Plumas, Shasta-Trinity)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic | Alternative | Unit |
|-----------------|------------|---------------|---------------------|------------------------|---------------------|-------------------------------|--------------------|---------------------|---------------------|--------------|
| TD | M5 | 166 | 10,305 | \$11,540,259 | \$1,735,576 | \$13,275,835 | -\$17,657,762 | | | |
| Bae 146 | M6 | 112 | 2,086 | \$1,856,166 | \$550,227 | \$2,406,393 | -\$1,555,965 | | | \$30,933,597 |
| | M8 | 46 | 867 | \$1,013,645 | \$214,974 | \$1,228,619 | -\$2,346,841 | | | \$3,962,358 |
| | M9 | 113 | 3,495 | \$2,312,142 | \$340,327 | \$2,652,469 | -\$2,181,398 | | | \$3,575,460 |
| | N0 | 85 | 2,290 | \$8,817,484 | \$302,265 | \$9,119,749 | -\$5,082,985 | | | \$4,833,867 |
| | N1 | 191 | 764 | \$2,055,480 | \$1,431,285 | \$3,486,765 | -\$4,994,956 | | | \$14,202,734 |
| | N4 | 200 | 2,847 | \$5,069,571 | \$3,289,186 | \$8,358,757 | -\$5,801,920 | | | \$8,481,721 |
| | | | | | | | | | | \$14,160,677 |
| | | | | | | | Daily Availability | \$8,107 | \$1,621,400 | |
| Totals | 913 | 22,654 | \$32,664,747 | \$7,863,840 | \$40,528,587 | -\$39,621,827 | \$1,621,400 | \$81,771,814 | -\$105,894 | |
| TG | | | | | | | | | | |
| C 130 E | M5 | 166 | 6,599 | \$7,947,331 | \$1,726,623 | \$9,673,954 | -\$13,078,085 | | | \$22,752,039 |
| Military | M6 | 112 | 2,086 | \$1,866,046 | \$533,272 | \$2,399,318 | -\$1,555,561 | | | \$3,954,879 |
| | M8 | 46 | 864 | \$996,239 | \$207,694 | \$1,203,933 | -\$2,342,799 | | | \$3,546,732 |
| | M9 | 113 | 2,690 | \$1,876,942 | \$327,604 | \$2,204,546 | -\$1,866,622 | | | \$4,071,168 |
| | N0 | 85 | 2,225 | \$8,616,105 | \$300,681 | \$8,916,786 | -\$4,919,060 | | | \$13,835,846 |
| | N1 | 191 | 726 | \$2,069,705 | \$1,376,695 | \$3,446,400 | -\$4,954,622 | | | \$8,401,022 |
| | N4 | 200 | 1,934 | \$4,176,317 | \$2,866,615 | \$7,042,932 | -\$3,854,455 | | | \$10,897,387 |
| | | | | | | | Daily Availability | \$6,797 | \$1,359,400 | |
| Totals | 913 | 17,124 | \$27,548,685 | \$7,339,184 | \$34,887,869 | -\$32,571,204 | \$1,359,400 | \$68,818,473 | \$12,847,447 | |
| TH | | | | | | | | | | |
| C 130 E | M5 | 166 | 6,599 | \$7,947,331 | \$1,726,623 | \$9,673,954 | -\$13,078,085 | | | \$22,752,039 |
| Comm | M6 | 112 | 2,086 | \$1,866,046 | \$533,272 | \$2,399,318 | -\$1,555,561 | | | \$3,954,879 |
| | M8 | 46 | 864 | \$996,239 | \$207,694 | \$1,203,933 | -\$2,342,799 | | | \$3,546,732 |
| | M9 | 113 | 2,690 | \$1,876,942 | \$327,604 | \$2,204,546 | -\$1,866,622 | | | \$4,071,168 |
| | N0 | 85 | 2,225 | \$8,616,105 | \$300,681 | \$8,916,786 | -\$4,919,060 | | | \$13,835,846 |
| | N1 | 191 | 726 | \$2,069,705 | \$1,376,695 | \$3,446,400 | -\$4,954,622 | | | \$8,401,022 |
| | N4 | 200 | 1,934 | \$4,176,317 | \$2,866,615 | \$7,042,932 | -\$3,854,455 | | | \$10,897,387 |
| | | | | | | | Daily Availability | \$14,393 | \$2,878,600 | |

**Redding Service Area –
NF (Klamath, Lassen, Mendocino, Modoc, Six Rivers, Plumas, Shasta-Trinity)**

100 = Days of Availability for 1st Air Tanker

100 = Days of Availability for 2nd Air Tanker

| Alternative | Unit | Freq | Acres Burned | Fire Suppression Costs | Net Value Change | Air Tanker Daily Availability | Row Totals | Change From Generic | Alternative | Unit |
|---------------|------|------------|---------------|------------------------|--------------------|-------------------------------|----------------------|---------------------|---------------------|---------------------|
| Totals | | 913 | 17,124 | \$27,548,685 | \$7,339,184 | \$34,887,869 | -\$32,571,204 | \$2,878,600 | \$70,337,673 | \$11,328,247 |
| TI | | | | | | | | | | |
| S3 | M5 | 166 | 10,321 | \$11,616,517 | \$1,723,984 | \$13,340,501 | -\$17,681,300 | | \$31,021,801 | |
| | M6 | 112 | 2,095 | \$1,885,939 | \$522,882 | \$2,408,821 | -\$1,563,457 | | \$3,972,278 | |
| | M8 | 46 | 911 | \$1,162,388 | \$197,612 | \$1,360,000 | -\$2,360,707 | | \$3,720,707 | |
| | M9 | 113 | 4,827 | \$3,322,943 | \$404,858 | \$3,727,801 | -\$2,799,366 | | \$6,527,167 | |
| | N0 | 85 | 2,290 | \$8,818,453 | \$301,296 | \$9,119,749 | -\$5,082,985 | | \$14,202,734 | |
| | N1 | 191 | 808 | \$2,370,552 | \$1,115,222 | \$3,485,774 | -\$5,133,287 | | \$8,619,061 | |
| | N4 | 200 | 2,951 | \$5,327,414 | \$3,044,025 | \$8,371,439 | -\$6,006,309 | | \$14,377,748 | |
| | | | | | | Daily Availability | \$5,052 | \$1,010,400 | | |
| Totals | | 913 | 24,203 | \$34,504,206 | \$7,309,879 | \$41,814,085 | -\$40,627,411 | \$1,010,400 | \$83,451,896 | -\$1,785,976 |

Appendix H

AutoAT4 Modeling – Platform Capacity Less Than 5,000 Gallons

Narrative of Results

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Findings by Example Aircraft Platforms with Platform Capacity Less Than 5000 Gallons

C-130H (Military)

This aircraft provided the highest change in C+NVC from the currently defined generic future airtanker. This increase is mainly due to the increase in tank size from 3,000 gallons to 4,300 gallons. It is a reflection of the value of fireline production support during the very early stages of a fire when its perimeter is relatively small compared to later timeframes.

Figure H-1 – C-130H (Military)



C-130H (Private)

All of the comments made for the C-130H (Military) platform apply to the C-130H (Private) platform except for cost. The procurement of a platform from military surplus is less expensive than via a private acquisition reducing the estimated daily availability from \$14,400 for the private acquisition to about \$6,800. It is important to note that it is not necessary to acquire aircraft platforms from the military for the conversion to and use as an airtanker to have positive economic value.

Figure H-2 – C-130H (Private)



BAe-146

This platform had a positive comparison in C+NVC with the currently defined generic future airtanker at three of the airtanker bases tested. The difference at the other two varied from about -\$106,000 to about -\$199,000. These differences are within any expected variation of this analysis. In general, it appears this platform is roughly equivalent to the currently defined generic future airtanker based on the metric of C+NVC. This aircraft also is compatible with a high percentage of airtanker bases (88%).

Figure H-3 – BAe-146



S-3, Viking

This platform had a negative comparison in C+NVC with the currently defined generic future airtanker at all of the airtanker bases tested. This is mainly due to its smaller tank size (1,800 vs. 2,700 gallons) as the daily availability and flight rates are less. This smaller tank size also affects its ranking versus the C-130H (4,300 gallons). This is particularly true when travel is below 10,000 feet since the travel speed is the same. The compatibility with airtanker bases is low at 62% (Table 6).

Figure H-4 – S3, Viking



Bombardier Aerospace Q-400

This platform had a negative comparison in C+NVC with the currently defined generic future airtanker at all of the airtanker bases tested. This is mainly due to the higher daily availability (\$18,226 vs. \$6,500) as the flight rates and tank size are similar. The daily availability value used assumes the aircraft is performing additional work outside the fire season. If not, the daily availability is estimated to \$37,785. On the positive side, this platform has a high compatibility with airports (86%) (Table 6).

Figure H-5 – Q-400



Bombardier Aerospace Q-200

This platform had a negative comparison in C+NVC with the currently defined generic future airtanker at all of the airtanker bases tested. This is mainly due to its smaller tank size (1,600 vs. 2,700 gallons) and the daily availability (\$7,507 vs. \$6,500). On the positive side, this platform has the highest compatibility with airports (92%) (Table 6).

Figure H-6 – Q-200

