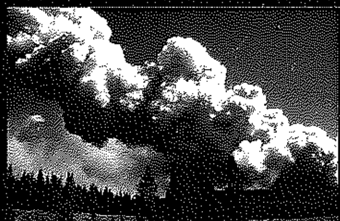
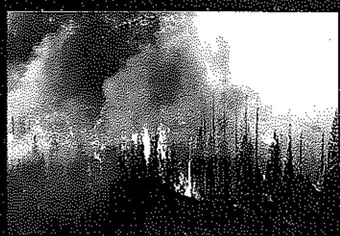
National Study of Large Airtankers to Support Initial Attack and Large Fire Suppression

Final Report
Phase 2
November 1996



USDA Forest Service
Department of Interior
Bureau of Land Management

NATIONAL STUDY OF (LARGE) AIRTANKERS TO SUPPORT INITIAL ATTACK AND LARGE FIRE SUPPRESSION

FINAL REPORT
PHASE 2

USDA FOREST SERVICE
DEPARTMENT OF INTERIOR
November, 1996

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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!

ACKNOWLEDGEMENTS

To accomplish the analysis work necessary, a large number of people graciously gave significant amounts of time and expertise. The committee would like to express special thanks AGAIN to Doug Ford and Brian Booher for their dedication to excellence, modelling expertise and commitment to continually search for solutions. Without the quality leadership and dedication of Bill Biastoch, Ginger Brudevold, Bill Mitchell, Ward Monroe, Howard Roose, Barbara Knieling, Dan Winner, and Elizibeth Wright at the Area analysis level, the analysis of proposed airtanker platforms and investment at airtanker bases could not have been completed. Many dedicated fire planners at the local level spent significant amounts of time supporting Area initial attack analysis. Special commendation goes to those airtankers managers and civil engineers who gave their time and expertise to completion of the surveys at airtanker bases. The study committee wishes to say THANKS as you are all the real heros who deserve the highest level appreciation for your patience, determination and perseverance of excellence.

EXECUTIVE SUMMARY
Phase 2 Report

PREFACE

Large airtankers defined as fixed or rotor wing aircraft with a capacity to carry at least 1000 gallons of retardant were studied. This study justification for staffing fixed or rotor wing aircraft with a capacity to carry less than 1000 gallons is left to local analysis processes.

As one reads this report, the study committee suggests the reader's view remain *strategic*. Be open to different ideas and to change. Ask yourself the question, "What should the large airtanker and large airtanker base program look like for the next 20 years?" Release from the current situation and ownership of today. Review the recommendations following careful examination of the analysis and decision process supporting the recommendations. Lots of professional expertise and judgement as well as analytical results were used. The committee and countless local planners have spent literally thousands of hours developing the data and concepts that may appear on a single sheet of paper within this report. This work has definitely advanced our knowledge base and cooperation with others to new a level. Some of this knowledge has already been used to save money and support other management related decisions. Economic efficiency across agency/state/regional boundaries was a goal. Consider the report in it's entirety. It is the product of a highly qualified set of individuals who worked diligently as a TEAM. Implementation of recommendations by management, coordinators, specialists and firefighters working as a TEAM will be critical to achieving predicted benefits.

BACKGROUND

The National Shared Forces Task Force Report (1991) proposes a "schedule" for completion of National Shared Forces studies. The studies conducted under the umbrella of the Report are led by the Forest Service. They are interagency in scope with committee representation and/or coordination with the USDI-Bureau of Land Management, National Park Service, Bureau of Indian Affairs, Fish and Wildlife Service and State wildfire suppression agencies.

THE STUDY CHARTER

The Study Charter is contained in Appendix A and contains the vision, mission and guiding principles (assumptions).

<u>The Study Vision</u> The National Airtanker Study shall provide information, guidance and support to managers for National and Regional decisions affecting the National airtanker program and their support components for the next 10-20 years.

<u>The Study Mission</u> The National Airtanker Study shall provide analytical support and model development allowing for display of interrelationships and tradeoffs of different large airtanker capability and location in support of wildfire initial attack and extended attack operations. For the purposes of this study, "large airtanker" will refer to fixed or rotor wing aircraft with a capacity to carry at least 1000 gallons of retardant. In addition, support and interrelationships to large fire suppression will be obtained. Analytical support and model development shall result in the identification of the most effective and efficient utilization of airtankers. Alternatives will be examined and displayed for numbers and base locations.

The Timeline This National Airtanker Study was conducted in two phases. Phase 1 provided the basis for determining agency needs in the short term and became the basis for the 1996-1998 Forest Service and Department of Interior large airtanker contract solicitations. Phase 1 was completed in March, 1995. This report completes Phase 2 which was structured to provide the basis for determining agency large airtanker and airtanker base improvement needs in the long term (1999-2020) and will become the basis for the Forest Service and Department of Interior large airtanker contract solicitations from 1999 into the future or until revised.

GOALS/OBJECTIVES FOR PHASE 2

The goal of Phase 2 is to optimize all reasonable airtanker base locations and airtanker fleet possibilities and is not constrained by the current fleet. The outcomes of Phase 2 will provide information to guide modernization of the airtanker program and will allow for stabilization of the airtanker supply and agency demand situation. The study will reflect move-up conductivity of the system. An attempt will be made to optimize the dispatch philosophy and the role of the total initial attack organization will be examined. The study will clarify the roles of large airtankers in initial attack and large fire support. Specificly, it will examine airtanker performance, airtanker capability in the 1000 and 5000 gallon size class, night use, the role of MAFFS and the role of Type I helicopters in the application of retardant.

As a minimum, recommendations will be made on:

1. The number and size of airtankers by location.

2. The need for airtankers with capacity of between 1000 and 2000 gallons.

3. The need to develop night time capability.

THE STUDY PLAN AND PROCESS FOR PHASE 2

Step 1. Review information from Phase 1. In addition, examine historic uses and trends including airtanker base information on an interagency basis.

Initial attack data from local NFMAS analysis, together with data on the use of airtankers to support large fire suppression was identified as needed to be collected to support this analysis. For each area, the purpose, data needed, data sources, and responsible person were identified. The historic period for gathering initial attack analysis varied based on local NFMAS analysis but in general included the time period 1980 - 1995.

Step 2. Gather and information on potential airtanker types and airtanker bases.

For the determination of future airtanker platforms, a survey will be made of existing civilian and military aircraft types. Details on performance and availability will be determined.

In addition, an initial survey of the physical status of airtankers bases in Phase 1 will receive more detailed attention. During Phase 1, a questionnaire was completed by personnel at each federal airtanker base in the United States. The information received on Phase 1 was collected in a short time period without an opportunity to review for consistency with an agency standard. Since Phase 1, the "Interagency Retardant Base Planning Guide--Fixed and Rotor Wing" was released by the National Wildfire Coordinating Committee's Fire Equipment Working Team. This will be referred to as the

Airtanker Base Planning Guide. In Phase 2, the questionnaire was based on this guide and required extensive civil engineering involvement to complete. The questionnaire gathered information on the physical status of each base. The results will be used to develop a collective list of needed capital improvements. Detailing results from the questionnaire are in Appendix H.

Step 3. Develop evaluation criteria and alternatives for potential airtanker types and airtanker base locations.

Criteria to be used in the evaluation of each of the two items, aircraft and airtanker bases, will be developed in this step.

Step 4. Display procurement and staffing options. Use the NFMAS initial attack assessment (IAA) model and other analysis tools to perform analysis of aircraft and airtanker base alternatives. Examine historic retardant use on wildfires which have escaped initial attack to predicted airtanker needs to support extended attack and escaped wildfire needs. Display dispatch flow options based on analysis results.

Different methods of procuring aircraft and the staffing of these aircraft as well as the process to analyze airtanker bases will be developed.

Forces used for initial attack of wildland fires are analyzed and justified using NFMAS and the BLM/BIA Fire Management Activity Plan. The NFMAS initial attack assessment (IAA) model considers initial attack support and is used to analyze the effect of the alternatives. The local initial attack forces will remain constant as airtanker staffing and locations are changed. This system will be used to estimate the initial attack efficiency for the various potential airtanker platforms. This same system together with large fire support requirements will be used to estimate the economic justification of proposed airtanker base investments. A final "reality" check against professional judgement will be done to assure the proper integration of analytical results with experience, skill and intuition.

Also to be examined will be the current dispatch and coordination process for airtankers. Recommendations for a more efficient operation will follow.

Step 5. Develop recommendations to address goals/objectives for Phase 2.

Step 6. Concerns and opportunities generated by the this study and comments for future analysis.

REVIEW OF PHASE 1, HISTORIC USE, DEMAND AND TRENDS FOR LARGE AIRTANKERS

The demand for large airtankers on wildfires has remained steady in the recent past varying mainly based on the severity of the fire season. The average annual number of flight hours flown is 7,262 for large airtankers contracted for by the Forest Service and the Department of Interior from 1987-1994. The twenty year average for gallons of long term fire retardant dropped by large airtankers is 13,420,488 gallons per year. Using data from the past three years with adjustments for State and MAFFS gallons dropped, it appears that 3001 gallons are dropped per flight hour flown and the average time for a round trip dispatch is 50 minutes.

The primary user is the Forest Service, although other federal and state agencies have also requested this capability. The states of Alaska, California and Minnesota contract for large airtankers and many states use airtankers with a retardant capacity of less than 1000 gallons.

For all agencies, large airtankers (multi-engine with capacity greater than 1000 gallons) have been available through exclusive-use contracting methods although at times, additional airtankers have been added during the fire season. The primary need for large airtankers is initial attack of wildfires but large fire support is also needed. Records for the past three years, show extensive use on size class "D" and larger fires (fires greater than 100 acres in size). Peak utilization occurs at the times when large fires are most likely to occur. Generally this is in February-April in the Southern and Eastern Areas, May-July in Alaska and in the Southwest Area and June-September in the western United States.

GATHER INFORMATION on POTENTIAL AIRTANKER TYPES and AIRTANKER BASES AND RELATED TOPICS

Current Aircraft

The current multi-engine large airtanker fleet is 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 the last 1980's and early 1990's, two turbine aircraft models were added to the fleet, the P-3A and the C-130A.

Future Aircraft

A variety of aircraft (excess military, commercial, and turbine upgrades) were considered as potential large airtanker platforms for the future. Future fixed wing fleet possibilities were restricted to multi-engine platforms capable of delivering over 1000 gallons of retardant.

Only turbine powered aircraft were considered. There is a concern for the future availability of aviation fuel which reciprocating engine aircraft use. The fuel available may also be of less octane rating which will affect performance and the economics of large reciprocating engine powered aircraft. The turbine aircraft have higher speed capability and greater engine reliability.

Potential future fixed wing airtanker fleet aircraft where categorized into three categories. These are Civilian Aircraft, Military Excess Aircraft, and Turbine Refit Aircraft. In addition, Type I helicopter aircraft that can haul at least 1000 gallons at 5,000 feet at 30 degrees centigrade are listed.

Civilian Aircraft	Military Excess Aircraft	Turbine Refit Aircraft	Type 1 Helicopters
- CL-215T	- E-2C	- C-123T	- BV-234
- CL-415T	- S-3	- P-2T	- S-64F
- F-27	- A-6	- DC-4T	- BV-107
- CV-580	- A-10	- S-2T	
- L-188	- P-3A		
- L-382G	- C-130A,B		
- C-130E	- C-130E		
- B-737-200			
- B-747-200B			

Information from Operators

The committee solicited information from the airtanker industry that was proprietary. Information provided was used in the analysis.

Specifications and Performance

Published flight manuals were used to determine the flight performance of the aircraft studied as retardant airtankers. In case of turbine conversions (aircraft which could have their reciprocating engines replaced with turbine driven propellers), data from a prior converted aircraft were used to develop a model to predict the performance of the studied aircraft, unless actual data were available. Retardant tank capacities were developed considering each aircraft's weight capabilities (maximum gross weight, zero fuel weight, empty weight), appropriate fuselage volume constraints, ground clearance and age of the aircraft. The estimated retardant volumes are considered conservative in that the maximum capacity, based on weight, was never used. For turbine conversion aircraft, a engineering estimate was made for the weight change involved in the conversion. Appendix B contains the performance information that was developed for the studied aircraft.

Future Procurement Options

In August, 1993, the Forest Service did staff work for the Secretary of Agriculture on six methods for providing airtanker services. In the decision memo for the Secretary of Agriculture, the recommendation was made to adopt a method where contractors would own, operate and maintain airtankers acquired with the sale of excess military aircraft. Implementation of this method required legislation which occurred in October, 1996.

NFMAS Analysis - General

Forces used for initial attack of wildland fires are analyzed and justified using the National Fire Management Analysis System (NFMAS). NFMAS initial attack assessment (IAA) model analyses initial attack effectiveness and was used to analyze the effect of the alternatives. The local initial attack forces remained constant as airtanker staffing and locations was 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. Detailed information on the assumptions of the IAA that are critical to this study and the specific rules used in this analysis are contained in Appendix C.

All dollar amounts displayed in this report are in 1996 dollars unless otherwise stated. The current OMB Price Adjustment Index was used to calculate factors to move all dollars to 1996 dollars.

Airtanker Base "Customer Service Area" and Attribute Determination

The protection units in the analysis that had data from the Initial Attack Assessment (IAA) model provided this data to the study for the Most Efficient Level budget option. The "customer service area" (CSA) for an airtanker base was defined and consisted of all the protection units in this analysis that receive any airtanker dispatches from the airtanker base. Analysis within a CSA allows for the estimation of the economic efficiency as well as the initial effectiveness of staffing different airtanker platforms at an airtanker base.

For each protection unit within the CSA, three attributes were defined:

- The average numbers of fires per million acres protected;
- The average Suppression Cost (FFF) plus Net Value Change (NVC) that occurs per acre burned, and;
- The average coverage level of chemical fire retardant that is required based on the fuel models on the protection unit.

Cost/Chain and Cost/Gallons Estimates

A display of cost/chain and/or cost/gallon will give an initial indication the most efficient way to deliver a requested load of retardant. Additional analysis within CSA using the Initial Attack Assessment will show economic efficiency as well as the initial attack effectiveness of staffing different airtanker platforms at an airtanker base. For each Federal airtanker base that has an airtanker(s) staffed under the 1996-1998 Federal airtanker contract, the average cost per gallon and cost per chain of retardant delivered within its "customer service area" was determined.

Airtanker Base Compatibility

Compatibility of the potential future airtanker fleet with the existing base structure as well as new basing concepts was examined. This examination considered three criteria; runway load bearing, wing and tail clearance, and ground roll required for take off.

Flight Crew Survey on Safety Related Issues at Airports and Airtanker Bases

A survey was conducted to obtain input from airtanker flight crews on what they view to be safety related issues at airports and airtanker bases. Telephone interviews with over 80% of the flight crews (Captains and co-pilots) were made. Leadplane Pilots and Air Tactical Group Supervisors were also interviewed.

Investments Needs at Airtanker Bases

As recommended in Phase 1 of the National Airtanker Study, a subcommittee of agency airtanker base specialists and facilities engineers from Forest Service Regional Offices and Bureau of Land Management State Offices conducted a Condition Survey of each Federal Airtanker Base. The Condition Survey was conducted in accordance with the instructions developed. The Interagency Retardant Base Planning Guide--Fixed and Rotor Wing, March, 1995, (Guide) was the basis for the Condition Survey. Implementation guidelines for this survey are contained in Appendix G.

Real Time Status and Location Determination for Airtankers

Any analysis to maximize the efficient placement and use of airtankers is dependent on a dispatch system efficiently and consistently applied nationwide. The committee determined that it would be beneficial to identify costs of systems which would assist dispatchers in determining the location and status of airtankers on a real time basis. Present systems rely on verbal or electronic mail notification of a change in resource status and location. This process is cumbersome and prone to human performance failures. An automated process would improve performance and allow coordinators at the Geographic and National level to better allocate resources and improve operational and cost efficiencies.

The group identified vendors/agencies who were known to have done this kind of work before. In all probability, there are other potential vendors who could deliver all or parts of this kind of system. A letter was sent to four vendors asking for an informal description of a system they could provide and the associated costs. The committee is aware that implementing any system exclusively for airtankers is not efficient. Detailed planning and analysis of how any system might integrate with other aviation related activities would need to be undertaken prior to implementation.

Capability to Perform Airtanker Capability at Night

Proponents of modern aircraft for use in aerial firefighting have suggested that such aircraft not only provide superior suppressant delivery capability, but also are capable of night retardant operations. The aircraft, excess or surplus military, according to the proponents are or can be fitted with sensors and avionics that will provide safe and reliable night operations in fighting wildland fire. An

examination of the equipment needed for night retardant operations was completed as well as identification of risk, safety and policy issues needing attention.

DEVELOP EVALUATION CRITERIA AND ALTERNATIVES

<u>Evaluation Criteria for Aircraft</u>
Six evaluation criteria were established for aircraft that related to the following: Compatibility of Aircraft with Airtanker Bases; Initial Attack Efficiency; Accuracy and Performance in the Air; Aircraft Availability; Viable Vendors Availability; and a Reality/Professional Judgement Check.

Five evaluation criteria were established for airtanker bases that related to the following: Compatibility of Aircraft with Airtanker Bases; Initial Attack Efficiency; Large Fire Support; Frequency of Need to a Temporary Base; and a Reality/Professional Judgement Check.

PERFORM ANALYSIS OF AIRCRAFT and AIRTANKER BASE ALTERNATIVES

<u>Analysis of Potential Fixed Wing Future Airtankers</u>
Aircraft analyze are identified in BOLD below:

Civilian Aircraft	Military Excess Aircraft	Turbine Refit Aircraft
- 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	**- C-130E**	
- B-737-200		
- B-747-200B		

<u>Analysis of Potential Rotor Wing Aircraft and the CL-215T/CL-415T as Airtankers</u>
An analysis and comparison was done on the cost efficiency of the S-64F and CL-415T in initial attack and large fire support.

<u>Resolution of Airtanker Base Location and Investment Issues</u>
To analyze these evaluation criteria, a generic airtanker platform was defined and staffed at each base as is defined in the 1996-1998 federal airtanker contract. The attributes of this generic airtanker are as follows:

Retardant Capacity:	2700 gallons
Climb Rate:	1500 Feet/Minute
Flight Rate:	$2300 per hour
Flight Time Before Refuel is Necessary:	120 minutes
Time for Airtanker to Setup for Drop:	5 minutes
Cruise Speed (KTAS) for Flight Below 10,000 Feet (MSL):	220 knots
Cruise Speed (KTAS) for Flight Above 10,000 Feet (MSL):	265 knots

This generic airtanker staffing concept was developed and used to insure that differences in airtanker size or speed did not effect the results.

If an airtanker was stationed at the airtanker base in the 1996-1998 Federal contract, several alternative locations to that airtanker should be analyzed. If an airtanker was not stationed at the airtanker base in the 1996-1998 Federal contract, only two alternatives were examined: the current situation with the base as a "reload" base and closing the base.

For each airtanker base where investments are proposed, an Annual Airtanker Base Total Cost was developed. It is equal to the Annualized Cost of Proposed Investments plus the Annual Operation and Maintenance Costs at the base minus the Annual Expected Large Fire Support Costs for Temporary Base Operation.

The Fire Suppression (FFF) Costs and Net Value Change (NVC) Costs were determined for each alternative defined at the airtanker base. In addition, the Annual Airtanker Base Total Costs for the airtanker base being analyzed was added with the Annual Airtanker Base Total Costs for all other airtanker bases staffed in alternatives defined for an airtanker base. This value was added to the Fire Suppression (FFF) Costs and Net Value Change (NVC) Costs to obtain a total Alternative Cost. The alternative with the lowest Alternative Cost is the most cost efficient alternative.

RECOMMENDATIONS

Airtankers for Future Contract Periods

Following examination of how well candidate airtanker platforms met the evaluation criteria, the 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.**

All aircraft with retardant capacities from 1000 gallons to 2500 gallons show low to moderate initial attack effectiveness ratings. This is a result of limited capacity and relatively high cost/gallon delivered and cost/chain of fireline built without commensurate reductions in fire suppression cost and/or resource losses. In some cases, distances to fires on Forest Service and Bureau of Land Management protected lands are not "close" to airports with the capacity to handle airtankers. The cost to convert a turbine or jet powered aircraft to an airtanker appears to be relatively constant. The economics of scale appear in this case. Also note that since 83% of the representative fire locations are within 100 statue miles of airtanker bases, the potential speed achieved at cruise elevations above 10,000 feet (MSL) are not needed.

From Phase 1, it was determined that a National fleet size of 41 large airtankers is needed.

The next page contains a summary of the relative rankings from evaluation criteria 1-4. In making recommendations, initial attack efficiency is considered paramount followed by airport compatibility and performance. Availability is also critical so that benefits can be attained.

In Recommendation #7, changes in airtanker base configuration are proposed. For the column labeled "(Final) Airports," the percentage and relative ranking reflects what would be the case if all the recommendations were adopted.

Summary of Relative Rankings for Airtankers

	(Final) Airports		Initial Attack Efficiency	Accuracy and Performance	Aircraft Availability
Civilian					
CV-580	9	94%	1	4	6
L-188	10	99%	7	6	4
L-382G	5	58%	6	6	8
C-130E	5	58%	9	6	6
B-737	6	68%	5	2	10
Military					
E-2C	2	48%	2	6	4
S-3	2	48%	5	8	4
A-10	1	36%	2	10	4
P-3A	10	99%	7	6	10
C-130A,B	10	97%	7	6	10
C-130E	5	58%	10	6	10
Refit					
S-2T	10	100%	1	8	8
P-2T	7	83%	6	8	10

Committee Recommendations

Recommendation #1 - Procurement

The committee recommends the procurement of excess military aircraft as this is most cost effective way to acquire airtanker platforms.

Recommendation #2 - Aircraft

The committee recommends a future fleet composition of twenty P-3A aircraft, ten C-130B aircraft and 11 C-130E aircraft. This would provide for 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 benefit/cost at the Representative Airtanker Bases 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.

Existing C-130A aircraft are acceptable however it is recommended that no additional C-130A aircraft be sought except as parts sources for existing aircraft.

With 58% airtanker base compatibility, the C-130E would appear to be a problem. The distribution of bases capable of handling these aircraft is of value to understand the rationale for the recommendation. It is quite good. The committee has determined this airtanker base distribution to be adequate coverage to attain the initial attack benefits from the increased amount of retardant on board. This benefit can be critical on the first load into a fire. As 25% of the fleet is in this size class, adequate distribution will remain between this size class and the 3000 gallon size class for coverage on multiple fire events.

The P2T is also a very attractive platform and if it were to exist, would be an acceptable alternative for a 3000 gallon platform. There is still some uncertainty as to performance and cost but extensive staff work has been done by industry. Airport compatibility is an issue as well as availability of the

components for conversion. It appears that the most logical way to acquire the components is from a P-3A aircraft. If one were available though, it would seem more appropriate and economical to convert the P-3A into an airtanker than do the conversion. Also given the strategy to develop an airtanker fleet that will be viable until 2020, pursuing more current aircraft platforms appears to be prudent.

Of the attack aircraft analyzed, the S3 performed the best. Main drawbacks are airtanker base compatibility and initial attack effectiveness due to a 2400 gallon tank capacity.

Recommendation #3: - Number of Aircraft Needed for Spare Parts

The committee recommends a plan whereby contractors could acquire three aircraft for each two flyable airtankers. This should allow for adequate availability of spare parts given current supply levels available commercially and through military sale.

Recommendation #4 - Transition Period for Implementation of Aircraft

The committee recommends a transition plan should be developed with industry outlining a timely conversion process. A reasonable transition period will be necessary to enable the industry to convert to a turbine powered fleet. Transition to a fleet of P-3A, C-130B and C-130E aircraft is proposed to occur by contract period as follows:

	1999	2002	2005	2008
P-3A/C-130B	4	4	6	4
C-130E	0	3	4	4

If desirable and practical, a accelerated transition period could be:

	1999	2002	2005
P-3A/C-130B	4	6	8
C-130E	0	5	6

Bases where a C-130E aircraft would reside by 2008 are as follows: Albuquerque, Missoula, Phoenix, Klamath Falls, Redmond, Norton, Redding, Mather, Durango, Hill, Boise, Fresno, Roswell and Pocatello.

Recommendation #5 - Role of MAFFS

The committee reaffirms the need for MAFFS during peak use periods when all available commercial are committed and recommends pursuing the upgrading of eight MAFFS units. Funds are needed for design, development, and acquisition of MAFFS units which will meet established performance and effectiveness criteria. Improved design technology would result in improved fire retardant delivery capability, reliability and performance including improved performance in retardant coverage levels. Redesign cost of approximately $3 million, and acquisition costs of $1 million per unit are estimated, for a total cost of approximately $11 million for eight upgraded units. A case could be made for FEMA funding of MAFFS replacement since justification for its existence is the protection of developed wildland/urban areas.

Recommendation #6: - Type I Helicopters and the CL-215T/CL-415T

The committee recommends a review of the currency of the assumptions within The National Study of Type I and II Helicopters to Support Large Fire Suppression (1992), particularly for Type I helicopters. Based on this review, staffing, as recommended in the Study, is supported at a level that

approximates the expected efficient number based on long term fire occurrence information. An examination of large fire occurrence for 1970-1995 for the Forest Service Nationally was made. The information was applied to the modelling and assumptions from the Study. The 50th percentile demand verified that 3-4 Type I helicopters staffed for 45-60 days under an exclusive use contract would be the economic optimum staffing.

The committee recommended work continue examining the these platforms in their initial attack support roles. No recommendation is made at this time on the role of the Type I helicopters and the CL-215T/CL-415T based on initial attack efficiency. The committee recommends continued work with Forests to determine initial attack efficiency of both Type I helicopters and the CL-215T/CL-415T.

Recommendation #7: - Airtanker Bases

Restructuring the airtanker base locations and numbers is needed to support the future airtanker fleet and to provide for the most efficient use of the capital investment and maintenance dollars available for physical facilities. Airports with adequate runway lengths, taxiway strength and support facilities will best support the airtanker fleet of the future. Airtanker bases are as critical a link in the system as the aircraft.

Recommendations are made for airtanker bases. For all bases were closure is recommended, a comprehensive closure plan should be developed identifying actions and costs necessary. For those investments recommended, adequate investigation of the most cost efficient way to implement project objectives should occur following approved agency guidelines prior to actual project work implementation. Total savings in proposed capital investments from bases where closure is recommended is $7,500,000 to $9,000,000.

A brief explanation of the recommendations by Geographic Area follow.

Alaska Geographic Area
Prior analysis by the Alaska Fire Service as documented in their Fire Management Activity Plan justifies these airtanker bases and investments, hence no additional analysis was done in this study.

California Geographic Area
Investments proposed at BISHOP, FRESNO, PORTERVILLE, REDDING, and SANTA BARBARA are recommended for implementation.

Closure is recommended at MONTAQUE. At CHESTER, some re-construction is in progress. It does not appear that the P-3A or C-130E models will be compatible due to runway length and/or weight bearing. Initial attack analysis indicates this as an economicly efficient location. Due to time considerations, alternative locations for the airtanker were not examined but should occur including moving airtanker to Mather.

HEMET-RYAN was recommended to be moved to San Bernardino Airport (NORTON AFB) in Phase 1. The committee recommends funding for Norton be a top priority Nationally. Establishment of Norton mitigates many limitations currently in place at Hemet-Ryan while allowing for increased service as the larger capacity airtankers can operate from at Norton. The committee recommends having two airtanker bases in the Los Angeles basin (Norton and Lancaster) with the capability to handle the future airtanker fleet in a number that is commonly needed to support large fires situations as well as initial attack. The committee recommends moving the airtanker at RAMONA to Norton and upgrading the airtanker to a 3000 gallon capacity. Positioning of Federal airtankers at Ramona,

as appropriate, will be considered when the airtanker base and airport are improved. LANCASTER (Fox Field) is a key base in South Zone. Plans exist to extend the runway 2000 feet longer and this will allow for the C-130A/B and P-3A to operate there. The C-130E is still too heavy but there is currently an over-weight waiver for the KC-97 there, so it appears that an exemption for the C-130E is possible.

MATHER AFB was recommended in Phase 1 for implementation. The Forest Service needs to acquire land for use. When Mather is ready, it is recommended the STOCKTON airtanker base facilities be moved to Mather and the PORTERVILLE BLM airtanker be moved to Mather. Consider future analysis on the effects of moving of the Chester airtanker to Mather.

Eastern Geographic Area
No airtanker base surveys were available from the two Federal airtanker bases, BEMIDJI and ELY. The committee recommends they be kept open but that no investments be made until an airtanker base survey is completed and approved.

Great Basin Geographic Area
Investments proposed at BATTLE MOUNTAIN, BOISE, CEDAR CITY, HILL, McCALL, POCATELLO, STEAD, and TWIN FALLS are recommended for implementation. Note that in Recommendation #9, it states "When practical, move the second airtanker (R2450) at Prescott to Ceder City."

Northern Geographic Area
Investments proposed at COEUR D'ALENE, MISSOULA, and WEST YELLOWSTONE are recommended for implementation.

BILLINGS is recommended for implementation but it appears to the committee that the design standards may be for a base with too high of a capacity. Prior to actual project work implementation, adequate investigation of the most cost efficient way to implement this project should occur using the approved agency guidelines. GRANGEVILLE is recommended to be closed as an airtanker base for large airtankers. As soon as practical, move the airtanker to McCall and increase the size to 2450 gallon minimum capacity. Local analysis of this base in support of single engine airtankers should occur to determine the long term direction for the facilities. HELENA was not shown in this study to be needed BUT it is also felt that data was lacking from all users on the benefits of this airtanker base. The committee recommends the base be kept open for now. The committee recommends necessary NFMAS analysis on Federal units within the service area be completed promptly to allow for determination of future status of the base and the airtanker. The committee recommends no investments be made until the adequate NFMAS work is done. KALISPELL is recommended to be closed with the airtanker moved to Missoula. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and most efficient use of the capital investment dollars available.

Pacific Northwest Geographic Area
Investments proposed at KLAMATH FALLS, LA GRANDE, REDMOND and TROUTDALE are recommended for implementation.

EVERETT and OMAK are recommended to be closed. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and for the most efficient use of the capital investment dollars available. Cooperative plans can be developed with

British Columbia Forest Service to provide service when needed. LAKEVIEW is recommended to be closed as initial attack and large fire support does not appear to be compromised with service from Redmond and Klamath Falls.

MEDFORD was analyzed using only the effects on Forest Service protected lands due to lack of current data on State protected lands. The effects on Forest Service protected lands in the Medford airtanker base service area is low considering the recommended airtanker staffing at Klamath Falls (2 airtankers), Redmond (2 airtankers) and Redding (2 airtankers). This analysis showed significant benefits to the alternative of closing Medford and moving the airtanker to LaGrande. The committee recommends the base be closed, if appropriate after evaluation and integration of potential effects on State protected lands, and the airtanker moved to LaGrande. Invest no additional Federal dollars at this time.

WENATCHEE was recommended for changes in Phase 1. The current estimate for the new airtanker base portion of a larger site plan is $3,250,000. Prior to actual project work implementation, adequate investigation of the most cost efficient way to implement project objectives should occur following approved agency guidelines. MOSES LAKE is recommended to be developed as a base which can be activated, as needed, to relieve the workload at Wenatchee and to provide an airtanker base in Central Washington compatible with the C-130E.

Rocky Mountain Geographic Area
Investments proposed at RAPID CITY and GRAND JUNCTION are recommended for implementation.

JEFFCO is not compatible with P-3A or C-130E operation. The committee recommends no further investment at Jeffco and recommends relocation to Colorado Springs. After relocation, perform local analysis at Jeffco in support of single engine airtankers should occur to determine the long term direction for the facilities. COLORADO SPRINGS is recommended to be developed as a replacement for Jeffco. DURANGO is recommended to be developed as a new airtanker base. Upon development, move one airtanker from Ft. Huachuca to Durango.

Southern Geographic Area
Investments proposed at LAKE CITY and TALLAHASSEE are recommended for implementation.

ALEXANDRIA, CHARLESTON AFB, JACKSON, and SANFORD are proposed as potential locations where temporary airtanker bases could be developed. Note that in respect to many of the standards in the Airtanker Base Planning Guide, there is no appreciable difference between a type of airtanker base or if a base has an airtanker assigned to the base via a contract. The committee recommends no Federal investment until a complete airtanker base survey is completed and approved by the Regional Forester and the Washington Office.

ASHEVILLE is recommended to be continued. Development of a new airtanker base on the airport is proposed with costs under development. The committee recommends no Federal investment until a new complete and comprehensive airtanker base survey is completed and approved by the Regional Forester and the Washington Office. KNOXVILLE is recommended to be closed following upgrading of the airtanker base at Asheville. Invest no additional Federal dollars at Knoxville at this time.

FT. SMITH is recommended to be continued. Development of a new airtanker base on the airport is proposed with costs under development. The committee recommends no Federal investment until a new complete and comprehensive airtanker base survey is completed and approved by the Regional Forester and the Washington Office.

GEORGETOWN and STAUNTON are recommended to be closed as future airtankers are not compatible with this airport. This closure should be staged as alternative sites are developed. Invest no additional Federal dollars at this time to improve.

Southwest Geographic Area
Investments proposed at ALAMOGORDO, ALBUQUERQUE, FT. HUACHUCA, PHOENIX, PRESCOTT, ROSWELL, SILVER CITY, and WINSLOW are recommended for implementation.

Recommendation #8 - Capital Improvement Initiative for Airtanker Bases
The committee recommends that a National initiative be developed to fund improvements and investments at airtanker bases. The committee has divided the recommended investments into three priorities. It is recommended that priority 1 projects be completed within 3 years, priority 2 projects be completed within 7 years and priority 3 projects be completed within 10 years. Priority 1 projects total to $15,561,259, priority 2 projects total to $16,627,072 and priority 3 total to $6,460,074. The total recommended capital improvement cost at airtanker bases is $38,738,405.

Recommendation #9 - Airtanker Location Changes
Through the airtanker base analysis work, several efficiencies where discovered that improve on the Phase 1 report recommendations. It is recommended, when practical, to move the second airtanker (R2450) at Prescott to Ceder City. Additional changes are recommended and have been noted in Recommendation #7 of this report.

Recommendation #10 - Funding, Managing and Controlling of Airtankers
As recommended in Phase 1, the committee reaffirms that large airtankers are National resources and they should be funded, managed and controlled in a manner that is consistent with this objective. Effective strategic management is the responsibility of Geographic Area Coordination Centers and the National Interagency Coordination Center.

The committee further recommends implementation of a system similar to the one in British Columbia to allow for flight following and the tracking of information allowing for more optimum management of the airtanker fleet. Implement the system in all large airtankers, leadplanes and air attack aircraft. Establish a group to further define specifics with the following implementation timeline: study report complete by 6/1/97; system installation in FY98; operational use in FY99.

Recommendation #11 - Night Operations
The committee does not recommend pursuing of night operations for fixed wing airtankers. In review of the historic use of airtankers, it appears that some daylight hours are under utilized. Full utilization of these daylight hours should be achieved before further exploration of night operations is pursued. Night operations have been tested in rotor wing aircraft and the committee recommends pursuing the opportunity as a way to help support night operation on extended attack or large fire operations.

Recommendation #12 - Adherence to Train0xg Standards
The committee recommends establishment of and adherence to minimum training and performance standards for airtanker base personnel.

Recommendation #13 - Maintaining Standards at Airtanker Bases

The committee recommends that if the hosting unit for an airtanker base is unwilling to support minimum base standards defined in the Airtanker Base Planning Guide, then relocation of an assigned airtanker should be pursued. Adequate airtanker base facilities promotes efficient and safe use of airtankers.

Recommendation #14 - Funding Airtankers and Airtanker Bases on an Interagency Basis

The committee recommends funding of airtanker base cost and airtanker availability funded on an interagency basis.

Recommendation #15 - Fire Planning Issues

The committee recommends the Washington Office, in conjunction with the fire planning update project, verify and validate with interagency coordination the assumptions used in the IAA as it relates to airtanker use. Of particular interest is the production rate functions used to determine fireline amounts based on gallons delivered and fire rate-of-spread.

Recommendation #16 - Dispatch Philosophy for Airtankers

The committee recommends dispatch plans provide for the appropriate number of airtankers as is needed to maximize the fireline production "early on" versus minimizing the number of airtankers dispatches requiring extended reloading.

CONCERNS and OPPORTUNITIES

1. The need to provide urban interface protection using airtanker support was mentioned by several geographic areas. This reinforces the desire to have interagency participation in the planning, funding and implementation of the airtanker program.

2. Information from this study should be used in training courses.

3. There is a desire to improve the strategic management of airtankers, leadplanes and air attack platforms. Current practices often result in less than efficient utilization of these critical resources. No one can assure that these resources are being placed at the points of most critical need. Our flight following practices are prone to performance breakdowns and can result in unsatisfactory search and rescue response.

   Strategic management of tactical resources must be coordinated and include as much real time decision support information as is possible. We should run our suppression programs as a business, allocating resources to incidents of greatest need (values at risk) while providing for firefighter safety. Opportunities exist which can improve upon this situation.

NATIONAL STUDY OF (LARGE) AIRTANKERS TO SUPPORT INITIAL ATTACK AND LARGE FIRE SUPPRESSION

Phase 2 Report

PREFACE

Large airtankers defined as fixed or rotor wing aircraft with a capacity to carry at least 1000 gallons of retardant were studied. The study justification for staffing fixed or rotor wing aircraft with a capacity to carry less than 1000 gallons is left to local analysis processes.

As one reads this r0xort, the study committee suggests the reader's view remain *strategic*. Be open to different ideas and to change. Ask yourself the question, "What should the large airtanker and large airtanker base program look like for the next 20 years?" Release from the current situation and ownership of today. Review the recommendations following careful examination of the analysis and decision process supporting the recommendations. Lots of professional expertise and judgement as well as analytical results were used. The committee and countless local planners have spent literally thousands of hours developing the data and concepts that may appear on a single sheet of paper within this report. This work has definitely advanced our knowledge base and cooperation with others to new a level. Some of this knowledge has already been used to save money and support other management related decisions. Economic efficiency across agency/state/regional boundaries was a goal. Consider the report in it's entirety. It is the product of a highly qualified set of individuals who worked diligently as a TEAM. Implementation of recommendations by management, coordinators, specialists and firefighters working as a TEAM will be critical to achieving predicted benefits.

BACKGROUND

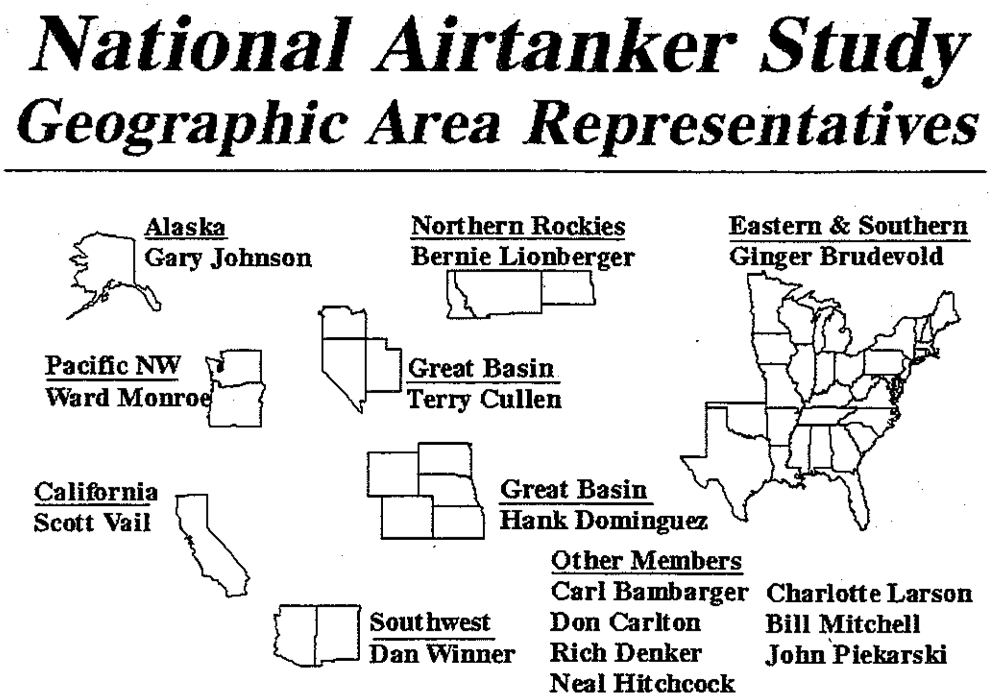
The National Shared Forces Task Force Report (1991) proposes a "schedule" for completion of National Shared Forces studies. The studies conducted under the umbrella of the Report are led by the Forest Service. They are interagency in scope with committee representation and/or coordination with the USDI-Bureau of Land Management, National Park Service, Bureau of Indian Affairs, Fish and Wildlife Service and State wildfire suppression agencies.

The first study completed under the umbrella of the National Shared Forces Task Force Report (NSFTFR) was the National study of Type I and II Helicopters To Support Large Fire Suppression (1992). The second study chartered by the NSFTFR Steering Committee is the National Aerial Delivered Firefighter Study which is currently in progress. The third study chartered was the National Airtanker Study of which Phase 1 was completed in March, 1996. The initial phase of this study examines and recommends the most efficient number and initial staffing location for large airtankers to support fire initial attack and large fire suppression.

THE STUDY TEAM

The NSFTFR Steering Committee requested the USDA Forest Service's PNW Region to provide the coordination and leadership for a National Airtanker Study (NATS). A Study Team was established to conduct this effort. The committee had membership from all Regions of the Forest Service and representatives from the Bureau of Land Management and Office of Aircraft Services. Coordination with the USDI-National Park Service, Bureau of Indian Affairs, and Fish and Wildlife Service at the National level was through the Bureau of Land Management. Coordination with Regional and State Levels as well as State agencies was through team members representing geographic areas. The committee members selected represent agencies, technical specialty and geographic areas and are listed in Appendix A. Figure 1 outlines the geographic areas and identifies the individuals on the study team representing the areas.

Figure 1.



THE STUDY CHARTER

The Study Charter is contained in Appendix A and contains the vision, mission and guiding principles (assumptions).

The Study Vision The National Airtanker Study shall provide information, guidance and support to managers for National and Regional decisions affecting the National airtanker program and their support components for the next 10-20 years.

The Study Mission The National Airtanker Study shall provide analytical support and model development allowing for display of interrelationships and tradeoffs of different large airtanker capability and location in support of wildfire initial attack and extended attack operations. For the purposes of this study, "large airtanker" will refer to fixed or rotor wing aircraft with a capacity to carry at least 1000 gallons of retardant. In addition, support and interrelationships to large fire suppression will be obtained. Analytical support and model development shall result in the identification of the most effective and efficient utilization of airtankers. Alternatives will be examined and displayed for numbers and base locations.

The Timeline This National Airtanker Study was conducted in two phases. Phase 1 provided the basis for determining agency needs in the short term and became the basis for the 1996-1998 Forest Service and Department of Interior large airtanker contract solicitations. Phase 1 was completed in March, 1995. This report completes Phase 2 which was structured to provide the basis for determining agency large airtanker and airtanker base improvement needs in the long term (1999-2020) and will become the basis for the Forest Service and Department of Interior large airtanker contract solicitations from 1999 into the future or until revised.

GOALS/OBJECTIVES FOR PHASE 2

The goal of Phase 2 is to optimize all reasonable airtanker base locations and airtanker fleet possibilities and is not constrained by the current fleet. The outcomes of Phase 2 will provide information to guide modernization of the airtanker program and will allow for stabilization of the airtanker supply and agency demand situation. The study will reflect move-up conductivity of the system. An attempt will be made to optimize the dispatch philosophy and the role of the total initial attack organization will be examined. The study will clarify the roles of large airtankers in initial attack and large fire support. Specificly, it will examine airtanker performance, airtanker capability in the 1000 and 5000 gallon size class, night use, the role of MAFFS and the role of Type I helicopters in the application of retardant.

As a minimum, recommendations will be made on:

1. The number and size of airtankers by location.

2. The need for airtankers with capacity of between 1000 and 2000 gallons.

3. The need to develop night time capability.

GUIDING PRINCIPLES (ASSUMPTIONS) USED IN THE STUDY

Traditional methods of operation were examined and challenged where appropriate. A structured critical path for the study defined benchmarks and time frames. The study examined the cost of institutional barriers to total availability, mobility and flexibility. The study includes alternatives for maximizing the effectiveness of airtankers. A study communications plan defined actions to convey study progress, status and recommendations to affected groups.

Specific assumptions for Phase 2 are:

1. Both the Forest Service and Bureau of Land Management, use the National Fire Management Analysis System (NFMAS) to analyze and justify initial attack resources for wildland protection. Phase 2 used of the Initial Attack Assessment (IAA) model and existing local NFMAS analysis. Past history of demand, unavailability and current dispatch philosophy in initial attack analysis (NFMAS) was assumed. Some states also use NFMAS while other agencies use similar systems which are appropriate to their specific agency mission.

   The NFMAS initial attack assessment (IAA) model considers initial attack support and as such, is not the absolute answer in terms of total fire support to current and projected escaped wildfire activity. In particular, large fire support needs will be considered. A final reality/professional judgement check using experienced fire professionals will be done to assure the proper integration of analytical results with experience, skill and intuition.

2. Generally the information currently available or that which could be developed will be adequate for this study.

3. The study provided for interagency participation even though the Forest Service provided the leadership in conducting the study. Interagency information was included when provided and appropriate. Other agency personnel had the opportunity to review and comment on the study.

4. Phase 2 will not critique airtanker operational effectiveness and efficiency at the incident.

THE STUDY PLAN AND PROCESS FOR PHASE 2

Step 1. Review information from Phase 1. In addition, examine historic uses and trends including airtanker base information on an interagency basis.
Initial attack data from local NFMAS analysis, together with data on the use of airtankers to support large fire suppression was identified as needed to be collected to support this analysis. For each area, the purpose, data needed, data sources, and responsible person were identified. The historic period for gathering initial attack analysis varied based on local NFMAS analysis but in general included the time period 1980 - 1995.

Data on airtanker use to support large wildfires varied but in general covers the 1980-1993 period of time. The data displayed on pages 36-41 and in Phase 1, Appendices L and M, was considered adequate for use in Phase 2 due to the length of the time period sampled.

Step 2. Gather and information on potential airtanker types and airtanker bases.
For the determination of future airtanker platforms, a survey will be made of existing civilian and military aircraft types. Details on performance and availability will be determined.

In addition, an initial survey of the physical status of airtankers bases in Phase 1 will receive more detailed attention. During Phase 1, a questionnaire was completed by personnel at each federal airtanker base in the United States. The information received on Phase 1 was collected in a short time period without an opportunity to review for consistency with an agency standard. Since Phase 1, the "Interagency Retardant Base Planning Guide--Fixed and Rotor Wing" was released by the National

Wildfire Coordinating Committee's Fire Equipment Working Team. This will be referred to as the Airtanker Base Planning Guide. In Phase 2, the questionnaire was based on this guide and required extensive civil engineering involvement to complete. The questionnaire gathered information on the physical status of each base. The results will be used to develop a collective list of needed capital improvements. Detailing results from the questionnaire are in Appendix H.

Step 3. Develop evaluation criteria and alternatives for potential airtanker types and airtanker base locations.

Criteria to be used in the evaluation of each of the two items, aircraft and airtanker bases, will be developed in this step.

Step 4. Display procurement and staffing options. Use the NFMAS initial attack assessment (IAA) model and other analysis tools to perform analysis of aircraft and airtanker base alternatives. Examine historic retardant use on wildfires which have escaped initial attack to predicted airtanker needs to support extended attack and escaped wildfire needs. Display dispatch flow options based on analysis results.

Different methods of procuring aircraft and the staffing of these aircraft as well as the process to analyze airtanker bases will be developed.

Forces used for initial attack of wildland fires are analyzed and justified using NFMAS and the BLM/BIA Fire Management Activity Plan. The NFMAS initial attack assessment (IAA) model considers initial attack support and is used to analyze the effect of the alternatives. The local initial attack forces will remain constant as airtanker staffing and locations are changed. This system will be used to estimate the initial attack efficiency for the various potential airtanker platforms. This same system together with large fire support requirements will be used to estimate the economic justification of proposed airtanker base investments. A final "reality" check against professional judgement will be done to assure the proper integration of analytical results with experience, skill and intuition.

Also to be examined will be the current dispatch and coordination process for airtankers. Recommendations for a more efficient operation will follow.

Step 5. Develop recommendations to address goals/objectives for Phase 2.

Step 6. Concerns and opportunities generated by the this study and comments for future analysis.

The process used is displayed in Figure 2 which diagrams the flow of activities in this study. The scope of the study was to determine the most efficient number of airtankers to support initial attack and large fire suppression. The use of the military and aircraft from other sources such as Canada when demand reaches a very high percentile of supply was not considered but information on when use can be expected is displayed. 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. The diagram displays these relationships within the scope of this study.

```
|<---IA--->|<-----Large Fire Suppression------>|<----Other---->|
|<------- Scope of this Airtanker Study------->|<---Military-->|
|<----- Private Sector Airtanker Supply ------>|
```

Figure 2 - Study Process and Flow

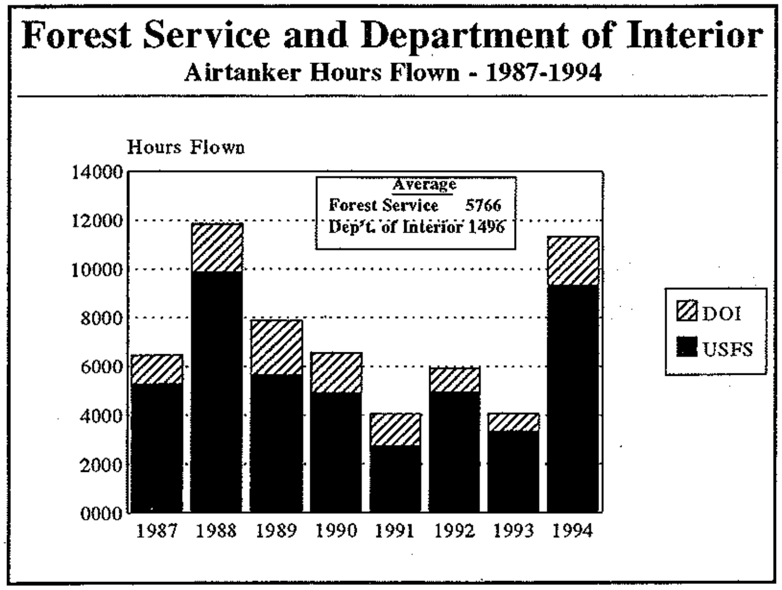
```
     -----------------       -----------------      ----------------------
    |     Step 1      |---->|    Analysis     |----->|        Step 2        |
    | Historic Data   |      -----------------      |  Gather Information  |
    |  Interagency    |----------------------------->| on Aircraft and Bases |
     -----------------                              ----------------------
            |                                                 |
             -------------------------------------------------
                                    |
                                    V
    ----------------------------------------------------------------------------
|<-| Step 3-Develop Evaluation Criteria and Alternatives for Aircraft and Bases  |
|  | Step 4-Perform Alternative Evaluation.                                     |
|   ----------------------------------------------------------------------------
|
|   ------------------       ------------
|  | Are there enough  |Yes | Procurement |---------
|->|    airtankers?    |--->|   Options   |         |
|   ------------------       ------------          |
|          | No                   ^                 |
|          V                      |                 |
|   --------------------          |                 |
|  | Define ways to get |         |                 |
|  | more airtankers or |----------                 V
|  | display effects.   |                 ----------   | Recommended |
|   --------------------                 | Analysis |-->| Alternative |->|
|                                         ----------    -----------     |
|                                             ^              ^          |
|                                             |              |          |
|   ------------------       ------------     |              |          |
|  | Can we adequately | No |  Staffing  |-----              |          |
|->| operate and staff |--->|    and     |                   |          |
|  | at airtanker bases?|   |   Bases    |                   |          |
|   ------------------      |  Options   |                   |          |
|          | Yes             ------------                    |          |
|          V                                                 |          |
|      ----------                                            |          |
|     | Implement |------------------------------------------            |
|      ----------                                                       |
|   ------------------       ------------                 -------------  |
|  | Is the dispatch   | No |  Display   |      ----------   | Recommended | |
|->| flow as efficient |--->|  Dispatch  |-->| Analysis |-->| Alternative |->|
|  |   as possible?    |    |  Options   |      ----------    -------------  |
    ------------------       ------------                        ^          |
           | Yes                                                 |          |
           V                                                     |          |
       ----------                                                |          |
      | Implement |-----------------------------------------------          |
       ----------                  ------------------------------------------
                                   |
                                   V
     ------------------------------------------------------------------
    |                   Step 5 - Develop Recommendations                |
    | Number of and how to Procure!!   How to Staff!!  How to Mobilize!! |
     ------------------------------------------------------------------
     ------------------------------------------------------------------
    | Step 6 - Display Concerns and Opportunities Generated by the Study |
     ------------------------------------------------------------------
```

STEP 1: REVIEW OF PHASE 1, HISTORIC USE, DEMAND AND TRENDS FOR LARGE AIRTANKERS

The demand for large airtankers on wildfires has remained steady overtime though use fluctuates from year to year based on seasonal severity. The chart in Figure 3 shows the number of flight hours flown by large airtankers contracted for by the Forest Service and the Department of Interior over the period 1987-1994. The average annual hours flown is 7,262.

The twenty year average for gallons of long term fire retardant dropped by large airtankers is 13,420,488 gallons per year. Using data from the 1992-1994 period with adjustments for retardant gallons dropped from other sources, it appears that 3001 gallons are dropped per flight hour flown. The weighted average size of airtanker contracted for by the federal agencies is 2497 gallons. Hence, the average round trip time for a airtanker retardant drop is 50 minutes (60) * (2497/3001). Subject matter experts verified that this value is close to experienced values. The information was used in Step 4 of the study process.

Figure 3 - Hours Flown



The primary user of large airtankers is the Forest Service, although other federal and state agencies have this capability. The states of Alaska, California and Minnesota contract for large airtankers and many states use airtankers with a retardant capacity of less than 1000 gallons. For all agencies, large airtankers have been available through exclusive-use contracting methods although at times, additional airtankers have been added during the fire season.

Table 1 - Supplemental Airtanker Capability Requested

	<------ MAFFS------>		Additional Days Airtankers Were
Year	Number of Missions	Gallons Dropped	Added From Private Contractors
1973	47	141,000	Info Not Available
1974	0	0	Info Not Available
1975	99	297,000	Info Not Available
1976	6	18,000	Info Not Available
1977	204	612,000	Info Not Available
1978	0	0	Info Not Available
1979	254	732,000	Info Not Available
1980	7	21,000	Info Not Available
1981	0	0	Info Not Available
1982	0	0	Info Not Available
1983	47	140,000	Info Not Available
1984	0	0	Info Not Available
1985	285	798,000	Info Not Available
1986	0	0	Info Not Available
1987	193	597,000	Info Not Available
1988	646	1,917,000	Info Not Available
1989	311	907,000	32 days
1990	187	528,000	119 days
1991	0	0	2 days
1992	163	447,000	421 days
1993	159	465,000	None available
1994	1,897	5,036,800	197 days

The primary use for large airtankers is initial attack of wildfires but large fire support is a significant role. Records for the past three years, show extensive use on size class "D" and larger fires (fires greater than

100 acres in size). Peak utilization occurs at the times when large fires are most likely to occur. Generally this is in February-April in the Southern and Eastern Areas, May-July in Alaska and in the Southwest Area and June-September in the western United States. Table 1 contains information on the extent of supplemental airtanker capability by year. This information is given to provide understanding that events do occur which tax the large airtanker fleet.

Table 2 shows the critical time periods by Geographic Area when large airtankers are needed in initial attack, extended attack and large wildfire suppression. Staffing of large airtankers may vary some from these periods to achieve overall National cost efficiencies.

Table 2 - Critical Time Period to Staff Large Airtankers

```
                                  MONTH
--------------------------------------------------------------------------------
AREA     FEB----MAR----APR----MAY----JUN----JUL----AUG----SEP----OCT----NOV
--------------------------------------------------------------------------------
Northern                                         <------------>
   |      |      |      |      |      |       |     |      |      |      |
Rocky Mt                                    <--------------->
   |      |      |      |      |      |       |     |      |      |      |
Southwest                      <------------------>
   |      |      |      |      |      |       |     |      |      |      |
Great Basin                           <------------------------>
   |      |      |      |      |      |       |     |      |      |      |
California                           <-------------------------------------->
   |      |      |      |      |      |       |     |      |      |      |
Pacific NW                                <-------------------------->
   |      |      |      |      |      |       |     |      |      |      |
Southern    <---------------------->
   |      |      |      |      |      |       |     |      |      |      |
Eastern              <----------------->
   |      |      |      |      |      |       |     |      |      |      |
Alaska                         <------------------------>
```

Military Role

The Modular Airborne Fire Fighting System, MAFFS, was originally a Department of Defense (DOD) project resulting from a series of wildfires on Air Force and private lands in Southern California during 1970 and 1971. Funding for initial design and development, and production and testing of a prototype MAFFS unit was provided by the Air Force. The project was completed in 1972.

In Fiscal Year 1973, the Forest Service budget included a special line item for the purchase of additional MAFFS units. The Forest Service awarded a contract for the purchase of seven additional MAFFS units in 1974. Since 1975, USDA and DOD have coordinated the use of a total of eight MAFFS units under a Memorandum of Understanding (MOU). The Department of Interior subsequently entered into the same MOU in 1978.

The existing MAFFS units are aging, less effective than conventional airtankers, and are in need of replacement. System failure due to corrosion and maintenance difficulties is a major concern. The current MAFFS design does not meet the Interagency Airtanker Board's criteria for airtanker effectiveness.

STEP 2: GATHER INFORMATION on POTENTIAL AIRTANKER TYPES and AIRTANKER BASES AND RELATED TOPICS

Current Aircraft

The current multi-engine large airtanker fleet is 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 the last 1980's and early 1990's, two turbine aircraft models were added to the fleet, the P-3A and the C-130A. In Phase 1, airtanker categories were defined by the number of gallons of fire retardant the aircraft could carry. This allowed grouping of aircraft for the purpose of analysis. A special category was defined for all airtanker aircraft operated by cooperators. In Phase 1, these categories were only defined for fixed wing aircraft. The category definitions follow:

Category	Tank Size	Engine Type	Aircraft in Category
T3000	3000 Gal.	Turbine	C-130A, P3A
R2200	2200 Gal.	Reciprocating	P2V, DC-4, PB4Y2, SP2H, DC-6
R3000	3000 Gal.	Reciprocating	DC-7, KC-97
Coop	Various	Various	Various

Also in Phase 1, flight rate, cruise speed and climb rate were defined as follows for each category. The 1995 flight rate by airtanker category used is based on a weighted average from the Forest Service 1995 Airtanker Contract. The 1996-1998 flight rate by airtanker category used is based on a weighted average from the Forest Service 1996-1998 Airtanker Contract.

Aircraft	Base Flight Rate	Base Flight Rate 1996-	Daily Availability		(Knots)	Number of Minutes To Climb <-To Given Altitude (Ft. AGL)->				
Type	1995	1998	1995	1996-1998	Speed	1000	2000	3000	4000	5000
T3000	$2,801	$2,861	$2,486	$2,887	238	0.70	1.30	2.00	2.70	3.30
R2200	$1,467	$1,541	$1,987	$2,253	189	1.05	2.10	3.20	4.30	5.30
R3000	$2,145	$2,230	$2,420	$2,134	235	1.30	2.60	3.90	5.20	6.50

Current Airtanker Bases

Figure 4 indicates the airtanker base locations in 1996 for Alaska with a 100 statute mile circle around each base.

Figure 4a shows this same information for the lower 48 states.

For current airtanker bases, 83% of a representative fires are with this distance.

The average distance is 84 statue miles.

Figure 4.

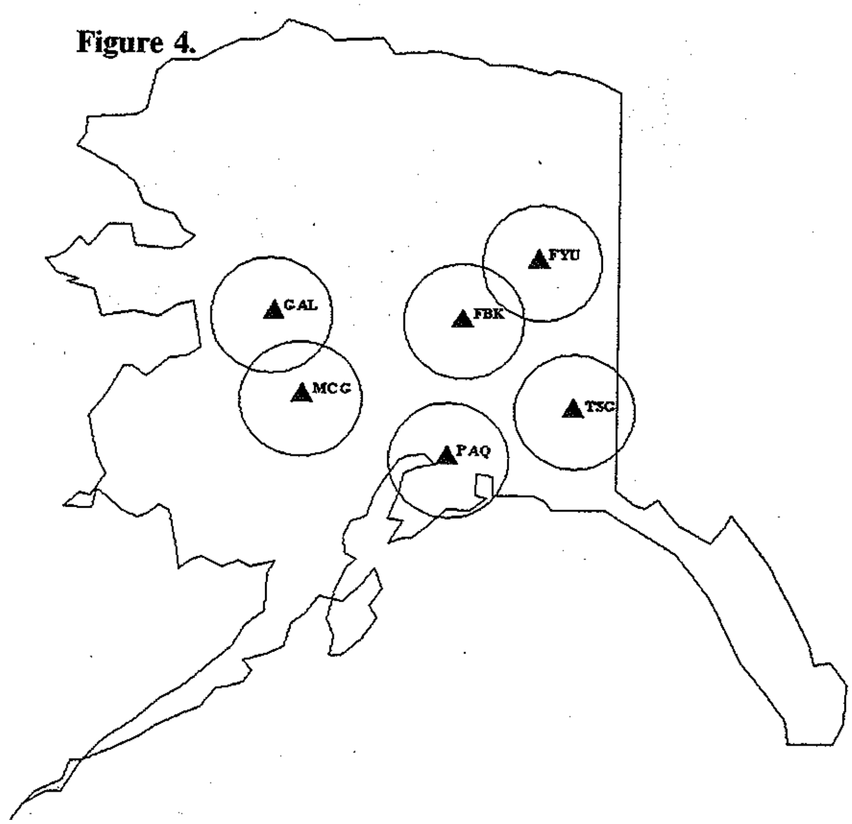
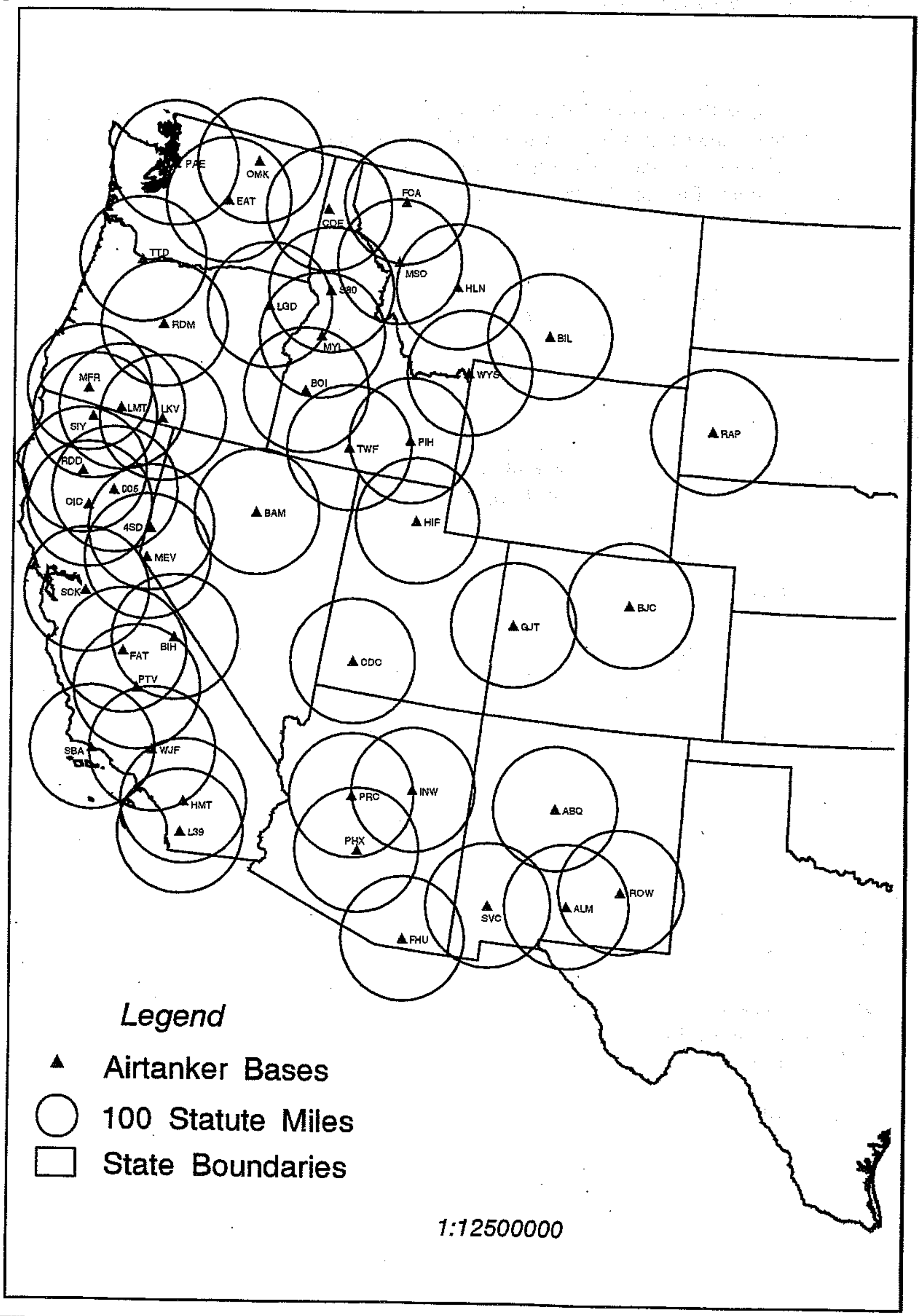
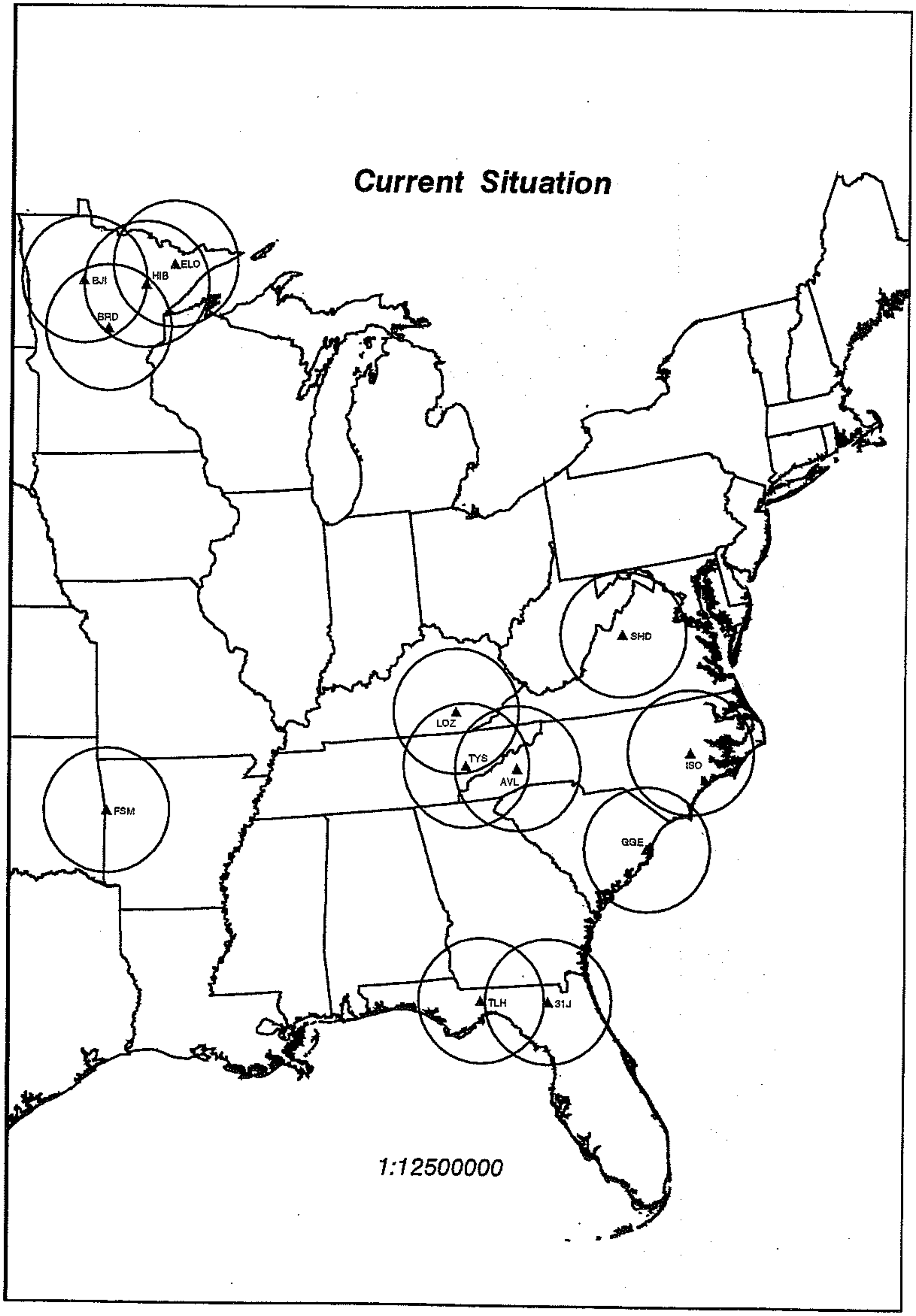


Figure 4a - Airtanker Bases That Large Airtanker Use




Current Situation
BJI
HIB
ELO
BRD
SHD
LOZ
TYS
AVL
ISO
FSM
GGE
TLH
31J
1:12500000

The recommended placement of Federal large airtankers at these bases for 1996-1998 period from the Phase 1 report is shown in Table 3. Items highlighted in bold were not procured due to a lack of available aircraft. Specific aircraft performance and physical information for the fixed wing aircraft are contained Appendix B.

Table 3 -1996-98 Large Airtanker Staffing

Geo. Area	Base	Season	No. Days	Study Category
AK-BLM	Ft. Wainwright	5/20-8/17	90	AT2200
AK-BLM	Ft. Wainwright	6/01-8/29	90	AT2200
AK-AK	Palmer	5/01-7/29	90	AT2200
AK-AK	Ft. Wainwright	5/22-8/19	90	AT3000
C-FS	Chester	6/15-10/15	106	AT2200
C-FS	Fresno	5/23-10/31	139	AT3000
C-FS	Hemet (San Bern. Co.)	6/11-11/17	123	AT2200
C-FS	Hemet (San Bern Co.)	6/01-11/01	132	AT2200
C-FS	Lancaster	6/03-11/01	130	AT2200
C-FS	Lancaster	7/02-11/15	118	AT2200
C-FS	Chico (Mather)	7/03-10/16	90	AT2200
C-BLM	Porterville BLM (Mather)	6/02-08/17	66	AT2200
C-CA	Paso Robles	6/01-10/31	153	AT2200
C-FS	Porterville	6/07-10/24	120	AT2200
C-FS	Ramona	6/01-11/15	144	AT2200
C-FS	Redding	6/11-10/14	108	AT3000
C-FS	**Redding (D-G Fires)**	**6/15-9/15**	**79**	**AT2200**
C-CA	Redding	7/01-10/15	107	AT2200
C-FS	Santa Barbara	6/14-11/02	122	AT3000
C-CA	Santa Rosa	7/01-10/15	107	AT3000
E-MN	Hibbing	4/15-5/29	39	AT2200
E-MN	Bemidji	4/15-5/29	39	AT2200
E-BIA	Brainerd	4/05-5/19	39	AT2200
GB-FS	Boise (D-G Fires)	7/14-9/29	67	AT2200
GB-FS	Boise	6/15-9/15	80	AT2200
GB-FS	Hill (SLC)	7/17-9/30	65	AT3000
GB-FS	McCall	7/17-9/21	57	AT3000
GB-BLM	Minden	6/08-9/13	84	AT3000
GB-BLM	Pocatello	6/23-9/29	85	AT3000
GB-BLM	Stead	6/01-9/08	86	AT2200
N-BLM	Billings	7/13-9/30	69	AT2200
N-FS	Coeur'd Alene	7/15-9/29	66	AT3000
N-FS	Grangeville	7/18-9/18	54	AT2200
N-FS	Helena	7/29-9/18	44	AT2200
N-FS	Kalispell	7/14-9/14	55	AT2200
N-FS	Missoula	7/13-9/14	55	AT2200
N-FS	West Yellowstone	7/29-9/18	44	AT3000
PNW-FS	Klamath Falls	7/13-9/29	68	AT2200
PNW-FS	Klamath Falls	5/29-10/30	109	AT3000
PNW-FS	LaGrande	6/28-10/15	95	AT3000
PNW-FS	**LaGrande (D-G Fires)**	**7/15-10/01**	**66**	**AT2200**
PNW-FS	Medford	6/15-10/19	109	AT3000
PNW-FS	Redmond	6/08-9/26	95	AT2200
PNW-FS	Redmond	7/01-10/23	99	AT3000
PNW-FS	Wenatchee	7/15-10/01	66	AT3000
PNW-FS	Wenatchee	6/10-10/25	118	AT3000
RM-FS	Jeffco	6/16-9/30	92	AT2200
RM-BLM	Grand Junction	6/09-9/16	86	AT2200
S-FS	Asheville	3/01-5/30	78	AT2200
S-FS	Ft. Smith	2/23-5/04	62	AT3000
S-FS	Knoxville (D-G Fires)	3/01-5/20	70	AT2200
S-FS	Knoxville	2/24-5/09	65	AT2200
SW-FS	Alamogordo	4/01-7/11	87	AT2200
SW-FS	Albuquerque	5/22-7/14	47	AT2200
SW-FS	Albuquerque	4/29-7/11	64	AT2200
SW-FS	Ft. Huachuca	5/14-6/21	33	AT3000
SW-FS	Ft. Huachuca (D-G Fires)	6/01-7/15	38	AT2200
SW-FS	Phoenix	5/05-8/18	91	AT3000
SW-FS	Prescott	5/04-7/15	62	AT3000
SW-FS	Prescott (Old GCN)	5/11-7/27	67	AT2200
SW-BLM	Roswell (D-G Fires)	6/01-7/14	38	AT2200
SW-FS	Silver City	5/06-7/26	70	AT3000
SW-FS	Silver City	4/19-7/11	72	AT2200
SW-FS	Winslow	5/11-7/12	54	AT2200
SW-FS	Winslow	5/03-7/12	61	AT3000

Information from Operators

The committee solicited information from the airtanker industry that was proprietary. Information provided was used in the analysis.

The questions asked follow:

1. What is your inventory of fixed wing aircraft that might reasonably be able to be tanked with a tank capacity of at least 1000 gallons and used as airtankers? For rotor wing aircraft, what is your inventory of aircraft that could either sling a bucket with a capacity greater than 1000 gallons or carry a fixed tank

with a capacity greater than 1000 gallons? If possible, please be specific as to aircraft model, engine configuration, and retardant tank capacity. These are aircraft that we would use to mainly support wildland fire initial attack and most likely be contracted for on a exclusive-use basis.

2. Based on the aircraft specified in question No. 1 or by other means of procurement, what is your capability and intent to tank additional airtankers based on Interagency Airtanker Board standards?

3. What are your concerns about the airtanker program regarding the airtanker fleet and primary base locations that you might wish to share with the study committee? Your ideas for improvement are very important to us and the future of the airtanker program. Be as specific or as general as you wish.

4. Phase 2 of the study provides an opportunity to define the vision for the airtanker program beyond the 1996-1998 contract period. This includes both multi-engine and rotor wing, as well as initial attack and large fire support needs. What would be your vision and what capability enhancements would you support the committee exploring? What platforms do you feel most appropriate and cost effective to consider in Phase 2? What would you prefer, privately owned airtankers, government-furnished property, or a combination there of as airtankers? Please be as specific as you can.

5. The study committee has been requested to carefully evaluate aviation safety considerations at airtanker bases. Do you have any safety concerns or issues related to a specific airtanker base? Please be specific as to aviation safety concerns in the airport environment, i.e., taxi, take-off, departure and approach, landing, or taxi to the loading pits. Please include aviation safety concerns in the loading pits and airtanker parking areas.

6. Is there any additional information that you wish to share with the study committee?

In addition, the committee received two proposals from individuals proposing the A-10 as a potential airtanker.

<u>Future Aircraft</u>
A variety of aircraft (excess military, commercial, and turbine upgrades) were considered as potential large airtanker platforms for the future. Future fixed wing fleet possibilities were restricted to multi-engine platforms capable of delivering over 1000 gallons of retardant.

Only turbine powered aircraft were considered. There is a concern for the future availability of aviation fuel which reciprocating engine aircraft use. The fuel available may also be of less octane rating which will affect performance and the economics of large reciprocating engine powered aircraft. The turbine aircraft have higher speed capability and greater engine reliability.

It is recognized that the airtanker industry may elect to procure and convert to airtankers other aircraft not examined in this study. However, because of the mix of size classes and available sources for acquisition of the aircraft contained in this study, the studied aircraft are seen as suitable surrogates (in terms of size, capacity, capability, performance, economics of procurement and operation, etc.) to aircraft not specifically included as a part of this study. A reasonable transition period from the current fleet mix to the desired future mix will be necessary to enable the industry to convert to a turbine powered fleet. A transition plan should be developed with industry outlining a timely conversion process.

Potential future fixed wing airtanker fleet aircraft where categorized into three categories. These are Civilian Aircraft, Military Excess Aircraft, and Turbine Refit Aircraft. In addition, Type I helicopter aircraft that can haul at least 1000 gallons at 5,000 feet at 30 degrees centigrade are listed.

Civilian Aircraft	Military Excess Aircraft	Turbine Refit Aircraft	Type 1 Helicopters
- CL-215T	- E-2C	- C-123T	- BV-234
- CL-415T	- S-3	- P-2T	- S-64F
- F-27	- A-6	- DC-4T	- BV-107
- CV-580	- A-10	- S-2T	
- L-188	- P-3A		
- L-382G	- C-130A,B		
- C-130E	- C-130E		
- B-737-200			
- B-747-200B			

Civilian Aircraft Descriptions

PV2

The PV-2 Harpoon is a variant of the PV-1 Ventura IV. Both aircraft were designed as overseas patrol aircraft to attack surface and submarine vessels. The Harpoon's upgrades include a larger wing span, larger bomb-bay, heavier armament, and modification to the rudder and elevator. Both aircraft are powered by two Pratt & Whitney R2800-31 engines. Production information for the PV-2 could not be found. This aircraft was included because Hirth Airtankers approached the committee about its viability as a future airtanker.

CL-215T/CL-415T

The Canadair CL-415T (Super Scooper) was selected as a potential candidate aircraft due to its unique amphibious capabilities; successful utilization in the eastern region and northern border states; and direct and indirect attack performance. The CL-215 was produced as a piston powered aircraft in 1969. Upgrade of the CL-215 to a turbine aircraft (CL-215T) was accomplished in 1991. Retrofit kits were made available in the same year for owners of the piston versions. The CL-415T is a complete redesign of the CL-215T model. It is in production and sales have been made to European and other countries. The CL-415T is capable of delivering 1500 gallons of retardant from a land base, and 1622 gallons of water/foam mixture in its water scooping mode. The CL-415T has a cruise speed below 10,000 feet MSL of 193 KTAS (Knots True Air Speed) and 191 KTAS at 15,000 feet.

L-188, Electra

This aircraft was selected because it is the commercial equivalent of the P-3, which is currently in service and is known to perform well. The Electra began deliveries in 1959 and by 1963 approximately 160 aircraft were delivered to commercial customers around the world. The 188 is powered by four Allison Model 501 (T-56) turbo-prop engines. The Electra is capable of delivering 3000 gallons of retardant. The aircraft's cruise speed, below 10,000 feet MSL, is 269 KTAS and 374 KTAS at 15,000 feet.

L-382G, Hercules
The L-382G Hercules (also know as L-100-30) is a commercial version of the military C-130 E model. This aircraft was selected to be studied because of the known performance of the C-130 A models as retardant tankers. The L-382G has upgraded performance over the A model 130 and is estimated to carry 5000 gallons of retardant. The aircraft is powered by 4 Allison 501 Model turbo-prop engines, which generate over 4000 shaft horsepower. Over 110 of these aircraft were delivered to world wide customers by 1988. The L-382G has a cruise speed is 269 KTAS, below 10,000 MSL and 317 KTAS at 15,000 feet.

C-130E
The description of this platform is the same as the L-382G. Aircraft with this type certificate are included here as it appears there may be some of these aircraft available for procurement. The aircraft will have the same payload and speed as the L-382G but the expected daily availability cost will be different as the purchase price will vary from the L-382G.

CV-580
The aircraft was selected for study because a Canadian company is in the process of converting one into an airtanker. The CV-580 is the turbo-prop upgrade of the CV-340/440. Conversions became available in 1960, and 100 were completed by 1967. The CV-580 is powered by two Allison 501 engines which each produce 4050 shaft horsepower. The estimated retardant load is 1,500 gallons; and the cruise speed is 269 KTAS below 10,000 feet MSL and 298 KTAS at 15,000.

Boeing 737-200
Similar to the CV-580, this aircraft was selected because of work underway to convert one to an airtanker. The 737-200 is a derivative of the original B-737. Production of the 200 model began in 1978 and continued until 1987 with 1,114 aircraft delivered. The aircraft is powered by two Pratt & Whitney JT8D turbofan engines. The estimated retardant capacity is 2,700 gallons and the aircraft's cruise speed is 269 KTAS below 10,000 feet MSL and 435 KTAS at 15000.

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. Production of the 200B model began in 1971 and completed with 226 delivered by 1991. The aircraft is still in production in other models. The aircraft is powered by four turbofan engines produced by either Pratt & Whitney, General Electric or Rolls-Royce. The estimated retardant capacity for the B-747 is 17,000 gallons. Its cruise speed below 10,000 MSL is 269 KTAS and 414 KTAS at 15,000.

Folker, F-27
This aircraft was selected for study because of its size being smaller than that of a Boeing 737 and larger than the CV-580, in terms of retardant capacity. The F-27 has a estimated retardant capacity of 1700 gallons, and KTAS of 247 below 10,000 feet MSL. During the investigation of this aircraft, several issues (availability of data, spare parts, among others) regarding its suitability as a retardant airtanker were uncovered. Therefore, pursuit of this airframe as a future tanker was not pursued.

Military Excess Aircraft Descriptions

E-2C, Hawkeye
This aircraft would provide an upgrade capability to turbine power for the airtanker industry. The E-2C is a derivative of the E-2A which began delivery to the US Navy in 1964. The E-2 series aircraft were initially designed as aerial early warning platforms. The C model began with deliveries to the US Navy in 1972 and over 160 aircraft have been built by 1996. The estimated retardant capacity is 1,900 gallons, and its cruise speed below 10,000 MSL is 269 KTAS and 310 KTAS at 15,000.

S-3, Viking
This aircraft would provide an upgrade capability to turbine power for the same current fleet capability. Originally designed as a aircraft carrier based anti-submarine aircraft, deliveries to the Navy began in 1974 and ended in 1978 with the 187th. The aircraft has received electronic warfare system upgrades since than. 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 269 KTAS, below 10,000 MSL, and 450 KTAS at 15,000 feet.

A-6, Intruder
This aircraft was selected for the study because it is quite maneuverable. Prior airtanker studies have not examined attack class aircraft as airtankers. The A-6 was designed as a low level all weather/night attack bomber. Production of 482 Intruders were delivered between 1963 and 1969. Since that time 318 E models were also procured by the US Navy. Upgrades to the avionics have also been made in the form of the F model. Additionally, the wings were modified due to a fatigue problem believed to be the result of operating the aircraft at higher weights and load factors than the original design. The aircraft is powered by two Pratt & Whitney J52-P-8A jet engines. The estimated retardant capacity for the A-6 is 2,000 gallons, and its cruise speed below 10,000 feet MSL is 269 KTAS and 380 KTAS at 15,000 feet.

A-10, Thunderbolt II
The Thunderbolt (also know as the Warthog) also represents the investigation into more maneuverable and fast turbine aircraft. The A-10 was designed as a tank hunter/killer. The aircraft is the most maneuverable aircraft examined in this study. Additionally, several individuals have expressed interest converting the A-10 to a retardant aircraft. Also, the USDA Forest Service examined it as a airtanker in the early 1990's. The Thunderbolt II began delivery in 1975 and completed with 713 aircraft when production was terminated in 1983. The A-10 is powered by two GE TF34-GE-100 high bypass turbo-fan engines, each rated at 9,065 pounds static thrust. The estimated retardant capacity of the aircraft is 1,800 gallons, and the cruise speed below 10,000 feet MSL is 269 KTAS and 355 KTAS at 15,000.

P-3A, Orion
The P-3A was selected as a future retardant platform because of it's known performance in that role. The Orion, a derivative of the Lockheed L188, was developed in an "off-the-shelf" contract for the US Navy. The aircraft was initially developed for anti-submarine warfare. Changes to the aircraft from the L-188 are a tail boom and modified nose for sensors. One hundred fifty-seven A models were built in the years 1962 to 1966. Variation of this aircraft have been made over the years since its initial military version. Currently, the C model is being produced. The P-3A has a known retardant capacity of 3,000 gallons; its cruise speed below 10,000 feet MSL is 258 KTAS and 340 KTAS at 15,000 feet.

C-130B, Hercules
This aircraft was selected for the study because of its predecessor version, the A model. The C-130B A has performed well as a retardant airtanker. The study is examining the B model because of recent issues identified in the wings of the A model. The B model is estimated to be capable of the same retardant load as the A model, 3,000 gallons. The performance is similar to the A model. The C-130B has a known retardant capacity of 3,000 gallons; its cruise speed below 10,000 feet MSL is 254 KTAS and 296 KTAS at 15,000 feet.

C-130E
Since the commercial version L-382G is included in the study, the military equivalent C-130E model is also being studied. The description of this platform is the same as the L-382G. The aircraft will have the same payload and speed as the L-382G but the expected daily availability cost will be different as the acquisition price will vary from the L-382G. In addition, the daily availability will vary depending on the method used to obtain the aircraft as military excess equipment.

Turbine Refit Aircraft Descriptions

P-2T
This aircraft is a conversion of the two jet, two reciprocating engine P-2V to a twin turbine engine aircraft designated the P-2T. Additionally within the current airtanker fleet, the P-2V represents about 25%. The estimated retardant capacity after conversion is 2,700-3,000 gallons. Its cruise speed below 10,000 feet MSL is 236 KTAS and above 15,000 feet is also 236 KTAS.

DC-4T
The DC-4T was selected for study as well, due to its inclusion in the current fleet and high level of compatibility with the existing airtanker bases. The estimated retardant capacity after conversion is 2,000 gallons. The cruise speed below 10,000 feet MSL is 215 KTAS and above 15,000 feet is also 220 KTAS.

S-2T
The S-2T was selected for study to fill the gap and represent a turbo-prop aircraft in the 1000-1200 gallon range. Phase one of the study provided indications that larger capacity aircraft provided better economics and firefighting capabilities, but this phase would be used to set the direction for the Forest Service with regard to its future tanker fleet. Hence, representation of an aircraft at the 1,000-1200 gallon level would be used to either validate or invalidate the indications in phase one of this study. The estimated retardant capacity for the turbo-prop conversion of the S-2 is 1,100 gallons. Its cruise speed is 230 KTAS below 10,000 feet MSL and above 15,000 feet is also 230 KTAS..

C-123T
One airtanker was made from the C-123. The aircraft was selected because of its short field characteristics and payload capability. The 123's estimated retardant capacity is 2,500 gallons. Its cruise speed is 190 KTAS below 10,000 feet MSL and 225 KTAS above 15,000 feet.

Type 1 Helicopters

BV-107

The Boeing-Vertol Model 107 began design in 1956 and was to take advantage of the small, light weight, 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 II (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.

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, less than 15 aircraft were delivered.

S-64

The Sikorsky S-64, also know 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 supporting exploration drilling. However, by 1974 a total of less than 100 aircraft were built.

Specifications and Performance

Published flight manuals were used to determine the flight performance of the aircraft studied as retardant airtankers. In case of turbine conversions (aircraft which could have their reciprocating engines replaced with turbine driven propellers), data from a prior converted aircraft were used to develop a model to predict the performance of the studied aircraft, unless actual data were available. Retardant tank capacities were developed considering each aircraft's weight capabilities (maximum gross weight, zero fuel weight, empty weight) , appropriate fuselage volume constraints, ground clearance and age of the aircraft. The estimated retardant volumes are considered conservative in that the maximum capacity, based on weight, was never used. For turbine conversion aircraft, a engineering estimate was made for the weight change involved in the conversion. Appendix B contains the performance information that was developed for the studied aircraft.

Daily Availability Determination

Aircraft Procurement Costs

For Civilian Market aircraft, a market purchase price was determined from available data and sources depending on aircraft type model. In some cases, information was obtained from the manufacturer and from aircraft sales publications. In others, information came from private companies who were willing to share this data. This was particularly for the P-2T and DC-4T aircraft in the Turbine Refit category.

For Excess Military aircraft acquired by industry by competitive bid, it was assumed that these aircraft would be privately owned and privately operated. The industry competitive bid estimate was based on recent sales for some aircraft. Due to the lack of data for other aircraft and uncertainty of price, a range was developed around the average estimate. This estimate was also used for C-123T in the Turbine Refit category. There is a low and a high estimate for each aircraft. The salvage value of each aircraft was calculated based on 75% of the empty weight and ingot aluminum value. The high estimate used a value of $1.00 per pound while the low estimate was based on a value of $0.70 per pound. Each estimate was adjusted by a Acquisition Realization Factor to allow for the need to acquire more than one aircraft for spare parts to keep the primary aircraft flying.

Inspection and Repair Costs

This is the estimated cost to bring the aircraft to a state of airworthiness. Due to the lack of data for some aircraft and uncertainty of the price for others, a range was developed around the average estimate. The estimate is $75,000 to $150,000.

Conversion Costs

This is the cost to fabricate and install a retardant tank in the aircraft, to provide for modification and installation of avionics, and to provide conversion to turbine engines (if necessary). As with other costs, low and high range estimates were used to account for variability. The sum of the aircraft procurement costs, the inspection and repair costs and the conversion costs will be referred to as the total capitalized value of an aircraft.

Capitalization and Depreciation Costs

The average number of days per bid item in the current airtanker contract is 120 days. This number was used to convert annual cost to a daily costs (rate). Amortization and interest on the total capitalized value of the airtanker was computed at 5.625% for 15 years based on direction in Office of Management and Budget (OMB) Circular A-76. Since operators need to insure their investment against lost, the cost of this insurance was calculated at 3% of the total capitalized value. Operators have additional cost centers for overhead, salaries, profit, etc. and this total was estimated by Forest Service contracting experts using past observed values.

A summary table is contained in Appendix B showing the assumptions in the calculation of the daily availability.

Flight Rate Determination

Engine Use Rate Costs
The numbers of hours needed between each major engine overhaul and between hot engine inspections was determined for each aircraft. The cost to perform each overhaul and inspection was generated from engine manufacturer and overhaul facilities data, as well as costs for needed accessories and components. These costs were determined per engine. The total cost per aircraft was determined by multiplying this value by the number of engines on the aircraft. Costs were converted to an hourly rate.

Flight Crew Costs
Crew labor was calculated at $70 per flight hour and the number of crew members needed to fly each aircraft.

Fuel Costs
Fuel burn rates were determined for each aircraft. A fuel cost of $1.93 per gallon was assumed. Burn rates were determined for a maximum speed of 250 knots IAS (Indicated Air Speed) based on maximum continuous power at an elevation of 5,000 feet (MSL) and for the maximum speed at maximum continuous power an aircraft is capable of in knots (IAS) at an elevation of 15,000 feet (MSL). Over 83% of the initial attack fire distances at a distance of less than 100 statue miles from the closest airtanker base. At these distances, it is most efficient to travel to the fire at an elevation below 10,000 feet versus climbing to greater than 10,000 feet. Hence, in evaluations of aircraft and airtankers bases, the burn rate for flight below 10,000 feet was used.

Other Costs
This category includes costs for miscellaneous repairs and scheduled maintenance. In addition, allowances were included to provide for profit and taxes.

Type I Helicopters
There is little experience in contracting for Type I helicopters using an exclusive use contract. An exclusive use contract is where a contractor is bound to provide services for a specified period of time and is paid a "daily guarantee" (daily availability) to provide these service. More common are call-when-needed (CWN) contracts where an operator bids a daily availability given a defined flight rate by the government. Estimates for the daily availability for an exclusive use contract are based on professional estimates from experienced contracting officers.

Table 4 - Summary of Potential Future Airtanker Aircraft

Aircraft Category	Aircraft Name	Gallons of Retardant	Base Flight Rate	Daily Avail. Rate	<10K Speed Knots	>10K Speed Knots	Rate of Climb Feet/Minute
Civilian	PV-2	1,075	$1,196	$2,247	194	194	690
Civilian	CL-215T	1,300	$1,445	$15,154	193	193	1,367
Civilian	CL-415T	1,500	$1,445	$21,677	193	191	1,367
Civilian	F-27	1,700	$1,645	$3,209	247	248	1,300
Civilian	CV-580	1,500	$1,989	$3,902	269	298	1,670
Civilian	L-188	3,000	$2,923	$4,160	269	374	2,000
Civilian	L-382G	5,000	$2,811	$11,967	269	317	2,008
Civilian	C-130E	5,000	$2,811	$5,852	269	317	2,008
Civilian	B-737-200	2,700	$3,026	$6,878	269	435	2,000
Civilian	B-747-200B	17,000	$9,581	$21,289	269	414	2,985
Military	E-2C	1,900	$1,725	$3,131	269	310	2,400
Military	S-3	2,400	$2,042	$3,131	269	450	3,400
Military	A-6	2,000	$3,098	$3,131	269	380	2,175
Military	A-10	1,800	$3,202	$2,581	269	355	2,800
Military	P-3A	3,000	$2,877	$3,131	258	340	1,500
Military	C-130A,B	3,000	$3,077	$3,681	254	296	1,500
Military	C-130E	5,000	$2,811	$3,681	269	317	2,008
Refit	S-2T	1,100	$1,286	$5,092	230	230	2,630
Refit	C-123T	2,500	$1,650	$4,864	190	226	1,550
Refit	P-2T	2,700	$1,882	$4,636	236	236	1,335
Refit	DC-4T	2,000	$2,022	$4,635	215	220	765
Heli	BV-234	3,200	$3,395	$15,836	135	135	---
Heli	S-64F	2,050	$3,596	$13,860	91	91	---
Heli	BV-107	1,200	$1,829	$6,560	130	130	---

Table 4 is a summary of the mean estimate for the daily availability and flight rates for each aircraft. In the Aircraft Category column, the term Civilian means Civilian Aircraft; the term Military means Military Excess and the rate is based on Privately Owned/Privately Operated; the term Refit means Turbine Refit aircraft from the civilian sector. In the Aircraft Category column, the term Heli means Helicopter. For the Heli category, professional estimates were used to develop the daily availability under an exclusive use contract.

Future Procurement Options

In August, 1993, the Forest Service did staff work for the Secretary of Agriculture on six methods for providing airtanker services. These six methods are as follows:

Option I: Government-owned aircraft

- Method Ia: Government-owned aircraft operated and maintained by the Forest Service.
- Method Ib: Government-owned aircraft operated and maintained by the Department of Defence.
- Method Ic: Government-owned aircraft provided as "Government Furnished Property" under the airtanker services contract.

Option II: Contractor-owned aircraft

Method IIa: Contractor-owned aircraft with the contractors buying, operating and maintaining aircraft on the commercial market.
Method IIb: Contractor-owned aircraft operated and maintained by the contractors and acquired with the assistance of the Forest Service.
Method IIc: Contractor-owned aircraft operated and maintained by the contractors and acquired with the sale of excess military aircraft.

In the decision memo for the Secretary of Agriculture, the recommendation was made to adopt Method IIc based on economical, political, administrative and program interests. Implementation of this method required legislation which occurred in October, 1996. If legislation had not been forthcoming, Method Ic was the second choice. With this decision and the passage of legislation, the recommended procurement option is Contractor-owned aircraft operated and maintained by the contractors obtained through the sale of excess military aircraft.

NFMAS Analysis - General

Forces used for initial attack of wildland fires are analyzed and justified using the National Fire Management Analysis System (NFMAS). NFMAS initial attack assessment (IAA) model analyses initial attack effectiveness and was used to analyze the effect of the alternatives. The local initial attack forces remained constant as airtanker staffing and locations was 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. Detailed information on the assumptions of the IAA that are critical to this study and the specific rules used in this analysis are contained in Appendix C.

Several key assumptions do apply to airtankers. The amount of fireline produced by a 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:

Chains of line = (Gallons in Drop)/100 * Production Factor

where the production factor is 1.0 for NFDRS fuel models A, L and T; 0.6 for NFDRS fuel models C, N, S, and U; and is 0.4 for the remainder of the NFDRS fuel models.

As a recommendation from Phase 1, these production factors were reviewed. Following an intense literature review, examination of results from Phase 1 and consultation with subject matter experts in research and the field, agreement was reached to change the factors to the following: 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 .2 for NFDRS fuel models B, O, J, and I.

In the IAA and as used in Phase 1, 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. Maximum fireline production is assumed when the rate of fire spread is equal to one chain/hour. The fireline production rate is then decreased linearly so that the fireline production rate is zero when the rate of fire spread is equal to forty chains per hour or greater.

This assumption was examined based on a Recommendation from the Phase 1 Report. The following changes were used in the modeling in Phase 2. The fireline production rates 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 type. For the rest of the NFDRS fuel models, there was no change from the forty chain per hour limit.

Both of the above mentioned changes to IAA modelling procedures have been adopted by the Forest and Bureau of Land Management for future use in IAA modelling. Documentation is contained in an administrative report titled "An Analysis of the Fireline Production Rates Applied to Aerial Retardant Drops Contained in MNIAAPC, November 1995."

All dollar amounts displayed in this report are in 1996 dollars unless otherwise stated. The current OMB Price Adjustment Index was used to calculate factors as follows to move all dollars to 1996 dollars.

Year	Factor	Year	Factor
1984	1.496	1990	1.208
1985	1.440	1991	1.161
1986	1.400	1992	1.131
1987	1.359	1993	1.097
1988	1.311	1994	1.063
1989	1.256	1995	1.031

One time costs were annualized based on the total cost, number of years assumed to amortize the investment and the discount rate for amortization. The first step was to document the cost centers that make up the total. For airtanker base construction, these include buildings, ramps, tanks, pumps and plumbing, electrical, etc. The cost in today's value (dollars) to procure or develop the site was determined. This cost was annualized based on the number of years to amortize the investment and the discount rate using the following formula:

$$A = Pv * \left(\frac{i(1+i)^n}{(1+i)^n - 1} \right)$$

where A is the annualized value,
where i (Rate) is the discount rate expressed as a decimal,
where n (Nper) is the number of time periods (years),
where Pv is the present value of the investment.

The discount rate and time period varied based on the application to aircraft or airtanker bases.

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 $0.80 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 are negative and some positive. In general, the algebraic sum is a negative number.

When doing initial attack analysis, an agency may have agreements with other agencies to provide airtanker services. Use of cooperator airtankers was constrained proportionally with reductions in the agency's contract airtanker numbers. This rule was applied on an airtanker service area basis. For example, if a Geographic Area cut a Forest Service airtanker in an area also served by a cooperator's airtanker, the cooperator airtanker was also cut. Initial attack using other airtankers based further away was analyzed. If an agency in a Geographic Area had a reciprocal agreement with a cooperator, and in an alternative the agency cut its share of the reciprocal resource, then the cooperator's share was also dropped. If a cooperator received large airtanker support exclusively from the agency and if the cooperator did not have the capability to do initial attack analysis on cooperator lands, then the effects of alternatives were estimated using the effects on agency lands applied appropriately and proportionately to the cooperator lands.

Airtanker Base "Customer Service Area" and Attribute Determination

The protection units in the analysis that had data from the Initial Attack Assessment (IAA) model provided this data to the study for the Most Efficient Level budget option. The "customer service area" (CSA) for an airtanker base was defined and consisted of all the protection units in this analysis that receive any airtanker dispatches from the airtanker base. Analysis within a CSA allows for the estimation of the economic efficiency as well as the initial effectiveness of staffing different airtanker platforms at an airtanker base.

For each protection unit within the CSA, three attributes were defined:

- The average numbers of fires per million acres protected;
- The average Suppression Cost (FFF) plus Net Value Change (NVC) that occurs per acre burned, and;
- The average coverage level of chemical fire retardant that is required based on the fuel models on the protection unit.

Correlations between NFDRS fuel models and coverage levels needed are as follows:

NFDRS Fuel Model	Coverage Level
A,L,S	1
C,H,R,E,P,U	2
T,N,F,K	3
G	4
D,Q	6
B,O,J,I	6+ (8)

These attributes were than weighted by number of dispatches to the protection unit versus the total dispatches from the airtanker base to allow for calculation of these same attributes for the airtanker base. A listing of these attributes for each protection unit is contained in Appendix D and summarized in Table 5. Figures 5, 6 and 7 show the attributes for each Federal airtanker base where an airtanker is stationed based on the 1996-1998 Federal airtanker contract. A key to the airtanker base abbreviations and attributes follows.

Table 5 - Airtanker Base Customer Service Area Attributes

1	2	3	4	5	6	7	8	9	10	11	12
AREA	BASE ID	AIRTANKER BASE NAME	Avail/ Total Disp.	UMC/ IA Disp.	Total Cost per Disp.	Avg RT Flight Time Per Disp.	Avg Time To IA Rep Loc	Avg Miles To Rep Loc	Wted. CL	Wted. FFF+ NVC/ Acre Burned	Wted. Fires/ MM Ac/ Year
CA	CH	CHESTER	$3,207	$2,870	$6,077	30	45	46	4.8	$2,541	100
CA	C1	CHICO	$2,085	$2,571	$4,656	43	51	67	4.2	$6,627	142
CA	FR	FRESNO	$3,075	$3,947	$7,021	32	46	64	3.2	$3,162	137
CA	HR	HEMET-RYAN	$3,075	$3,947	$7,021	31	46	46	4.7	$1,368	279
CA	FF	LANCASTER	$4,139	$2,632	$6,772	46	53	72	4.7	$1,049	146
CA	PV	PORTERVILLE	$6,607	$2,402	$9,009	35	48	54	2.6	$2,053	149
CA	RM	RAMONA	$2,711	$2,380	$5,091	35	47	52	5.5	$1,505	258
CA	RE	REDDING	$1,200	$3,682	$4,883	27	43	51	6.6	$4,960	95
CA	SB	SANTA BARBARA	$2,596	$3,708	$6,304	27	44	53	5.8	$970	47
GB	BO	BOISE	$469	$3,706	$4,175	58	59	97	2.4	$458	28
GB	HI	HILL	$457	$5,361	$5,819	62	61	134	3.1	$509	26
GB	MI	MINDEN	$757	$6,146	$6,903	79	69	173	3.0	$1,542	84
GB	MC	McCALL	$1,139	$3,947	$5,086	32	46	64	2.5	$2,158	64
GB	PT	POCATELLO	$738	$4,423	$5,161	54	57	115	2.5	$348	24
GB	SD	STEAD	$939	$4,495	$5,434	84	72	145	3.0	$1,067	41
NO	BL	BILLINGS	$1,031	$3,493	$4,524	84	72	149	2.2	$425	21
NO	A1	COUER D'ALENE	$766	$4,157	$4,923	47	54	98	4.5	$4,800	60
NO	A2	GRANGEVILLE	$2,074	$2,305	$4,380	31	46	46	3.7	$1,266	61
NO	HE	HELENA	$4,368	$3,171	$7,539	40	50	64	3.0	$803	25
NO	A3	KALISPELL	$11,299	$3,307	$14,606	44	52	73	3.7	$4,216	37
NO	A4	MISSOULA	$795	$3,270	$4,066	43	52	70	3.3	$1,951	45
NO	A5	WEST YELLOW.	$2,923	$4,460	$7,383	55	58	117	3.0	$941	29
NW	KF	KLAMATH FALLS	$5,117	$4,013	$9,130	57	59	107	5.0	$3,586	103
NW	LG	LA GRANDE	$1,062	$5,221	$6,283	59	60	127	2.5	$958	77
NW	MF	MEDFORD	$2,828	$4,077	$6,904	35	48	71	3.6	$4,548	86
NW	RD	REDMOND	$5,738	$4,218	$9,956	47	53	87	3.1	$4,530	87
NW	WE	WENATHCEE	$5,393	$4,130	$9,523	50	55	94	3.8	$1,900	80
RM	GJ	GRAND JCT.	$842	$3,556	$4,398	53	56	88	2.5	$451	33
RM	JC	JEFFCO	$1,837	$3,175	$5,011	70	65	114	2.8	$538	38
SO	AV	ASHEVILLE	$1,094	$3,053	$4,147	64	62	104	2.0	$527	237
SO	FS	FT. SMITH	$1,601	$3,987	$5,588	43	51	87	2.1	$1,348	64
SO	KX	KNOXVILLE	$3,351	$3,235	$6,587	55	57	90	2.0	$548	234
SW	AL	ALAMOGORDO	$3,033	$3,689	$6,722	57	59	96	2.4	$728	73
SW	AB	ALBUQUERQUE	$5,559	$3,762	$9,321	75	67	126	2.5	$1,048	68
SW	FH	FT. HUACHUCA	$1,430	$5,274	$6,704	68	64	147	2.5	$714	87
SW	PH	PHOENIX	$1,028	$4,006	$5,034	34	47	67	4.8	$508	110
SW	PR	PRESCOTT	$3,680	$4,277	$7,957	54	57	102	3.7	$565	87
SW	RS	ROSWELL	$3,680	$3,302	$5,649	44	52	72	2.1	$322	40
SW	SC	SILVER CITY	$3,024	$3,550	$6,574	52	56	96	2.9	$961	96
SW	WS	WINSLOW	$4,740	$4,089	$8,829	57	58	108	4.4	$816	115

Column 1 - Geographic area where airtanker base is located.

Column 2 - The base abbreviation ison the figures and in analysis.

Column 3 - The name of the airtanker base.

Column 4 - The yearly airtanker availability at the base divided by the expected number of dispatches.

Column 5 - The sum of the cost of retardant and the flight time per airtanker mission.

Column 6 - The sum of columns 4 and 5. The total cost of a "load" of retardant for the airtanker base.

Column 7 - The average round trip flight time (with propellers turning) per dispatch.

Column 8 - The average time from dispatch alert to retardant drop. Flight time/2 + 30 minutes.

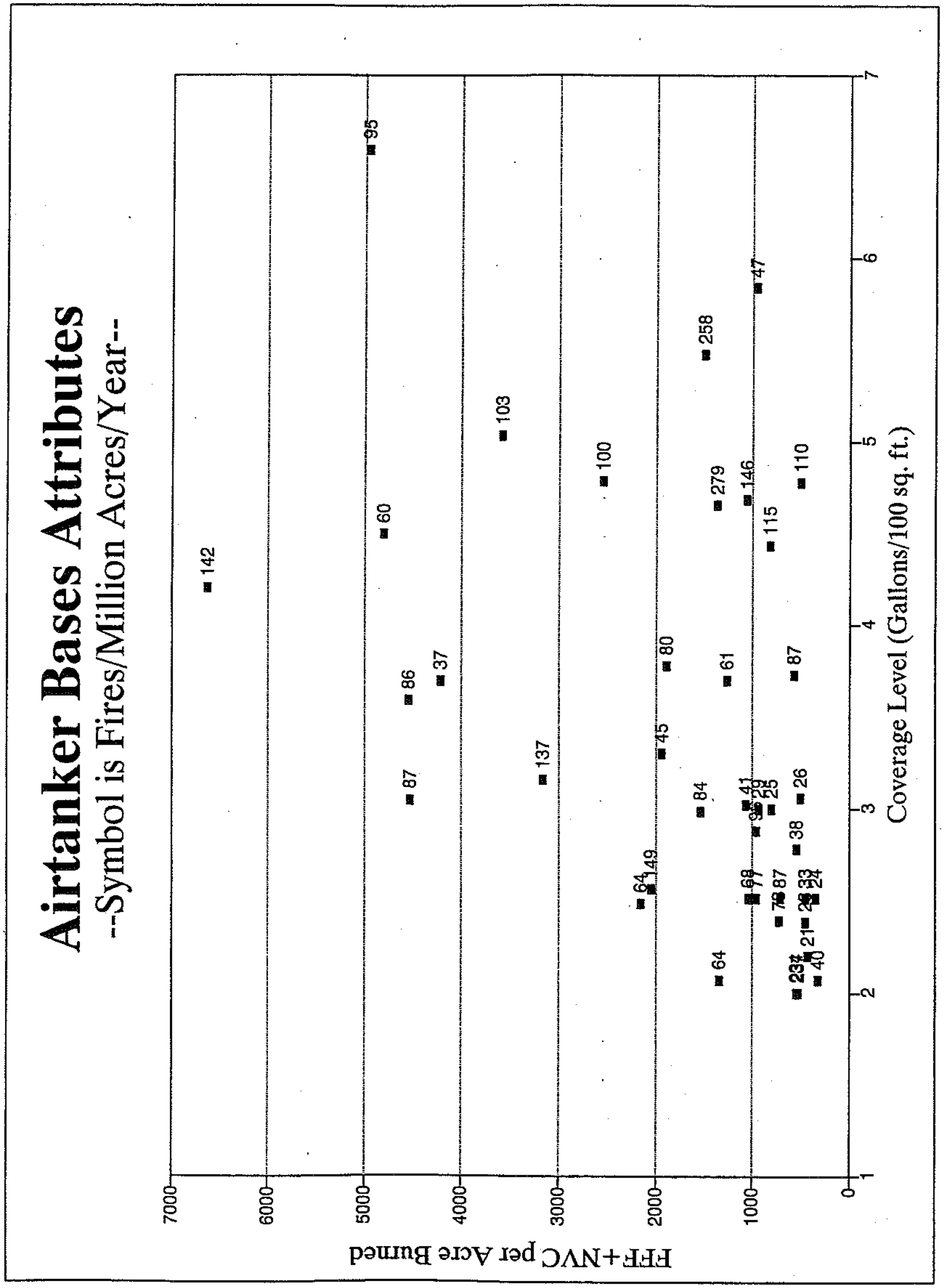
Column 9 - The average number of miles to representative fire location within the customer service area.

Column 10 - The "dispatch weighted" coverage level for the customer service area.

Column 11 - The "dispatch weighted" FFF + NVC per acre burned for the customer service area.

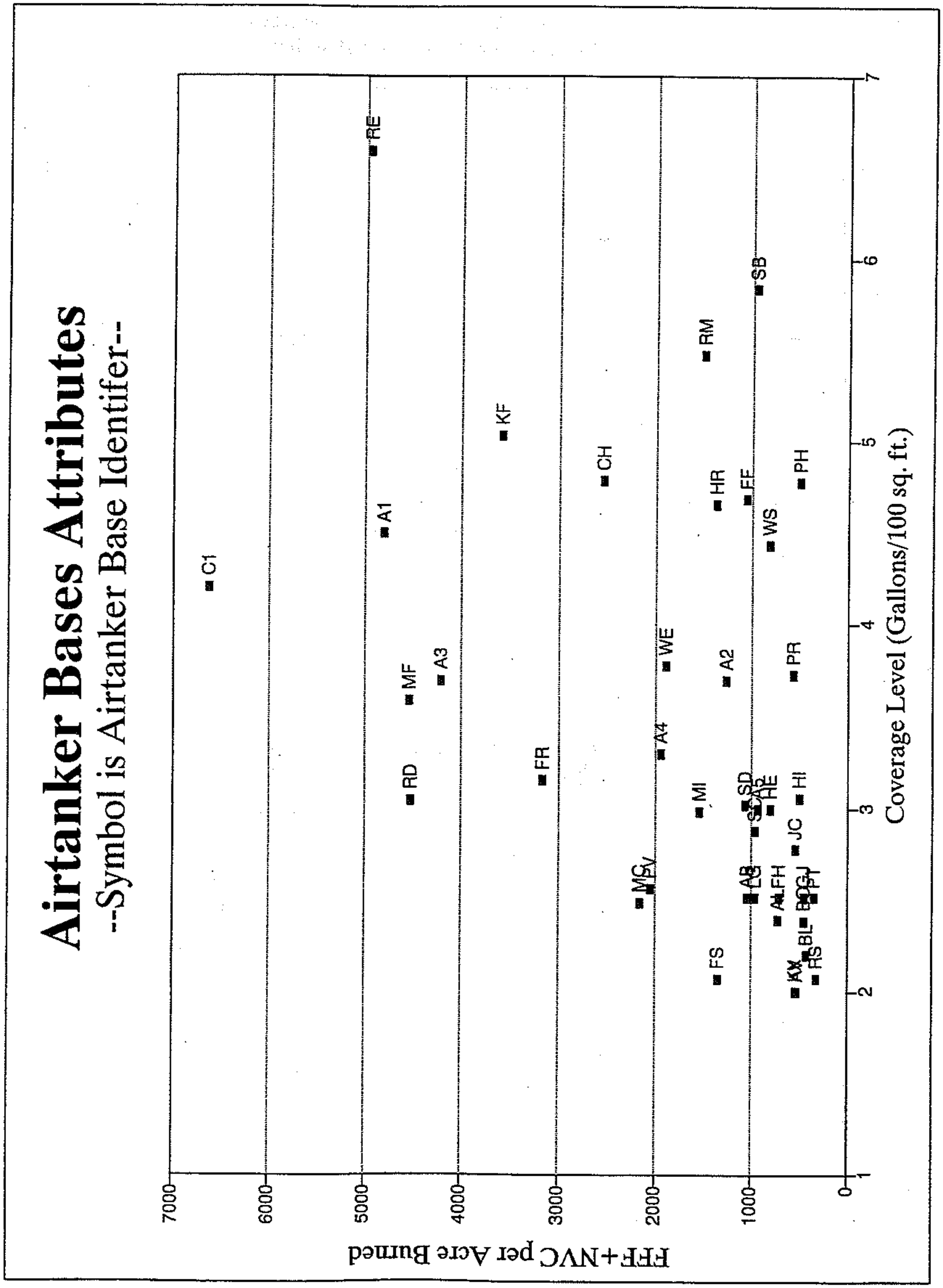
Column 12 - The "dispatch weighted" fires per million acres per year for the customer service area.

Figure 5



Airtanker Bases Attributes
--Symbol is Fires/Million Acres/Year--
FFF+NVC per Acre Burned
Coverage Level (Gallons/100 sq. ft.)
0
1000
2000
3000
4000
5000
6000
7000
1
2
3
4
5
6
7

Figure 6



Airtanker Bases Attributes
--Symbol is Airtanker Base Identifer--
FFF+NVC per Acre Burned
Coverage Level (Gallons/100 sq. ft.)
0
1000
2000
3000
4000
5000
6000
7000
1
2
3
4
5
6
7
RE
C1
A1
MF
A3
RD
FR
KF
CH
A4
WE
MI
A2
HR
RM
SB
FS
MC
FV
AB
LG
SD
HE
A5
FF
WS
PH
PR
HI
JC
LFH
PT
RS
BL
KX

Figure 7

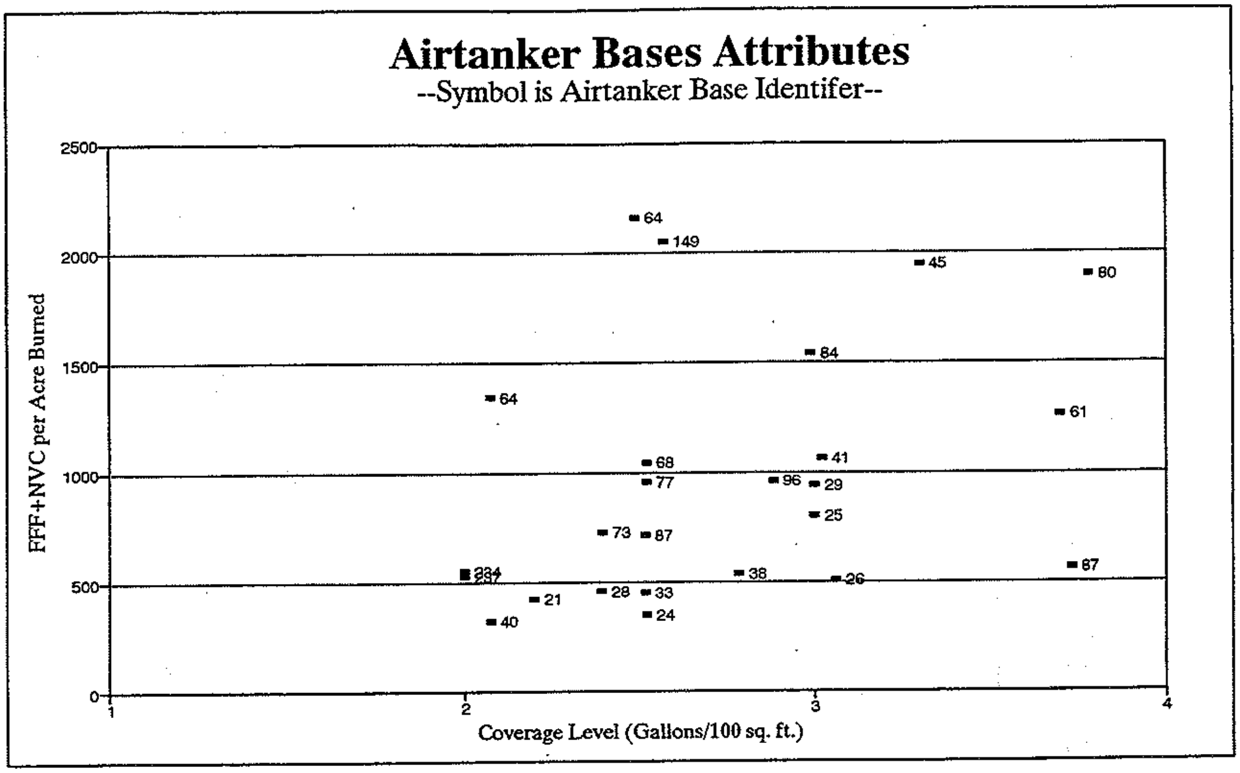
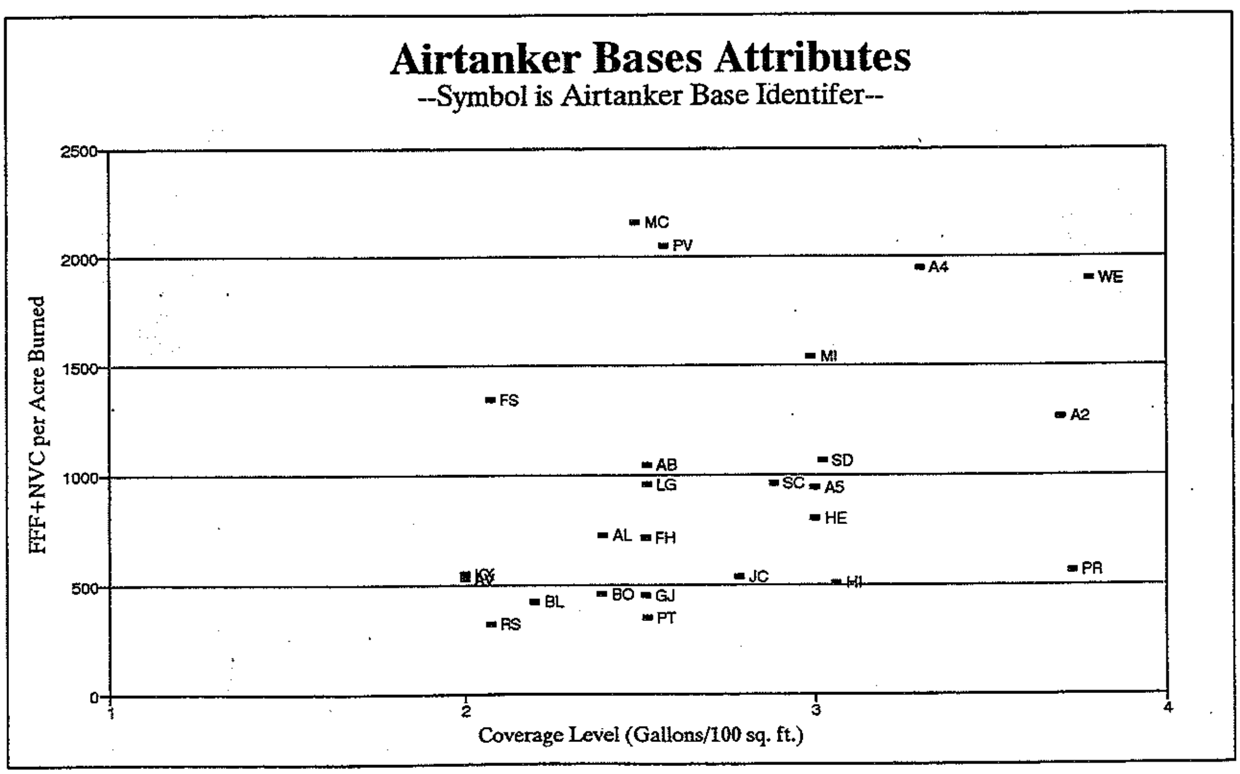


Figure 8



For analysis of the effectiveness and efficiency of potential future airtanker platforms, some airtanker bases were selected as "representative airtanker bases." Selected airtanker bases are: Albuquerque, Boise, Klamath Falls, Missoula, Phoenix, and Redding. Albuquerque and Boise represent the cluster of bases with coverage level requirements from 1 to 2 gallons per 100 square feet. Phoenix represents the cluster of bases with coverage level requirements from 4 to 6 gallons per 100 square feet and having relative average FFF+NVC per acre burned attributes. The remaining three bases were selected to observe the variability as coverage level and FFF+NVC per acre burned increase proportionately.

Cost/Chain and Cost/Gallons Estimates

A display of cost/chain and/or cost/gallon will give an initial indication the most efficient way to deliver a requested load of retardant. Additional analysis within CSA using the Initial Attack Assessment will show economic efficiency as well as the initial attack effectiveness of staffing different airtanker platforms at an airtanker base. For each Federal airtanker base that has an airtanker(s) staffed under the 1996-1998 Federal airtanker contract, the average cost per gallon of retardant delivered within its "customer service area" was determined. The average cost per chain of fireline produced by an airtanker drop was also calculated. In the average cost per chain of fireline produced determination, the rate of spread was assumed to be 40 chains per hour for NFDRS fuel models A, L, S and T and 20 chains per hour for the rest.

The relative ranking was based on a scale of 1 to 10 (best). The aircraft with the lowest cost is ranked a 10 with the aircraft having the highest cost ranked with a 1. The other rankings are scaled between these two extremes based on the cost relative to the difference between the high and the low. The initial relative ranging is the ranking on the left and includes all aircraft. The intermediate relative ranking on the right has the CL-215T and CL-415T excluded due to high unit cost. Type I helicopters were not included in this table and are evaluated in Step 4.

Table 6 - Initial and Intermediate Cost per Unit Relative Rankings

Aircraft Category	Aircraft Name	Gallons of Retardant	Cost per Chain	Initial and Intermediate Relative Ranking	Cost per Gallon	Initial and Intermediate Relative Ranking
Current	All Current	2,507	$ 856	9.7/9.2	$2.09	9.8/9.2
Civilian	PV-2	1,075	$1,646	8.3/4.5	$3.13	9.0/4.4
Civilian	CL-215T	1,300	$5,109	1.8/---	$12.29	1.9/---
Civilian	CL-415T	1,500	$6,140	1.0/---	$14.65	1.0/---
Civilian	F-27	1,700	$1,375	8.8/6.1	$3.21	8.9/6.2
Civilian	CV-580	1,500	$1,656	8.3/4.5	$4.05	8.3/3.9
Civilian	L-188	3,000	$1,022	9.4/8.2	$2.72	9.3/7.6
Civilian	L-382G	5,000	$1,423	8.7/5.8	$3.59	8.6/5.2
Civilian	C-130E	5,000	$ 868	9.7/9.1	$2.24	9.7/8.9
Civilian	B-737-200	2,700	$1,470	8.6/5.6	$3.86	8.4/4.4
Civilian	B-747-200B	17,000	$ 819	9.8/9.4	$2.31	9.6/8.7
Military	E-2C	1,900	$1,238	9.0/6.9	$2.93	9.2/7.0
Military	S-3	2,400	$1,048	9.4/8.0	$2.58	9.4/8.0
Military	A-6	2,000	$1,192	9.1/7.2	$3.30	8.9/6.0
Military	A-10	1,800	$1,176	9.1/7.3	$3.35	8.8/5.9
Military	P-3A	3,000	$ 904	9.6/8.9	$2.42	9.6/8.5
Military	C-130A,B	3,000	$ 971	9.5/8.5	$2.63	9.4/7.9
Military	C-130E	5,000	$ 713	10.0/10.0	$1.86	10.0/10.0
Refit	S-2T	1,200	$2,422	6.9/1.0	$5.46	7.2/1.0
Refit	C-123T	2,500	$1,347	8.8/6.3	$3.17	9.0/6.4
Refit	P-2T	2,700	$1,103	9.3/7.7	$2.67	9.4/7.7
Refit	DC-4T	2,000	$1,519	8.5/5.3	$3.73	8.5/4.8

Airtanker Base Compatibility

Compatibility of the potential future airtanker fleet with the existing base structure as well as new basing concepts was examined. This examination considered three criteria; runway load bearing, wing and tail clearance, and ground roll required for take off.

Runway Load Bearing

The NOAA Airport Facilities Directory was used as the source for published 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 military was consulted for data on bases which are strictly for military use; and similar data was obtained. 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 restrictions at others. These agreements and restrictions were assumed to be apply in the future at these bases. The compatibility of future airtankers and bases was adjusted accordingly.

Wing and Tail Clearances

The Interagency Airtanker Base Directory was used as the source for clearances. The directory identifies aircraft excluded from a tanker base based on its size. The dimensions of known aircraft were examined and compared with the future fleet candidates. Where current aircraft were excluded from a base due to size, future fleet candidates were also excluded. Where new airtanker bases were considered, it was assumed that the base would be constructed to be clearance compatible with the clearance requirements of the future fleet possibilities.

Take off Performance

Take off performance was based on the capability of the aircraft in the published flight manuals and hot day conditions. Hot day conditions are defined as ISA (International Standard Atmosphere) plus 30 degrees Fahrenheit at the altitude of the base with zero wind. The ground roll required to either take off or accelerate and stop was compared to the **longest available 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 know 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 to take off is less than 80 percent of the longest available runway. Runway lengths used in this study were obtained from the NOAA Airport Facilities Directory or the military as necessary.

The results of the compatibility analysis are summarized in Table 7. 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.

Aircraft Compatibility with Airtanker Bases

The E-2C, S-3, A-6, A-10, and B-747-200B all were compatible with less than 45% of the base locations. The major reason for this incompatibility was the requirement to meet accelerate and stop (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 in meet the 80 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.

Further analysis was done on the A-10 because of the prior analysis done by the Air Force and the Forest Service. McClellan AFB (MAFB) examined the A-10 operation out of the existing airtanker bases in 1990. Their analysis shows that the aircraft will operate out of most of these bases. However, further investigation found that the basis for their findings was different than those used for this analysis. The MAFB study utilized a post production aerodynamic drag report which, as they site, indicates that the aerodynamic drag of the aircraft is 15% lower than the flight manual. The flight manual has not been updated to reflect this. Also, the MAFB report computes take off roll with the engine fuel limiters turned off. This practice reduces engine life on some components, and is directly proportional to the time fuel limiters are off. For take off only, this is thought to have minimal impact on the engines. With the fuel limiters turned off, greater thrust is produced by the engines and thus reduces needed ground roll prior to lift off, i.e. better take off performance. However, the current flight manual states that this practice is an emergency use condition. Although the engine manufacturer has performed static tests and developed engine kits to improve the life of the threaten components, the Air Force has yet to adopt the practice (disabling the fuel limiter) as standard. In this study, no aircraft will operated any differently than the approved flight manual for the aircraft. As stated above, the MAFB report utilized different assumptions than will be used for the A-10 aircraft in this study. Attempts were made to duplicate the take off performance data in the MAFB report, but were unsuccessful. It is believed that the ground roll distances found there are take off roll distances in the MAFB report are take off distances and not critical field length distances.

The B-737-200B and L-382G were found to be compatible with approximately 50-60 percent of the studied bases. Compatibility for the B-737 is limited by the accelerate and stop requirement, while the L-382G is limited by the gear load bearing weight. Greater compatibility for the L-382G to those bases from which it is exclude may be possible. The L-382G, while its studied operational weight is higher than any current fleet aircraft, has a low bearing pressure (approximately 70 psi) relative to its operational weight. By comparison the KC-97 has a operational weight of 124,000 lbs, while the L-382G is estimated at 135,000 lbs. Yet, the bearing pressure of the KC-97 is 111 psi as compared to 70 psi for the L-382G. It may be possible to work with some of the airport authorities to grant over-weight agreements. In addition, these aircraft have the capability to change the tire inflation pressure in flight hence the ability provide a wider footprint is possible. The issues mentioned need further examination.

The P-2T, C-123T, CV-580, DC-4T, L-188, and CL-415 all are compatible with more than 70 percent of the bases. The major limiting issues with the P-2T and CV-580 is the accelerate and stop requirement; with the L-188 is take off within 80 percent of the available runway; and with the DC-4T, CL-415T, and C-123T is load bearing.

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.

Table 7 - Airtanker Compatibility With Airtanker Bases (1=Yes, 0=No)

Base	Region	P2T 66	C-123T	CV-580	E-2C	DC-4T	L-188	L-382	S-3	A-6	A-10	B737 200B	B747 200B	CL 415	S-2T	C-130A,B
Fairbanks	AK	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ft. Yukon, Reload	AK	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Galena, Reload	AK	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1
McGrath	AK	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Palmer	AK	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Tanacross	AK	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1
Bishop, Reload	CA	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Chester	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Chester Improved	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Chico	CA	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Columbia	CA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Fresno	CA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hemet-Ryan	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Hollister	CA	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Lancaster (Fox Field)	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Lancaster (Fox Field) 7000 ft Runway	CA	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
March AFB	CA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mather AFB	CA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Siskiyou/Montague, Reload	CA	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Norton AFB	CA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Paso Robles	CA	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Porterville	CA	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Ramona	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Ramona (5900 Ft)	CA	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Redding	CA	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Rohnerville	CA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Santa Barbara	CA	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Santa Rosa/Sonoma	CA	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Stockton, Reload	CA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ukiah	CA	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Bemidji	East	0	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Brainard	East	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Ely	East	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Hibbing	East	0	1	1	0	1	1	0	0	0	0	1	0	1	1	0
Battle Mountain	GB	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Boise	GB	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Cedar City	GB	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Hill	GB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
McCall	GB	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1
Minden	GB	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Pocatello	GB	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1
Reno/Stead	GB	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Twin Falls	GB	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1
Billings	NO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Coeur d'Alene	NO	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Grangeville	NO	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0
Helena	NO	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1
Kalispell	NO	1	1	1	1	1	1	0	1	0	0	1	0	1	1	1
Lewiston	NO	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0
Missoula	NO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
West Yellowstone	NO	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Everett, Reload	PNW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Kingsley/Klamath Falls	PNW	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
La Grande	PNW	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1
Lakeview, Reload	PNW	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
Medford	PNW	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1
Mose Lake, Grant County Airport	PNW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Omak, Reload	PNW	0	1	0	0	1	0	1	0	0	0	0	0	1	1	1
Troutdale, Reload	PNW	0	1	1	0	1	1	0	0	0	0	1	0	1	1	1
Redmond	PNW	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Wenatchee	PNW	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Yakima	PNW	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1
Buckley, CO	RM	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Casper, WY	RM	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Colorado Springs, Peterson AFB	RM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Durango, CO	RM	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Greybull, WY	RM	0	1	1	0	1	1	1	0	0	0	0	0	1	1	1
Jeffco	RM	1	1	1	0	1	0	0	0	0	0	0	0	1	1	1
Grand Junction	RM	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Montrose	RM	1	1	1	0	1	1	1	1	0	0	0	0	1	1	1
Pueblo, CO	RM	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Rapid City, Reload	RM	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1

Table 7 (Continued) - Airtanker Compatibility With Airtanker Bases (1=Yes, 0=No)

Base	Region	P2T 66	C-123T	CV-580	E-2C	DC-4T	L-188	L-382	S-3	A-6	A-10	B737 200B	B747 200B	CL 415	S-2T	C-130A,B
Alexandria	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Asheville	SO	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1
Charleston AFB	SO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ft. Smith	SO	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0
Georgetown	SO	0	1	1	0	1	1	0	0	0	0	0	0	1	1	0
Jackson Intl	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Kinston	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Knoxville	SO	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lake City	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
London	SO	1	1	1	0	1	0	0	0	0	0	0	0	1	1	0
Sanford	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Tallahassee	SO	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Weyers Cave/Staunton	SO	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Alamogordo	SW	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Alburquerque	SW	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Kingman	SW	0	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Libby/Ft Huachuca	SW	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1
Marana, Pinal Air Park	SW	0	0	1	0	1	1	0	0	0	0	1	0	0	1	1
Phoenix	SW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Prescott	SW	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Roswell	SW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Silver City	SW	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1
Winslow	SW	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
Number of Compatible Bases		48	67	58	25	69	59	33	25	21	18	40	9	68	68	63
Percentage of Compatible Bases		70%	97%	84%	36%	100%	86%	48%	36%	30%	26%	58%	13%	99%	99%	91%

Flight Crew Survey on Safety Related Issues at Airports and Airtanker Bases

A survey was conducted to obtain input from airtanker flight crews on what they view to be safety related issues at airports and airtanker bases. Telephone interviews with over 80% of the flight crews (Captains and co-pilots) were made. Leadplane Pilots and Air Tactical Group Supervisors were also interviewed. The following six questions were asked. Responses provided the committee an additional perspective.

Do you have safety concerns about operations in the airspace environment around the airtanker bases, be they FAA controlled or simply using CATF/UNICOM?

A high percentage of those pilots interviewed named Hemet and Ramona airtanker bases as being of concern as to airspace issues. Traffic intensity, mix of students with other general aviation traffic and no control tower were contributing factors. Phoenix was also mentioned, "because of the sheer traffic load in that airspace." "So Cal" approach is very difficult to deal with at times for pilots flying in that area. Kalispell, an uncontrolled field with commercial airline flights, can become crowded and difficult to deal with during periods of high activity. Pilots mentioned the "Sterile Flight Deck" approach to radio traffic as the way to go in helping pilots fly more safely in crowded airspace.

Temporary towers were not well received because the "frequency change" created problems in their operation, and the fact that they are usually there for only short periods of time.

Do you have safety concerns about the runway approach or departure corridor, runway lengths or width, or runway conditions at any of the airtanker bases?

A very high percentage of the pilots interviewed noted Hemet and Ramona, as well as Grangeville, Lakeview, and Omak as problem areas in regards to runway length.

An adequate margin of safety is "just not there" at those bases particularly when density altitude really becomes a factor. About half the pilots mentioned McCall as a concern when the temperatures are up. One pilot said he wouldn't go into Lakeview for a number of reasons and several others referred to it as a "non-tanker base."

Do you have safety concerns about taxiway widths or condition of the taxiway at any of the airtanker bases.

A majority of those pilots interviewed mentioned Lakeview (must backtaxi on the runway), Grangeville (taxiway on only a portion of the runway) and the same for Omak, Ramona, Hemet-Ryan and Twin Falls. Ft. Smith was noted as a problem in this category by most of those interviewed due to the proximity of hangers to the taxiway/ramp area. Chester was also mentioned by several pilots due to a total lack of taxiways.

Do you have safety concerns about any of the airtanker base ramp or loading pits considering wing clearance from obstructions and other aircraft? Are there any safety concerns about ramp management or overnight parking?

Most pilots voiced concerns about Ramona and Hemet as having "too small, confined" pit areas. Both these bases, as well as Santa Barbara and Grangeville were also noted as having very poor overnight parking areas. Jeffco and Rapid City were also examples given by most pilots as bases with inadequate ramp/pit facilities. (Jeffco is presently under construction and if the complete job is done, the problem should be eliminated.)

Concern was expressed about Rapid City and McGrath, Alaska, due to the need to taxi on gravel, and to continually "fire up and shut down to proceed around to the loading pit," while being "blown" by the aircraft ahead (Rapid City). Several pilots mentioned they have safety concerns with propeller blast from adjacent airtankers. Rapid City is also in the process of providing pavement for those gravel areas. However, the "loop" configuration will still exist.

Grand Junction was noted by about half the pilots sampled as being "too tight" when P-3's and C-130's are introduced in the mix. Ft. Smith was also mentioned in this category because of the aforementioned hangars which are close to the ramp/taxiway area. Grangeville was mentioned by a small number of pilots for being "a bit tight" in the pit/ramp area.

Billings was noted by several of the pilots as being a "real concern" in ramp/pit areas. Just too tight and in close proximity to general aviation operations (parking, etc.). Billings is also slated to get new base construction in the near future. A couple of the pilots mentioned Helena as "tight" because of the airline operation next door.

Do you have safety concerns with operations at bases within the areas of teamwork, communications (interpersonal), coordination, cooperation, and the base management's attitude towards safety?

The answers to this question were quite varied, although some concerns surfaced. The attitude of the base manager makes a tremendous difference in how smoothly the operation at a base runs. At some bases, the pilots felt like "just contractors" and they felt devalued. Some mentioned that those bases run with "military mentality" were unpleasant and in many cases very hard to deal with. About a third of the pilots noted interaction with CDF personnel at the bases often negative.

Most of the pilots established up-front that it simply comes down to the attitude of the base managers and pilots that makes the difference! There was mention by a number of pilots that dispatchers often don't have a good feel for the airtanker operation and its operating parameters.

Are there any other areas not addressed above, that you feel could improve safety at the airtanker bases?

A majority of the pilots interviewed took the opportunity to express their concerns about the Forest Service Leadplane program. The airtanker pilots feel the lead plane program is at an all-time low. They feel lead plane pilots are checked out to quickly, with no fire background, and when concerns have been raised, nothing has been done by the Agency.

A second concern, expressed by the majority of pilots dealt with cockpit temperatures and related stress and fatigue. "Fatigue causes mistakes" was the theme. Another concern dealt with communications and the feeling among the pilots that all bases should use common frequencies to assure ease of radio communications, thus reducing risk in base operations. Other areas of concerns in communication for mission planning, including pilots. Establishing a "team" attitude.

Investments Needs at Airtanker Bases

As recommended in Phase 1 of the National Airtanker Study, a subcommittee of agency airtanker base specialists and facilities engineers from Forest Service Regional Offices and Bureau of Land Management State Offices conducted a Condition Survey of each Federal Airtanker Base. The Condition Survey was conducted in accordance with the instructions developed. The Interagency Retardant Base Planning Guide--Fixed and Rotor Wing, March, 1995, (Guide) was the basis for the Condition Survey. Implementation guidelines for this survey are contained in Appendix G.

The condition survey was designed to address the condition of the airtanker base. In many cases, the airtanker base is a part of an aerial firefighting facility. In these situations, it was important to identify only those costs associated with the airtanker base.

The most frequently identified improvements are those structures and facilities that assure wastes generated at the base are contained and disposed of in a manner that protects the environment surrounding the base.

Each base has a designed capacity expressed in gallons per day (or gallons per hour) of retardant pumped based on the calculated daily peak (historic) demand. This design capacity was used to determine number of loading pits, gallons of storage of mixed and or bulk product and overall size of the base. All improvements proposed are consistent with the designed capacity of the base, and represent the most cost efficient and cost effective solutions possible.

In respect to many of the standards in the Guide, there is no appreciable difference between whether an airtanker base has an airtanker staffed at the base under a contract or not.

The estimated costs to allow for changes in chemical product were identified.

Table 8 - Summary of Airtanker Base Condition Survey

Geographic Area /Base	Average Gallons Per Year	Improvements Needed by Category: Chemical Mixing	Aircraft Facilities	Base Structures	Waste Treatment	G A Costs @ 30%	Total Requests	30 Year Per Year Cost @ 3%
ALASKA								
Fairbanks	214,343	$0	$357,000	$623,500	$200,000	$354,150	$1,534,650	$78,297
Ft. Yukon Reload	84,975	$15,000	$314,000	$1,200	$0	$99,060	$429,260	$21,901
Galena Reload	86,713	$257,000	$379,000	$750	$0	$191,025	$827,775	$42,232
Area Total	**386,031**						**2,791,685**	
CALIFORNIA								
Bishop Reload	10,000	$63,500	$100,000	$75,000	$100,000	$101,550	$440,050	$22,451
Chester	322,138	$53,000	$221,000	$151,500	$224,500	$195,000	$845,000	$43,111
Fox Field	700,000	$0	$90,000	$105,000	$90,000	$85,500	$370,500	$18,903
Fresno	232,216	$0	$0	$0	$0	$0	$0	$0
Hemet-Ryan	1,508,000	$0	$905,000	$161,500	$905,000	$591,450	$2,562,950	$130,760
Porterville	437,882	$127,000	$1,015,000	$95,000	$75,000	$393,600	$1,705,600	$87,018
Ramona	650,000	$350,000	$445,000	$257,000	$445,000	$449,100	$1,946,100	$99,289
Redding	966,636	$0	$10,000	$33,000	$12,500	$16,650	$72,150	$3,681
Santa Barbara	517,396	$0	$0	$124,000	$200,000	$97,200	$421,200	$21,489
Siskiyou Reload	142,660	$7,000	$10,000	$102,500	$55,000	$52,350	$226,850	$11,574
Stockton Reload	308,461	$0	$0	$145,500	$15,000	$48,150	$208,650	$10,645
Area Total	**5,795,389**						**8,799,050**	
EASTERN								
Bemidji	0	$0	$0	$0	$0	$0	$0	$0
Brainard	0	$0	$0	$0	$0	$0	$0	$0
Ely	0	$0	$0	$0	$0	$0	$0	$0
Hibbing	0	$0	$0	$0	$0	$0	$0	$0
Area Total	**0**						**$0**	
GREAT BASIN								
Battle Mountain	162,391	$180,000	$175,000	$200,000	$35,000	$177,000	$767,000	$39,132
Boise	512,581	$86,000	$1,400,000	$155,000	$159,000	$540,000	$2,340,000	$119,385
Cedar City	99,223	$103,000	$362,000	$95,000	$33,000	$177,900	$770,900	$39,331
Hill	0	$0	$400,000	$0	$0	$120,000	$520,000	$26,530
McCall	440,484	$171,400	$215,000	$128,500	$173,300	$206,460	$894,660	$45,645
Pocatello	280,728	$21,200	$12,000	$59,850	$31,200	$37,275	$161,525	$8,241
Reno/Stead	281,100	$0	$0	$0	$0	$0	$0	$0
Twin Falls	44,135	$48,285	$0	$20,960	$28,000	$29,174	$126,419	$6,450
Area Total	**1,820,642**						**$5,580,504**	
NORTHERN								
Billings	136,000	$127,000	$690,000	$275,000	$90,000	$354,600	$1,536,600	$78,396
Cour d' Alene	165,000	$97,536	$0	$1,920	$23,760	$36,965	$160,181	$8,172
Grangeville	157,000	$156,998	$4,500	$145,020	$42,100	$104,585	$453,203	$23,122
Helena	233,000	$16,450	$0	$0	$82,250	$29,610	$128,310	$6,546
Kalispell	188,000	$23,074	$0	$8,370	$50,000	$24,433	$105,877	$5,402
Missoula	470,000	$230,607	$0	$86,920	$7,860	$97,616	$423,003	$21,581
West Yellowstone	221,000	$29,763	$35,000	$79,400	$20,100	$49,279	$213,542	$10,895
Area Total	**1,570,000**						**$3,020,716**	

An estimate of the cost to clean-up and mitigate any hazardous waste situations currently at the airtanker base was made.

Geographic Areas completed the Condition Survey and provided a Summary of Information for each base. A copy of the Condition Survey for each base is located in Appendix H. The original copy of the surveys will be stored at the National Interagency Fire Center in Boise, Idaho, in the custody of the Forest Service's National Fixed-Wing Program Manager.

Table 8 (Continued) - Summary of Airtanker Base Condition Survey

Geographic Area /Base	Average Gallons Per Year	Improvements Needed by Category: Chemical Mixing	Aircraft Facilities	Base Structures	Waste Treatment	G A Costs @ 30%	Total Requests	30 Year Per Year Cost @ 3%
NORTHWEST								
Everett Reload	23,075	$95,599	$120,113	$136,353	$32,046	$115,233	$499,344	$25,476
Kingsley	375,000	$117,868	$225,546	$109,499	$217,830	$201,223	$871,966	$44,487
La Grande	555,585	$69,902	$178,913	$46,872	$146,825	$132,754	$575,266	$29,350
Lakeview Reload	87,200	$47,796	$27,300	$54,446	$42,840	$51,715	$224,097	$11,433
Medford	578,114	$89,824	$187,880	$197,918	$93,170	$170,638	$739,430	$37,725
Omak Reload	238,690	$125,377	$330,050	$91,896	$116,767	$199,227	$863,317	$44,046
Troutdale Reload	91,347	$25,046	$0	$65,345	$22,050	$33,732	$146,173	$7,458
Redmond	559,235	$63,952	$233,870	$234,409	$101,724	$190,187	$824,142	$42,047
Wenatchee	420,536	$57,834	$192,290	$227,948	$173,215	$195,386	$846,673	$43,197
Area Total	**2,928,782**						**$5,590,407**	
ROCKY MOUNTAIN								
Jeffco	73,616	$0	$335,000	$739,236	$3,000	$323,171	$1,400,407	$71,448
Grand Junction	394,642	$141,000	$1,350,000	$0	$0	$447,300	$1,938,300	$98,891
Rapid City Reload	111,180	$4,600	$0	$221,200	$37,500	$78,990	$342,290	$17,463
Area Total	**579,438**						**$3,680,997**	
SOUTHERN								
Asheville	50,000	$13,300	$34,450	$0	$11,700	$17,835	$77,285	$3,943
Ft. Smith	0	$15,540	$11,000	$0	$9,500	$10,812	$46,852	$2,390
Georgetown	0	$0	$0	$0	$0	$0	$0	$0
Kinston	0	$0	$0	$0	$0	$0	$0	$0
Knoxville	75,000	$22,000	$283,100	$0	$25,050	$99,045	$429,195	$21,897
Lake City	0	$17,200	$45,800	$0	$39,500	$30,750	$133,250	$6,798
London	0	$0	$0	$0	$0	$0	$0	$0
Tallahassee	0	$28,000	$74,950	$0	$36,600	$41,865	$181,415	$9,256
Weyers Cave	0	$28,850	$9,100	$9,800	$47,750	$28,650	$124,150	$6,334
Area Total	**125,000**						**$992,147**	
SOUTHWESTERN								
Alamogordo	291,564	$215,300	$560,000	$110,500	$360,000	$373,740	$1,619,540	$82,628
Alburquerque	172,894	$130,178	$0	$126,400	$106,060	$108,791	$471,429	$24,052
Libby	263,814	$10,000	$22,900	$8,000	$47,000	$26,370	$114,270	$5,830
Phoenix	1,215,844	$0	$0	$72,300	$0	$21,690	$93,990	$4,795
Prescott	228,225	$2,200	$707,000	$1,400	$22,000	$219,780	$952,380	$48,590
Rosewell	54,200	$39,371	$63,625	$23,383	$16,275	$42,796	$185,450	$9,462
Silver City	536,124	$28,000	$700,000	$113,400	$0	$252,420	$1,093,820	$55,806
Winslow	243,586	$160,000	$443,000	$165,000	$0	$230,400	$998,400	$50,938
Area Total	**3,006,251**						**$5,529,280**	
NATIONAL TOTAL	**16,211,533**						**$35,984,785**	**$1,835,917**

Average Gallons Per Year = 10 year average gallons of Retardant delivered from the base
Chemical Mixing = Improvements needed for Tanks , Pumps, Hoses, and Recirculation equipment.
Aircraft Facilities = Improvements needed for Pads, Ramps, Taxilanes, Taxiways to Base.
Base Structures = Improvements needed to Base Office, Workshop/Storage buildings and Pilot's Ready Room.
Waste Treatment = Improvements needed to collect, treat, and/or clean-up existing Airtanker Base waste water.
G A Costs= General Administration Costs at 30% of project costs.
Total Needs = Total of all improvements needed at the Base.
30 Year Per Year Cost = The annualized cost at 3% for 30 years.

The estimated costs of the improvements at each Airtanker Base to meet the current standards of the Guide are summarized in Table 8. The dollar amount in the column labeled 30 year cost at 3% per year is the annualized investment cost based on rules in OMB Circular A-94.

Real Time Status and Location Determination for Airtankers

Any analysis to maximize the efficient placement and use of airtankers is dependent on a dispatch system efficiently and consistently applied nationwide. The committee determined that it would be beneficial to identify costs of systems which would assist dispatchers in determining the location and status of airtankers on a real time basis. Present systems rely on verbal or electronic mail notification of a change in resource status and location. This process is cumbersome and prone to human performance failures. An automated process would improve performance and allow coordinators at the Geographic and National level to better allocate resources and improve operational and cost efficiencies.

The group identified vendors/agencies who were known to have done this kind of work before. In all probability, there are other potential vendors who could deliver all or parts of this kind of system. A letter was sent to four vendors asking for an informal description of a system they could provide and the associated costs. The committee is aware that implementing any system exclusively for airtankers is not efficient. Detailed planning and analysis of how any system might integrate with other aviation related activities would need to be undertaken prior to implementation.

British Columbia Forest Service Resource Management System

The Resource Management System utilizes Global Positioning Satellite (GPS) technology, a province wide computer network with fiber optic linkages and radio frequency modems. This system allows managers to identify and monitor the exact location of resources, as well as their direction and speed of travel. The system also allows for messaging between dispatch offices and field and aviation resources.

Their system uses 9 base stations and 18 relay sights to manage location and status information for 32 fixed wing aircraft, 5 rotary wing aircraft, 40 vehicles and 10 boats scattered across the entire province. The hardware cost to implement was $676,000 (US 1996 dollars). Software development cost $475,000 and installation for mountain tops, aircraft and vehicles cost $205,000. The total installation cost was $1,356,000 with annual operating costs of $150,000.

ARNAV Systems, Inc - System 6 Vehicle Tracking Equipment

This system is primarily focused on incident based resource statusing. The goal is to allow an incident commander to view and communicate with all resources instantly on a real time display, overlaid on a map of the incident. These systems can be installed in aircraft as well. This company proposes "top cover" aircraft in some applications to act as the communications focal point. They offer an alternative which uses their GeoNet Datalink, a three dimensional, high speed, bit oriented VHF Datalink with an exclusive air to air communications exchange. This allows an aircraft or vehicle to pass GPS position, GPS differential corrections, text messaging, weather and video graphics for up to 1600 miles beyond the line of sight of a GeoNet ground repeater.

Cost for this system was quoted at $9,500 per aircraft installation which includes the basic tracking system, the messaging system and the display. The base station cost is $14,000. ARNAV indicates repeater sights have been installed for around $5000, and options exist for costs accounting through a use fee. Other information shows that repeater site installation costs can vary widely according to what needs to be done. A typical repeater site installation cost is about $37,000. Repeater sites would have to be determined to provide adequate coverage. It is assumed that many would operate off of existing agency mountain top locations. Cost for installing the system in 40 airtankers and 20 leadplanes would be about $570,000. Base stations for Geographic Area Coordination Centers and the National Interagency Coordination Center would be about $168,000.

Mobile Datacom - Flightwatch
This system provides flight status information to dispatch and management personnel. It can provide current aircraft location, historical flight tracks, as well as providing e-mail and collecting data transmission between aircraft and dispatch center. Information is available real time via map display and text. Additional services are planned in future development. This data can be accessed via Internet. A GIS interface is possible. The Bureau of Land Management's Alaska Fire Service and the Office of Aircraft Services are currently testing this technology.

Cost for a simple transmission unit is $2500 and $4000 for a two way version. Flightwatch service will cost between $4 and $8 per flight hour depending on options selected. Other options include paying for raw data transmission on a per kilobyte basis. This cost is approximately $1 per kilobyte. The cost for installing the system into aircraft (40 airtankers and 20 lead planes) would be approximately $240,000 based on an estimated annual use for airtankers of 125 hours and for lead planes 300 hours. Estimated communications costs are $88,000 annually.

SRI International - InCON - Incident Command Operations Network.
This system provides a map based geographic situation display. The data management architecture automatically distributes information throughout the InCON network. This can include aircraft, dispatch centers and the incident itself. Communications structure can accommodate different physical modes, including radio, telephone, and digital networks. A complete record of reported aircraft movement is maintained with status and location information provided in real time by GPS. The system can also assist in dispatching aircraft by entering destinations or targets and can also identify flight hazards.

SRI provided a nation wide implementation proposal which would link the National Interagency Coordination Center and all the Geographic Area Coordination Centers, 40 local unit dispatch centers and 40 air attack bases with lead planes, airtankers, smokejumper aircraft, 20 helicopters and 40 air attack platforms. It does not include communications costs, which would vary depending on selected system(s). Implementing the ground base units would be $736,000. To outfit the aircraft would be an additional $900,000.

Issues and Opportunities
Based on a preliminary analysis, there appears to be no technical or financial reason not to pursue consideration of these technologies.

Any system implemented must not introduce new problems or distractions for flight crews and must integrate with other dispatch systems/activities. A detailed analysis of dispatch/coordination business events would allow this to happen.

Simply knowing where an aircraft is does not help determine whether its mission has priority.

A positive flight following system would improve search and rescue response.

Real time status would allow fire managers to analyze resource positioning and utilization at the strategic level resulting in cost and operational effectiveness. Automatic status updates frees dispatchers for other duties.

Radio traffic can be reduced, providing a simpler environment for pilots to concentrate on the business at hand.

Capability to Perform Airtanker Capability at Night

Proponents of modern aircraft for use in aerial firefighting have suggested that such aircraft not only provide superior suppressant delivery capability, but also are capable of night retardant operations. The aircraft, excess or surplus military, according to the proponents are or can be fitted with sensors and avionics that will provide safe and reliable night operations in fighting wildland fire. This explanation is focused on night retardant operations and is independent of any specific airtanker platform.

General.

The military has been successfully conducting night operations in battlefield conditions for many years. These conditions are somewhat analogous to the aerial firefighting environment in that low level flying (over both populated and remote areas), obstacles (both man-made and natural), smoke, and fire exist for each environment. However, there are significant differences between aerial firefighting and combat flying.

First, in combat flying, the military aircraft are there because they have to be. There is a war or other need that has placed soldiers in harms way. Military targets cannot be changed or relocated just because the flight operations area is dangerous. Firefighting may be seen as similar with one significant difference. If air crews believe that the location of the retardant drop (the target) poses a danger (greater than that of low level flying), the drop zone can and will be changed to a safer location regardless of what may be threaten by the fire.

The second difference is that in every military battle or engagement some degree of risk is acceptable to the strategist or planners. Typically this risk is measured in term of casualties. After all it is a military action, and the opponent wishes to win as well so the targets will be defended. In aerial firefighting, there is also some degree of risk involved but it is not measured in term of the number of casualties. ZERO casualties is the only acceptable risk in firefighting.

There is the inherent risk of low level flying. The Incident Management Team responsible for strategy and tactics on a fire develops plans with safety first in mind. Pilots are given the authority and responsibility to refuse a mission if they think it is not safe. The approach to firefighting is to establish firelines which are achievable, supportable and balance risk in terms of monetary losses and not lives.

Required Avionics Equipment for Night Retardant Operations

It must be realized that the installation of the equipment is not limited to the airtanker alone. Ground forces will be involved in fighting the fire. Lead planes or a Air Tactical Group Supervisor (ATGS) are required to assure that the drop zone is clear. (Reference FAA waiver to low level flying which requires a lead plane to assure the approach, drop and egress is clear in congested areas.) Hence, lead planes would be required to have this equipment installed too. To achieve the benefits of night operations, the ATGS aircraft must be equipped with adequate equipment for night operations.

The basic capability of aircraft is about the same. However, the installed equipment capability is not. The kinds of equipment which may be required for each aircraft are display at the top of the next page.

Lead Plane	ATGS	Airtanker
FLIR on gimbals	FLIR on gimbals	FLIR
Helmet Display	Helmet Display	HUD
Moving Map Display & GPS targeting Sys	Moving Map Display & GPS targeting Sys	Moving Map Display & GPS Targeting Sys
INS/Attitude Sensor	Strobe Lights	INS/Attitude Sensor
Strobe Lights	TCAS	Strobe Lights
TCAS		TCAS
Radar Altimeter		Radar Altimeter

For a detailed discussion of the application of these system in aircraft, refer to Appendix F.

Investment and Recurring Costs
The investigation found the equipment identified above to cost as follows:

Equipment	Cost
FLIR static mount	$70,000 - $ 90,000
FLIR mounted on gimbals	$140,000 - $170,000
HUD	$100,000 - $140,000
Helmet Display	$120,000 - $160,000
Moving Map Display & GPS targeting system	$15,000 - $ 30,000
INS/Attitude Sensor	$ 45,000 - $ 70,000
Strobe Lights	$ 1,000 - $ 1,000
TCAS	$ 60,000 - $100,000
Radar Altimeter	$ 20,000 - $ 20,000

Integration of some of these systems into the flight deck may require additional FAA certifications, especially if considered as primary navigation aids in low level, low visibility flight. This cost will be non recurring in addition to the system acquisition cost above. Also, the cost will be per aircraft type (DC-4T, C-130, etc.). The cost is estimated to be $2,000,000 to $3,000,000 per aircraft.

With the capability of night retardant operations, recurring costs in the form of double crews will increase. Pilot duty restrictions will not change, therefore additional crews will be needed to cover the additional hours. Additional training on the night systems will be required, as well as proficiency flying. Airtanker bases will require additional staffing to support night loading operations.

Capability and Availability of Avionics
The military as been conducting successful operations at night for many years using infrared and other sensors. Due to the shift in recent years away from a defense driven development economy, the commercial market is beginning to open up for what in the past has been exclusively a military market. An investigation into commercially available equipment, similar to the military, for installation into aircraft was performed for several reasons. First, commercial equipment is anticipated to be lower in acquisition and maintenance costs. Second, relying on excess or surplus military sources for spare parts and maintenance is not prudent due to the anticipation that the acquired equipment would no longer be in active military use. Third, if the equipment is no longer in active military use, the original equipment manufacturer most likely will not support the system; or that support will be expensive. And finally, equipment developed for the military was state of the art when new. Equipment such as is typically expensive to operate and maintain than subsequent versions.

Concern exists on the ability of equipment to identify flight hazards at night. Sensors are available which provide the resolution needed to detect and display high tension power lines. Initial calculations were not promising when the range of detection of power lines was estimated to be 400 feet. Subsequent investigations found that the range could be from 1200 to 2500 feet. The detector technology with this capability utilizes cryogenic cooling of the detector. While a new detector technology called microbolometers is coming available, it does not have a large commercial market as yet. This technology is expected to reduce the cost of infrared detectors as well as eliminate the need for cryogenic cooling. However, to date these detectors are not made in sufficient quantity to realize the reduced cost and the detectors are not as sensitive as the cryo-cooled units. It is anticipated that in the near future this technology will improve to closely match the capability of cryo-cooled detectors.

Safety and Tactics.
To evaluate safety of night operations, the 10 Standard Fire Orders and 18 Watchout Situations were used as a standard to compare the practice to:

Fire Order 1: <u>Fight fire aggressively but provide for safety first.</u>

Safety first applies not only to the flight crew, but to all firefighters at an incident. Ground crews, engines, water tenders, etc. must be considered in the equation for night aerial operations. The dropping retardant on trees and steep slopes, routinely takes the tops out of trees, fells snags, and causes rolling debris in the form of rocks and other material. These are hazardous to ground personnel. Additionally the retardant itself, if dropped too low where the cloud does not breakup is hazardous. While the aircraft will be fitted with strobes for visibility, at night the cloud will not be lighted and visible. Hence, the point of release will not be seen by ground personnel who may need to take avoidance action.

Fire Order 3: <u>Recognize current weather conditions and obtain forecasts.</u>

Infrared detectors "see" through smoke and fog, or in other words it does not detect it. During aerial operations, the ATGS and others are responsible to warn ground personnel if shifts in the direction of the wind shifts would threaten their safety. Since infrared see through the smoke of the fire, the only indication of shifts in the direction of the wind will be the fire its self. A greater work load will be placed on the ATGS to monitor flame direction for wind shifts rather than using smoke as an indication of wind direction change for ground crew safety and identifying appropriate targets.

Fire Order 8: <u>Establish lookouts in potentially hazardous situations.</u>

Comments to Fire Order 3 are applicable here. Additionally, Infrared may not discern ground features adequately between a safety zone for a ground crew which is being threatened and a unburned grass areas due to the resolution of the display system. Hence, aerial directions provided to ground personnel for rapid evacuation may not improve their situation.

Fire Order 9: <u>Retain control at all time.</u>

Using Infrared imaging during the day allows a view of the fire area in two spectrums, the visible light and Infrared. The both spectrums provide unique but separate abilities. Aerial retardant operations rely heavily on visual cues. Wildland agencies have recently begun implementation of infrared imaging for aerial attack, and the results have proven very favorable. In daylight operations, infrared is used to augment information obtained in visible light. At night, there is no visible light view of the incident to augment with infrared.

Watch Out Situation 2: In country not seen in daylight.

Aerial hazards such as snags, electrical power lines, towers, poles, etc. must be known to the pilots. While infrared technology has advanced and allows for the detection and display of these objects, familiarity of the terrain and aerial hazard viewed during daylight will be valuable.

Watch Out Situation 7: No communication link with crew members or supervisor.

This is extended to air attack in that ground crews must be informed that a retardant drop is being made. The flight crews need to be assured that personnel are not in the area of the drop.

To implement night operations some additional considerations for safety should be considered:

Terrain is a critical limitation. Retardant lines would most likely be limited to areas that are flat or on ridgetops. Flying in canyons below the ridges would be very hazardous.

Aircrews would need to fly in the area for a period of time prior to night fall to gain familiarity with the area before relying totally on FLIR images. This may take up to several hours.

A system of coordination with ground crews (fire engines, ground crews, water tenders, etc.) would need to be developed so that aircrews would know the locations of ground personnel, and thus avoid flying over them and dropping retardant on them or near them creating a hazard. Retardant when just applied to the ground can create a slick surface. Ground personnel which may be in the area and are traversing the drop zone may have greater risk of falling due to poor lighting conditions.

Historic Aerial Delivery

A review of historic patterns of airtanker use was done. The purpose of this investigation was to document the historic utilization of airtankers in comparison to available daylight hours. All dispatches are reported in AMIS (Aviation Management Information System). A survey of data from FY93 and FY94 which included 3159 dispatches follows:

Hour	0600	0700	0800	0900	1000	1100	1200	1300
Dispatches	5	47	104	128	156	165	209	262
% of Total	0	1	3	4	5	5	7	8

Hour	1400	1500	1600	1700	1800	1900	2000	2100
Dispatches	293	392	400	376	320	182	22	2
% of Total	9	12	13	12	10	6	1	0

Additional analysis also indicates 78 percent of the dispatches occurred between June 1 and September 1, with an equal split of 11% of the dispatches occurring either before or after these summer months. As can be seen by the above, only 18% of all dispatches occurred prior to 1200 noon. Hence, there are five hours of daylight which are available for more utilization of aerial retardant.

STEP 3: DEVELOP EVALUATION CRITERIA AND ALTERNATIVES

<u>Evaluation Criteria</u>

Aircraft

For aircraft, the following evaluation criteria were established by the committee:

Aircraft Evaluation Criteria #1: Compatibility of Aircraft with Airtanker Bases.

With a study goal to facilitate a highly mobile and effective fleet of airtankers, it is desirable for at least 75-80% of the future airtankers to be able to be used at least 90% of the bases. Evaluation of their compatibility will be based on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked.

Aircraft Evaluation Criteria #2: Initial Attack Efficiency.

Each airtanker platform will be evaluated using the Initial Attack Assessment (IAA) model at selected representative airtanker bases. In addition, cost per gallon delivered and cost per chain of fireline values will be developed for as many airtankers bases as possible nationally that have an airtanker assigned to the base in the 1996-1998 contract. Each of these elements are evaluated on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked.

Aircraft Evaluation Criteria #3: Accuracy and Performance in the Air

This is subjective evaluation based on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked.

Aircraft Evaluation Criteria #4: Aircraft Availability.

This criteria will measure the physical availability of the aircraft platforms for either the civilian sector or the military. Evaluation will be based on a scale of 1 to 10 with 10 the best. Aircraft platforms will be ranked.

Aircraft Evaluation Criteria #5: Viable Vendors.

Are there a viable number of vendors in the private sector that can provide airtanker services with this platform in the future. The answer to this criteria is yes or no.

Aircraft Evaluation Criteria #6: Reality/Professional Judgement Check.

A final check utilizing the professional judgement of committee members to assure the proper integration of analytical results with experience, skill and intuition.

Airtanker Bases

To evaluate airtanker bases where investments are proposed, the following criteria were established by the committee. The question asked is: "What would be the effect if the airtanker base was closed and airtanker support was provided from airtanker bases further away?" If an airtanker is stationed at the airtanker base in the 1996-1998 contract, several alternative locations to that airtanker should be analyzed.

Airtanker Base Evaluation Criteria #1: Compatibility of Aircraft with Airtanker Bases.

Can the selected future airtankers use this base?

Airtanker Base Evaluation Criteria #2: Initial Attack Efficiency.

What would be the effect if the airtanker base was closed and airtanker support for initial attack of fires was provided from airtanker bases further away?

Airtanker Base Evaluation Criteria #3: Large Fire Support.

What would be the effect if the airtanker base was closed and airtanker support for large or escaped fires was provided from airtanker bases further away or from helicopters assigned to the large fire?

Airtanker Base Evaluation Criteria #4: Temporary Base.

Based on the frequency of use, will a temporary base fill the need. It is important to note that a temporary airtanker base must also meet requirements defined in the Interagency Retardant Base Planning Guide--Fixed and Rotor Wing, March, 1995.

Airtanker Base Evaluation Criteria #5: Reality/Professional Judgement Check

A final check utilizing the professional judgement of committee members to assure the proper integration of analytical results with experience, skill and intuition.

Aircraft Alternatives

Based on the cost/chain rankings, the cost/gallon rankings and the compatibility of aircraft (Percent of Airports) with airtanker bases, the following aircraft that are **BOLDED** were not carried further into alternatives for evaluation in Customer Service Areas. An explanation for each follows.

Table 9 - Summary of Aircraft Not Carried Forward into Aircraft Alternatives

Aircraft Category	Aircraft Name	Gallons of Retardant	Cost/ Chain	Initial and Intermediate Relative Ranking	Cost/ Gallon	Initial and Intermediate Relative Ranking	Initial % of Airports
Current	Current A/C	2,507	$ 944	9.8/9.2	$2.28	9.8/9.4	90%
Civilian	**PV-2**	**1,075**	**$1,646**	**8.3/4.5**	**$3.13**	**9.0/4.4**	
Civilian	**CL-215T**	**1,300**	**$5,109**	**1.8/---**	**$12.29**	**1.9/---**	
Civilian	**CL-415T**	**1,500**	**$6,140**	**1.0/---**	**$14.65**	**1.0/---**	
Civilian	**F-27**	**1,700**	**$1,375**	**8.8/6.1**	**$3.21**	**8.9/6.2**	
Civilian	CV-580	1,500	$1,656	8.3/4.5	$4.05	8.3/3.9	
Civilian	L-188	3,000	$1,022	9.4/8.2	$2.72	9.3/7.6	
Civilian	L-382G	5,000	$1,423	8.7/5.8	$3.59	8.6/5.2	
Civilian	C-130E	5,000	$ 868	9.7/9.1	$2.24	9.7/8.9	
Civilian	B-737-200	2,700	$1,470	8.6/5.6	$3.86	8.4/4.4	
Civilian	B-747-200B	17,000	$ 819	9.8/9.4	$2.31	9.6/8.7	
Military	E-2C	1,900	$1,238	9.0/6.9	$2.93	9.2/7.0	
Military	S-3	2,400	$1,048	9.4/8.0	$2.58	9.4/8.0	
Military	**A-6**	**2,000**	**$1,192**	**9.1/7.2**	**$3.30**	**8.9/6.0**	
Military	A-10	1,800	$1,176	9.1/7.3	$3.35	8.8/5.9	
Military	P-3A	3,000	$ 904	9.6/8.9	$2.42	9.6/8.5	
Military	C-130A,B	3,000	$ 971	9.5/8.5	$2.63	9.4/7.9	
Military	C-130E	5,000	$ 713	10.0/10.0	$1.86	10.0/10.0	
Refit	S-2T	1,200	$2,422	6.9/1.0	$5.46	7.2/1.0	
Refit	**C-123T**	**2,500**	**$1,347**	**8.8/6.3**	**$3.17**	**9.0/6.4**	
Refit	P-2T	2,700	$1,103	9.3/7.7	$2.67	9.4/7.7	
Refit	**DC-4T**	**2,000**	**$1,519**	**8.5/5.3**	**$3.73**	**8.5/4.8**	

PV-2 - This is a reciprocating engine aircraft. It is viewed that the future airtanker fleet needs to be turbine powered. Given the limited number of airframes available, the cost to convert and the gallonage resulting (1100-1200 gallons), it appears there are other alternatives such as the S-2T to fill this size niche.

CL-215T and CL-415T - These aircraft are primarily "water scoopers" even though they can be loaded with fire retardant at fixed airtanker bases. The committee received a very complete and though briefing on these platforms from the manufacturer. It is their belief, and the committee's too, that these aircraft are quite expensive when they deliver retardant from fixed airtanker bases when compared to alterative aircraft. In addition, the tanking system is built to allow the dropping of water or foam which, for effectiveness, requires the flow rate from the tank be quite high. In effect, their main tactic is to "bomb" active fire with water or foam to cool it, allowing ground forces to be more effective. The conventional use of fire retardant airtankers operating from fixed bases is to support fireline construction, using long term retardant, in a general flanking or indirect attack mode. They frequently do however attack fires at their head and are capable of a "salvo" drop. Evaluation of the CL-215T and CL-415T is best done in comparison with Type I helicopters that fulfill a similar mission.

B-747-200B
The cost per chain and cost per gallon are a result of the "economies of scale" principle. The compatibility rating was only 16% though. In view of the goal of having a high compatibility between airtankers and airtanker bases, this aircraft does not fit.

A-6
The cost per chain and cost per gallon are not attractive. The airtanker base compatibility rating is 38%. In the spirit of developing a high compatibility between airtankers and airtanker bases, this aircraft does not appear to fit. The A-10 has very similar attributes. There is quite a bit of interest as far back as the last 1980's in the use of the A-10 as an airtanker. To thoroughly evaluate the A-10 is planned. This analysis hence can be assumed to be a "surrogate" for the A-6.

C-123T
Airtanker base compatibility is very high but cost per chain and cost per gallon are relatively high compared to alterative aircraft in the 2500-3000 gallon size class.

DC-4T
Putting turbines on the well proven aircraft do not allow it to haul more retardant. When complete, one would still have a relatively old platform. It appears there are better alternatives to looking at an airtanker that can haul 2000 gallons.

Helicopters
Both the CL-215T/CL-415T and Type I helicopters best operate in a mode of travelling to the fire location (either full or empty), dropping their load and then reloading at a spot near by. Many studies have shown that if this "turnaround time" can be less than 12 minutes hence delivering at least 6 loads per hour, the aircraft can be cost effective. In Step 4, this mode of operation will be examined.

Airtanker Base Alternatives
As stated previously, where investments are proposed at airtanker bases, the question that was asked is: "What would be the effect if the airtanker base was closed and airtanker support was provided from airtanker bases further away?"

If an airtanker is stationed at the airtanker base in the 1996-1998 contract, several alternative locations from that airtanker were analyzed.

If an airtanker is not stationed at the airtanker base in the 1996-1998 contract, one alternative was examined by closing the airtanker base hence not allowing airtankers to reload at the base. Results are displayed in Step 4.

STEP 4: PERFORM ANALYSIS OF AIRCRAFT and AIRTANKER BASE ALTERNATIVES

Analysis of Potential Fixed Wing Future Airtankers
Fleet diversity is important. It is desirable to have a mix of aircraft types/models in the airtanker fleet so that if problems occur with a particular model, grounding of that model will not mean that the entire airtanker fleet is grounded. In addition, not all aircraft have the same performance (speed, take off, etc.), retardant capacities and compatibility with the airtanker bases. The fixed wing airtanker platforms that were evaluated are as follows:

Table 10 - Summary of Aircraft Carried Forward into Aircraft Alternatives

Aircraft Category	Aircraft Name	Gallons of Retardant	Cost/ Chain	Initial and Intermediate Relative Ranking	Cost/ Gallon	Initial and Intermediate Relative Ranking	Initial % of Airports
Current	Current A/C	2,507	$ 856	9.7/9.2	$2.09	9.8/9.2	90%
Civilian	CV-580	1,500	$1,646	8.3/4.5	$4.05	8.3/391	84%
Civilian	L-188	3,000	$1,022	9.4/8.2	$2.72	9.3/7.6	86%
Civilian	L-382G	5,000	$1,423	8.7/5.8	$3.59	8.6/5.2	48%
Civilian	C-130E	5,000	$ 868	9.7/9.1	$2.24	9.7/8.9	48%
Civilian	B-737-200	2,700	$1,470	8.6/5.6	$3.86	8.4/4.4	58%
Military	E-2C	1,900	$1,238	9.0/6.9	$2.93	9.2/7.0	36%
Military	S-3	2,400	$1,048	9.4/8.0	$2.58	9.4/8.0	36%
Military	A-10	1,800	$1,176	9.1/7.3	$3.35	8.8/5.9	26%
Military	P-3A	3,000	$ 904	9.6/8.9	$2.42	9.6/8.5	86%
Military	C-130A,B	3,000	$ 971	9.5/8.5	$2.63	9.4/7.9	91%
Military	C-130E	5,000	$ 713	10.0/10.0	$1.86	10.0/10.0	48%
Refit	S-2T	1,200	$2,422	7.2/1.0	$5.46	7.2/1.0	99%
Refit	P-2T	2,700	$1,103	9.3/7.7	$2.67	9.4/7.7	70%

Results of analysis are summarized by the evaluation criteria.

Aircraft Evaluation Criteria #1: Compatibility of Aircraft with Airtanker Bases.
With a study goal to facilitate a highly mobile and effective fleet of airtankers, it is desirable for at least 75-80% of the future airtankers to be able to be used at least 90% of the bases. Evaluation of their compatibility will be based on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked.

Table 11 below displays the relative ranking of the airtanker platforms with respect to airtanker base compatibility. This is an initial ranking because following an evaluation of investments at airtanker bases, the number of airtanker bases may change hence requiring a recalculation.

Table 11 - Initial Relative Ranking of Airtanker Platforms at Airtanker Bases

	Percent	Relative Ranking
Current		
All Current	90%	9
Civilian		
CV-580	84%	8
L-188	86%	8
L-382G	48%	4
C-130E	48%	4
B-737	58%	5
Military		
E-2C	36%	2
S-3	36%	2
A-10	26%	1
P-3A	86%	8
C-130A,B	91%	8
C-130E	48%	4
Refit		
S-2T	99%	10
P-2T	70%	6

Aircraft Evaluation Criteria #2: Initial Attack Efficiency.
Each airtanker platform will be evaluated using the Initial Attack Assessment (IAA) model at selected representative airtanker bases. In addition, cost per gallon delivered and cost per chain of fireline values will be developed for as many airtankers bases as possible nationally that have an airtanker assigned to the base in the 1996-1998 contract. Each of these elements are evaluated on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked.

Selected airtanker bases were identified a "representative airtanker bases" for analysis for the effectiveness and efficiency of potential future airtanker platforms. These are as follows: Albuquerque, Boise, Klamath Fall, Missoula, Phoenix, and Redding. Albuquerque and Boise represent the cluster of bases with coverage level requirements from 1 to 2 gallons per 100 square feet. Phoenix represents the cluster of bases with coverage level requirements from 4 to 6 gallons per 100 square feet and having relative average FFF+NVC per acre burned attributes. The remaining three bases were selected to observe the variability as coverage level and FFF+NVC per acre burned increase proportionately.

Appendix E contains detailed results of the analysis of airtanker platforms at representative airtanker bases. Summaries follow in Tables 12 and 13.

Table 12 - Total Program Costs

	Albuquerque	Boise	Phoenix	Missoula	Klamath Falls	Redding
	<-----Total Program Costs----->					
Current						
R2000						
2450	$2,601,538	$35,924,948		$9,836,320		
T3000			$23,064,864		$51,490,145	$54,103,892
Civilian						
CV-580	$3,513,579	$36,202,451	$23,895,957	$10,338,695	$55,100,737	$62,979,618
L-188	$2,604,735	$35,596,063	$23,220,563	$9,403,640	$51,433,094	$54,163,755
L-382G	$2,626,688	$35,669,436	$23,685,163	$9,541,258	$50,614,186	$53,582,534
C-130E	$2,143,744	$35,186,492	$22,998,477	$9,126,228	$49,934,200	$52,767,566
B-737	$2,893,308	$35,909,498	$23,383,844	$9,665,851	$53,217,666	$56,902,065
Military						
E-2C	$3,302,651	$35,934,062	$23,671,450	$9,870,131	$53,832,724	$62,778,451
S-3	$2,642,095	$35,620,039	$23,370,327	$9,593,530	$52,609,076	$62,338,647
A-10	$3,452,930	$36,050,081	$23,708,129	$9,876,585	$53,892,937	$62,570,918
P-3A	$2,543,726	$35,679,026	$23,093,315	$9,427,308	$51,405,322	$54,086,245
C-130A,B	$2,582,474	$35,779,759	$23,154,258	$9,462,026	$51,458,133	$54,047,329
C-130E	$2,008,640	$35,051,388	$22,863,373	$8,991,124	$49,799,096	$52,632,462
Refit						
S-2T	$3,483,949	$36,258,172	$23,659,074	$10,510,707	$55,417,572	$63,409,838
P-2T	$2,633,521	$35,847,905	$23,202,529	$9,949,606	$51,698,023	$54,233,797

Table 13 - Relative Ranking of Airtanker Platforms on Initial Attack Efficiency

	Avg.	Albuquerque	Boise	Phoenix	Missoula	Klamath Falls	Redding
	<-----Relative Ranking----->						
Current							
R2000							
R2450	4	6	3		4		
T3000	8			8		7	9
Civilian							
CV-580	1	1	1	1	1	1	1
L-188	7	6	5	7	7	7	9
L-382G	6	6	5	2	6	9	9
C-130E	9	9	9	9	9	10	10
B-737	5	4	3	5	6	4	6
Military							
E-2C	2	1	3	2	4	3	1
S-3	5	6	5	5	6	5	1
A-10	2	0	2	2	4	3	1
P-3A	7	6	5	8	7	7	9
C-130A,B	7	6	4	7	7	7	9
C-130E	10	10	10	10	10	10	10
Refit							
S-2T	0	0	0	2	0	0	0
P-2T	6	6	3	7	4	7	9

Aircraft Evaluation Criteria #3: Accuracy and Performance in the Air
This is subjective evaluation based on a scale of 1 to 10 with 10 being the best. Aircraft platforms will be ranked and the results displayed in Table 14.

Table 14 - Initial Relative Ranking of Airtanker Platforms on Accuracy and Performance

		Relative Ranking
Civilian		
	CV-580	4
	L-188	6
	L-382G	6
	C-130E	6
	B-737	2
Military		
	E-2C	6
	S-3	8
	A-10	10
	P-3A	6
	C-130A,B	6
	C-130E	6
Refit		
	S-2T	8
	P-2T	8

Aircraft Evaluation Criteria #4: Aircraft Availability.
This criteria will measure the physical availability of the aircraft platforms for either the civilian sector or the military. Evaluation will be based on a scale of 1 to 10 with 10 the best. Aircraft platforms were ranked and a summary of the results is in Table 15.

Table 15 - Relative Ranking Based on Aircraft Availability

		Relative Ranking
Civilian		
	CV-580	6
	L-188	4
	L-382G	8
	C-130E	6
	B-737	10
Military		
	E-2C	4
	S-3	4
	A-10	4
	P-3A	10
	C-130A,B	10
	C-130E	10
Refit		
	S-2T	8
	P-2T	10

Aircraft Evaluation Criteria #5: Viable Vendors.
Are there a viable number of vendors in the private sector that can provide airtanker services with this platform in the future. The answer to this criteria is yes or no.

Yes. It is felt that contractors will be available to provide any of the aircraft that are being considered. A period of implementation will need to be defined in a Transition plan to allow for a "ramp up" time for industry to adjust financially and to acquire adequate skills and training to manage a future fleet.

Aircraft Evaluation Criteria #6: Reality/Professional Judgement Check
A final check utilizing the professional judgement of committee members was done to assure the proper integration of analytical results with experience, skill and intuition.

Analysis of Potential Rotor Wing Aircraft and the CL-215T/CL-415T as Airtankers

Airtanker Evaluation Criteria #1: Compatibility of Aircraft at Airtanker Bases.
All the rotor wing aircraft can operate from any current airtanker base as well as helibases in the field given the proper physical characteristics. The CL-215T and CL-415T have a 99% compatibility rating.

Airtanker Evaluation Criteria #2: Initial Attack Efficiency.
As stated previously, both of these platforms are best used in a mode of flying to a fire from an initial airtanker base location, then providing "reloads" from local water sources. Evaluation of these platforms will only be done with this mode of operation in mind.

In 1992, The National Study of Type I and II Helicopters to Support Large Fire Suppression was completed. This report documented the use of Type I helicopters in support of large fire suppression activities and displayed the tradeoffs of providing this support through call-when-needs or exclusive-use contracts. Recommended actions included staffing three of these Type I helicopters through exclusive-use contracts Nationally during defined fire seasons.

All of these platforms have the capability to inject surfactants to create foam. Water and foam are both short term retardants which are best used in direct support of ground base firefighting forces. Fixed wing airtankers carrying long term retardant can also perform this role but are more terrain limited than helicopters. After further examination, it is apparent that the Type I helicopter dropping foam or water, the CL-215T/CL-415T dropping foam or water and fixed wing airtankers carrying long term retardant each has a niche in the aerial firefighting support role. In support of initial attack, the Type I helicopters and CL-215T/CL-415T best support "direct attack" of a fire while fixed wing airtankers with long term retardant can support both "direct and indirect attack." This makes it difficult to compare these three tools with each other.

The study team determined several criteria which need to be met for these tools to be effective.

- Proximity of the fire to water allowing the required loads per hour is critical. For the Type I helicopter and the CL-215T/CL-415T in the mode of operation as defined, turnaround times between "reloads" is important. All of the rotor wing and the CL-215T/CL-415T have relatively high rates for daily availability. Both industry personnel and agency professionals recommend that for these platforms to be cost effective, at least 6 loads per hour need to be dropped on the fire. This advice will be compared to analytical results that follow.

- For initial attack, saving of high value losses and suppression costs would need to be possible to show cost efficiency.

- As ground support of the foam or water drops is needed, the location for use should have a very high degree of accessibility for ground based forces, either on foot or in a vehicle.

- The dropping of foam or water is best suited to grass and brush fuel types where larger size class fuels which can hold heat for extended periods of time are absent.

A comparison was done for the S-64F, CL-415T and P-3A as representatives of aircraft from the categories defined. The assumptions made are as follows. LTFR means long term fire retardant.

	S-64F	CL-415T	P-3A
Retardant Type =	Foam	Foam	LTFR
Retardant Cost=	$0.00	$0.00	$0.80
Miles to Fire =	84	84	84
Speed (Knots) =	93	193	269
Speed (MPH) =	81	168	234
Pickup Time (Min) =	1	2	15
Daily Availability=	$13,860	$21,677	$3,191
Flight Rate=	$3,596	$1,467	$2,877
Payload (Gallons)=	2000	1622	3000

Initial Attack

In the Historic Use, Demand and Trends for Large Airtankers section, it was documented that the average round trip time for large fixed wing airtankers with long term retardant was 53 minutes nationally which for the speed of the P-3A means that the average fire is 84 miles from the airtanker base. For initial attack assessment comparisons, all three aircraft start at the same airtanker base. The P-3A reloads at the original airtanker base whereas the S-64F and CL-415T reload at a location that would yield the number of round trips per hour in the column in the left of the table. The hours per day is used to control the total time allowed. The cost per gallon in each row is the total cost per gallon based on all gallons dropped within the allowed hours per day.

				S-64F	CL-415T	P-3A
		Hours/Days =		2	2	2
Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$7.20	$7.59	$2.02
1	60.0	39.8	81.1	$6.22	$7.57	$2.02
2	30.0	19.5	39.2	$3.27	$3.78	$2.02
3	20.0	12.8	25.2	$2.23	$2.52	$2.02
4	15.0	9.4	18.2	$1.70	$1.89	$2.02
5	12.0	7.4	14.0	$1.37	$1.51	$2.02
6	10.0	6.1	11.2	$1.15	$1.26	$2.02
7	8.6	5.1	9.2	$0.99	$1.08	$2.02
8	7.5	4.4	7.7	$0.87	$0.95	$2.02
9	6.7	3.8	6.5	$0.78	$0.84	$2.02
10	6.0	3.4	5.6	$0.70	$0.76	$2.02

Under these assumptions, equivalent cost per gallon to the P-3A would occur at three to four trips per hour for the S-64F and the CL-415 assuming water reload locations existed within the distances noted for these aircraft.

A survey of professional firefighters was done to determine as estimate of the relative value of long

term fire retardant versus water or foam. Used in the situations where both are effective and where firefighters exist on the ground to provide support, it was estimated that two loads of water or foams are needed per each load for long term fire retardant. This will be called the "retardant to water/foam" factor. Sensitivity analysis to this assumption was desired. The following displays cost per gallon values if the water/foam factor is set at 2.

	S-64F	CL-415T	P-3A
Hours/Days =	2	2	2
Retardant to Water/Foam Factor =	2	2	1

Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$14.40	$15.18	$2.02
1	60.0	39.8	81.1	$12.43	$15.14	$2.02
2	30.0	19.5	39.2	$6.53	$7.57	$2.02
3	20.0	12.8	25.2	$4.46	$5.04	$2.02
4	15.0	9.4	18.2	$3.39	$3.78	$2.02
5	12.0	7.4	14.0	$2.74	$3.02	$2.02
6	10.0	6.1	11.2	$2.30	$2.52	$2.02
7	8.6	5.1	9.2	$1.98	$2.16	$2.02
8	7.5	4.4	7.7	$1.74	$1.89	$2.02
9	6.7	3.8	6.5	$1.55	$1.68	$2.02
10	6.0	3.4	5.6	$1.40	$1.51	$2.02

Under these assumptions where the retardant to water/foam factor is changed to 2, the equivalent cost per gallon to the P-3A would occur at about seven trips per hour for the S-64F and seven to eight trips per hour for the CL-415T. This would require water reload sites within about five miles for the S-64F and within eight to nine miles for the CL-415T.

Terrain and wind can be limiting to either fixed wing or rotor wing aircraft. To account for these differences, the effectiveness factor is displayed and is estimated as the proportion of the time that the drop will be effective. To examine terrain and potential windy situations where the S-64F Type I helicopter might be more precise than the fixed wing CL-415T and the P-3A, a scenario was run assuming the conditions above the following effectiveness factors.

	S-64F	CL-415T	P-3A
Hours/Days =	2	2	2
Retardant to Water/Foam Factor =	2	2	1
Drop Effectiveness Factor =	1	.5	.5

Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$14.40	$30.35	$4.04
1	60.0	39.8	81.1	$12.43	$30.29	$4.04
2	30.0	19.5	39.2	$6.53	$15.13	$4.04
3	20.0	12.8	25.2	$4.46	$10.09	$4.04
4	15.0	9.4	18.2	$3.39	$7.56	$4.04
5	12.0	7.4	14.0	$2.74	$6.05	$4.04
6	10.0	6.1	11.2	$2.30	$5.04	$4.04
7	8.6	5.1	9.2	$1.98	$4.32	$4.04
8	7.5	4.4	7.7	$1.74	$3.78	$4.04
9	6.7	3.8	6.5	$1.55	$3.36	$4.04
10	6.0	3.4	5.6	$1.40	$3.02	$4.04

Under these assumptions, the equivalent cost per gallon to the P-3A would occur at three to four trips per hour for the S-64F and would occur at seven to eight trips per hour for the CL-415T. This would require water reload sites within 10-13 miles for the S-64F and within eight to nine miles for the CL-415T.

Large Fire Support

On large fires, it was documented in the National Study if Type I and Type II Helicopters to Support Large Fire Suppression (1992), the average number of hours flown on large fires by Type I helicopters was 5.4 hours per day. The maximum number of hours that can be flown by flight crews on fire suppression is eight hours under current Federal policies. Increasing the number of hours per day to six was examined to provide further information into the large fire support arena. Note the factor values and that the distance from the "helibase" to the fire assumed to be 10 miles from the fire.

	S-64F	CL-415T	P-3A
Retardant Type =	Foam	Foam	LTFR
Retardant Cost=	$0.00	$0.00	$0.80
Miles to Fire =	10	84	84
Speed (Knots) =	93	193	269
Speed (MPH) =	81	168	234
Pickup Time (Min) =	1	2	15
Daily Availability=	$13,860	$21,677	$3,191
Flight Rate=	$3,596	$1,467	$2,877
Payload (Gallons)=	2000	1622	3000

Hours/Days =	6	6	6
Retardant to Water/Foam Factor =	1	1	1
Drop Effectiveness Factor =	1	1	1

Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$1.60	$3.13	$1.67
1	60.0		81.1		$3.12	$1.67
2	30.0		39.2		$1.56	$1.67
3	20.0		25.2		$1.04	$1.67
4	15.0	9.4	18.2	$0.46	$0.78	$1.67
5	12.0	7.4	14.0	$0.36	$0.62	$1.67
6	10.0	6.1	11.2	$0.29	$0.52	$1.67
7	8.6	5.1	9.2	$0.25	$0.44	$1.67
8	7.5	4.4	7.7	$0.22	$0.39	$1.67

Under these assumptions, one can see the economic value of the S-64F.

If the retardant to water/foam factor is changed to 2 similar results are still shown.

	S-64F	CL-415T	P-3A
Hours/Days =	6	6	6
Retardant to Water/Foam Factor =	2	2	1
Drop Effectiveness Factor =	1	1	1

Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$3.20	$6.27	$1.67
1	60.0		81.1		$6.23	$1.67
2	30.0		39.2		$3.11	$1.67
3	20.0		25.2		$2.07	$1.67
4	15.0	9.4	18.2	$0.92	$1.55	$1.67
5	12.0	7.4	14.0	$0.72	$1.24	$1.67
6	10.0	6.1	11.2	$0.59	$1.04	$1.67
7	8.6	5.1	9.2	$0.50	$0.89	$1.67
8	7.5	4.4	7.7	$0.43	$0.78	$1.67

Under situations where terrain and wind can be limiting to fixed wing aircraft, the cost effectiveness of the Type I helicopter is more evident.

	S-64F	CL-415T	P-3A
Hours/Days =	6	6	6
Retardant to Water/Foam Factor =	2	2	1
Drop Effectiveness Factor =	1	.5	.5

Round Trips per Hr	Round Trip Time	S-64F Miles To Water	CL-415T Miles To Water	S-64F Cost per Gallon	CL-415T Cost per Gallon	P-3A Cost per Gallon
First Drop Cost per Gallon -->				$3.20	$12.53	$3.33
1	60.0		81.1	$4.52	$12.47	$3.33
2	30.0		39.2	$2.03	$6.22	$3.33
3	20.0		25.2	$1.28	$4.15	$3.33
4	15.0	9.4	18.2	$0.92	$3.11	$3.33
5	12.0	7.4	14.0	$0.72	$2.49	$3.33
6	10.0	6.1	11.2	$0.59	$2.07	$3.33
7	8.6	5.1	9.2	$0.50	$1.78	$3.33
8	7.5	4.4	7.7	$0.43	$1.55	$3.33
9	6.7	3.8	6.5	$0.38	$1.38	$3.33
10	6.0	3.4	5.6	$0.34	$1.24	$3.33

In this situation, the S-64F would be the most cost efficient. This verifies that on large fires where quick turnarounds can occur, Type I helicopter operations are the most efficient.

For initial attack, saving of high value losses and suppression costs would need to be possible to show cost efficiency. As ground support of the foam or water drops is needed, the location for use should have a very high degree of accessibility for ground based forces, either on foot or in a vehicle. The dropping of foam or water is best suited to grass and brush fuel types where larger size class fuels which can hold heat for extended periods of time are absent.

To analyze the CL-215T/CL-415T and the Type I, the study committee looked for an area that met these criteria for additional analysis. The Cleveland National Forest in southern California met the criteria. Due to time limitations, this initial attack assessment work was not able to be completed prior to the completion date of this report.

Airtanker Evaluation Criteria #3: Accuracy and Performance in the Air
The Type I helicopters are highly accurate. The CL-215T/CL-415T perform at a level similar to that of the attack class aircraft evaluated earlier in a firefighting role.

Airtanker Evaluation Criteria #4: Aircraft Availability.
The CL-215T and CL-415T are both manufactured in Canada. The majority of the companies that have Type I helicopters are in the Pacific Northwest .

Airtanker Evaluation Criteria #5: Viable Vendors.
Viable vendors exist for these aircraft.

Airtanker Evaluation Criteria #6: Reality/Professional Judgement Check
The committee recognizes the potential value of these tools in their defined niches characterized by the mentioned criteria. Further analysis is needed at the local level in the initial attack role. For Type I helicopters role in large fire support, the committee notes that The National Study of Type I and II Helicopters to Support Large Fire Suppression fills this analysis need.

Resolution of Airtanker Base Location and Investment Issues

Airtanker Dispatch Philosophy
During the analysis of airtanker and base locations in Phase 2 there was an indication of an overall benefit to relook at the dispatch philosophy of airtankers for initial attack.

In a large part of the Western United States, airtankers are not ordered until the first person in charge arrives on scene. This typically involves a delay of 30 to 40 minutes from the time of discovery. Once the airtanker is ordered, a 15 minute get-a-way, and flight time of and another 30 to 40 minutes, gets retardant on the fire somewhere between an hour and a half to two hours from the discovery time. Even at a modest rate of spread of 15-20 chains per hour, the fire has the potential to increase in size before the first airtanker arrives.

A scenario often occurring is as follows. On a fire, one airtanker is ordered for initial attack and arrives somewhere between one and a half to two hours after discovery. It drops the first load and is requested to reload and return. After the second drop, another 1-1/2 to 2 hours later, with the fire rapidly escaping Initial Attack, several airtankers are ordered and all of them are flown "round robin" until dark.

During the Phase 2 analysis, the model was set to allow multiple bases and therefore multiple airtankers to be available to all of the representative fire locations. The model then determined which airtankers to dispatch to the representative fire location based upon the which are the **quickest.** If the "dispatch philosophy" used in the analysis called for three loads of retardant at a given fire intensity level, the model would in most cases send three airtankers from three different bases. In some cases the resulting reduction in Cost Plus Net Value Change was dramatic for the Unit being analyzed.

An example may be of value to illustrate this situation. If up to six airtanker loads were to be delivered as needed by three airtankers, then three airtankers would be dispatched from the quickest locations and make initial drops. If needed, each airtanker would then go to the closest airtanker base

to "reload" and return. This "reload" airtanker base may not be the airtanker base it was dispatched from. One trip back to the fire from the "reload" base would be allowed. If only one airtanker was dispatched, it would make up to six "reload" trips back top the representative fire. As can be seen from the following real-time example, this lengthens greatly the delivery time.

	Drop 1	Drop 2	Drop 3	Drop 4	Drop 5	Drop 6
Minutes to drop with 3 airtankers -	73 min	78 min	87 min	123 min	128 min	137 min
Minutes to drop with 2 airtankers -	73 min	78 min	123 min	128 min	173 min	178 min
Minutes to drop with 1 airtanker -	73 min	123 min	173 min	178 min	238 min	288 min

In the modelling, it was assumed that fire were attacked with a "appropriate" number of airtankers based on the way fire occur and expected airtanker availability. Multiple fire occurrence is quite common and so in general, no more than three airtankers were allowed to attack a representative fire.

Analysis Guidelines and Process

Airtanker Base Evaluation Criteria #1: Compatibility of Aircraft with Airtanker Bases.

Table 7, Compatibility of Airtankers with Airtanker Bases, was used to display which potential future airtanker platforms which could operate from the base. This evaluation was completed following evaluation of aircraft platforms so that the focus was on the most likely aircraft that will make up the future fleet. For those bases where compatibility is an issue and where modifications are proposed in the recommendations section, a discussion of compatibility will be displayed there.

Airtanker Base Evaluation Criteria #2: Initial Attack Efficiency.

What would be the effect if the airtanker base was closed and airtanker support for initial attack of fires was provided from airtanker bases further away?

Airtanker Base Evaluation Criteria #3: Large Fire Support.

What would be the effect if the airtanker base was closed and airtanker support for large or escaped fires was provided from airtanker bases further away or from helicopters assigned to the large fire? This criteria was generally not evaluated except at airtanker bases that did not show staffing was economicly efficient in Airtanker Base Evaluation Criteria #2: Initial Attack Efficiency.

Airtanker Base Evaluation Criteria #4: Temporary Base.

Based on the frequency of use, will a temporary base fill the need. It is important to note that a temporary airtanker base must also meet requirements defined in the Interagency Retardant Base Planning Guide--Fixed and Rotor Wing, March, 1995.

Airtanker Base Evaluation Criteria #5: Reality/Professional Judgement Check

A final check utilizing the professional judgement of committee members to assure the proper integration of analytical results with experience, skill and intuition.

To analyze these criteria, a generic airtanker platform was defined and staffed at each base as is defined in the 1996-1998 federal airtanker contract. The attributes of this generic airtanker are as follows:

Retardant Capacity:	2700 gallons
Climb Rate:	1500 Feet/Minute
Flight Rate:	$2300 per hour
Flight Time Before Refuel is Necessary:	120 minutes
Time for Airtanker to Setup for Drop:	5 minutes
Cruise Speed (KTAS) for Flight Below 10,000 Feet (MSL):	220 knots
Cruise Speed (KTAS) for Flight Above 10,000 Feet (MSL):	265 knots

This generic airtanker staffing concept was developed and used to insure that differences in airtanker size or speed did not effect the results.

If an airtanker was stationed at the airtanker base in the 1996-1998 Federal contract, several alternative locations to that airtanker should be analyzed. If an airtanker was not stationed at the airtanker base in the 1996-1998 Federal contract, only two alternatives were examined: the current situation with the base as a "reload" base and closing the base.

For each airtanker base where investments are proposed, an Annual Airtanker Base Total Cost was developed to include the following:

Annualized Investment Cost: This is the annualized cost of the proposed investments which is either the displayed in Table 8 (Summary of Airtanker Bases Condition Survey) and documented in Appendix H OR the cost of a new airtanker base. The dollar amount is annualized using 3% per year for 30 years based on rules in OMB Circular A-94.

Annual Operation and Maintenance Costs: This is the annual cost to staff the airtanker base and it does not includes though any airtanker daily availability.

Annual Expected Large Fire Support Costs for Temporary Base: Based on historic large fire occurrence and the predicted fire occurrence from NFMAS initial attack analysis, an estimate was made of the large fire support need. An estimate was made of the frequency a temporary airtanker base would need to be established to support large fires. Based on the current National contract for this service, it was determined a daily cost of $12,500 would occur for each day a temporary base was in place.

Annual Airtanker Base Total Cost: This is calculated as follows:

Annual Investment Cost

+ Annual Operation and Maintenance Costs

- Annual Expected Large Fire Support Costs for Temporary Base

= Annual Airtanker Base Total Cost

The Annual Expected Large Fire Support Costs for Temporary Base is subtracted as a benefit since an airtanker base in existence can always provide service to large fires in lieu of a temporary base.

The Fire Suppression (FFF) Costs and Net Value Change (NVC) Costs were determined for each alternative defined at the airtanker base. In addition, the Annual Airtanker Base Total Costs for the airtanker base being analyzed was added with the Annual Airtanker Base Total Costs for all other airtanker bases staffed in alternatives defined for an airtanker base. This value was added to the Fire Suppression (FFF) Costs and Net Value Change (NVC) Costs to obtain a total Alternative Cost. The alternative with the lowest Alternative Cost is the most cost efficient alternative.

The following example is provided to aid understanding. From Table 8, $72,150 is proposed for investments at Redding, California, Airtanker Base. The annualized investment cost is $3,681. The Annual Operation and Maintenance Costs are $126,000. If no Annual Expected Large Fire Support Costs for Temporary Base are assumed (for now), then the Annual Airtanker Base Total Cost is $129,681.

ANNUALIZED INVESTMENT		O/M COST		ANNUALIZED LARGE FIRE		ANNUAL AIRTANKER BASE TOTAL COST
$3,681	+	$126,000	-	$0	=	$129,681

If Redding were closed, alternative locations for staffing the airtanker stationed there in the 1996-1998 Federal airtanker contract were defined as follows:

Alternative 99 - Current Situation, Airtanker at Redding
Alternative 9K - Close Redding and move the airtanker to Chester
Alternative 9L - Close Redding and move the airtanker to Chico

The Annual Airtanker Base Total Cost for Chester is $135,111 and for Chico is $31,000. The sum of the Annual Airtanker Base Total Costs for these bases is $166,111. If Redding is included, the total is $295,792.

The Total Alternative Cost is for all protection units that might be effected by any of these alternatives. In this example, the totals include the 18 National Forests in California and the three BLM Districts in California. All potentially effected protection units were included as the software developed to aid in this work was efficient, displayed results quickly and accurately, and applied assumptions uniformly. In reality, the only protection units effected by the alternative were the Mendocino, Modoc and Shasta-Trinity National Forests. The following table summarizes the results of initial attack assessment using the NFMAS IAA model.

	ACRES BURNED	FIRE SUPPRESSION COST		NET VALUE CHANGE		SUM OF ALL AIRTANKER BASE'S TOTAL COST		TOTAL ALTERNATIVE COST
Alternative 99	86579	$79,602,727	+	$69,816,468	+	$295,792	=	$149,714,987
Alternative 9K	87525	$80,526,038	+	$71,512,036	+	$166,111	=	$152,204,185
Alternative 9L	87539	$80,548,462	+	$71,524,823	+	$166,111	=	$152,239,396

Alternative 99 has the smallest Total Alternative Cost. If the selected future airtanker platforms will be compatible with Redding, then the most cost efficient recommendation would be to staff the airtanker at Redding and perform the improvements.

A second example is provided to show how the process would work at an airtanker base were an airtanker is not stationed in the 1996-1998 Federal contract. For this example, Omak, Washington, will be used. From Table 8, $863,317 is proposed for investments at Omak. The annualized investment cost is $44,046. The Annual Operation and Maintenance Costs are $8,000.

If no Annual Expected Large Fire Support Costs for Temporary Base are assumed (for now), then the Annual Airtanker Base Total Cost is $52,046.

ANNUALIZED INVESTMENT		O/M COST		ANNUALIZED LARGE FIRE		ANNUAL AIRTANKER BASE TOTAL COST
$44,046	+	$ 8,000	-	$0	=	$ 52,046

If Omak were closed, the alternatives would appear as follows.

Alternative 99 - Current Situation, Omak Airtanker Base Open
Alternative 9A - Close Omak

The results of the initial attack analysis follow.

	ACRES BURNED	FIRE SUPPRESSION COST		NET VALUE CHANGE		SUM OF ALL AIRTANKER BASE'S TOTAL COST		TOTAL ALTERNATIVE COST
Alternative 99	8405	$ 1,458,021	+	$ 1,996,822	+	$ 52,046	=	$ 3,506,889
Alternative 9A	8407	$ 1,461,001	+	$ 1,996,822	+	$ 0	=	$ 3,457,823

Alternative 9A has the lowest Total Alternative cost but by a small amount. Further examination of airtanker/airtanker compatibility upon selection of the future airtanker platforms is needed to allow for an informed decision on this airtanker base.

In Step 5, Recommendation #7 provides the results of the application of Airtanker Base Evaluation Criteria #1-#5 for each airtanker base where investments are proposed. Rationale for changes in a base's status are provided there. In Step 5, Recommendation #8 provides a prioritization of proposed investments for a National airtanker base capital improvement initiative.

STEP 5. RECOMMENDATIONS

Airtankers for Future Contract Periods

Following examination of how well candidate airtanker platforms met the evaluation criteria, the 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.**

All aircraft with retardant capacities from 1000 gallons to 2500 gallons show low to moderate initial attack effectiveness ratings. This is a result of limited capacity and relatively high cost/gallon delivered and cost/chain of fireline built without commensurate reductions in fire suppression cost and/or resource losses. In some cases, distances to fires on Forest Service and Bureau of Land Management protected lands are not "close" to airports with the capacity to handle airtankers. The cost to convert a turbine or jet powered aircraft to an airtanker appears to be relatively constant. The economics of scale appear in this case. Also note that since 83% of the representative fire locations are within 100

statue miles of airtanker bases, the potential speed achieved at cruise elevations above 10,000 feet (MSL) are not needed.

From Phase 1, it was determined that a National fleet size of 41 large airtankers is needed.

Table 16 contains a summary of the relative rankings from evaluation criteria 1-4. In making recommendations, initial attack efficiency is considered paramount followed by airport compatibility and performance. Availability is also critical so that benefits can be attained.

In Recommendation #7, changes in airtanker base configuration are proposed. For the column labeled "(Final) Airports," the percentage and relative ranking reflects what would be the case if all the recommendations were adopted.

Table 16 - Summary of Relative Rankings for Airtankers

	(Final) Airports		Initial Attack Efficiency	Accuracy and Performance	Aircraft Availability
Civilian					
CV-580	9	94%	1	4	6
L-188	10	99%	7	6	4
L-382G	5	58%	6	6	8
C-130E	5	58%	9	6	6
B-737	6	68%	5	2	10
Military					
E-2C	2	48%	2	6	4
S-3	2	48%	5	8	4
A-10	1	36%	2	10	4
P-3A	10	99%	7	6	10
C-130A,B	10	97%	7	6	10
C-130E	5	58%	10	6	10
Refit					
S-2T	10	100%	1	8	8
P-2T	7	83%	6	8	10

Committee Recommendations

Recommendation #1 - Procurement

The committee recommends the procurement of excess military aircraft as this is most cost effective way to acquire airtanker platforms.

Recommendation #2 - Aircraft

The committee recommends a future fleet composition of twenty P-3A aircraft, ten C-130B aircraft and 11 C-130E aircraft. This would provide for 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 benefit/cost at the Representative Airtanker Bases 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.

Existing C-130A aircraft are acceptable however it is recommended that no additional C-130A aircraft be sought except as parts sources for existing aircraft.

With 58% airtanker base compatibility, the C-130E would appear to be a problem. The distribution of bases capable of handling these aircraft is of value to understand the rationale for the recommendation. Figure 8 shows circles around airtanker bases that without a waiver have compatibility with the C-130E or L-382G. Around each base is a circle that is 100 statue miles in radius. The committee has determined this airtanker base distribution to be adequate coverage to attain the initial attack benefits from the increased amount of retardant on board. This benefit can be critical on the first load into a fire. As 25% of the fleet is in this size class, adequate distribution will remain between this size class and the 3000 gallon size class for coverage on multiple fire events. The incompatibility of this platform at airports is mainly load bearing, not size or runway length, hence over-weight exceptions may be able to be negotiated.

The P2T is also a very attractive platform and if it were to exist, would be an acceptable alternative for a 3000 gallon platform. There is still some uncertainty as to performance and cost but extensive staff work has been done by industry. Airport compatibility is an issue as well as availability of the components for conversion. It appears that the most logical way to acquire the components is from a P-3A aircraft. If one were available though, it would seem more appropriate and economical to convert the P-3A into an airtanker than do the conversion. Also given the strategy to develop an airtanker fleet that will be viable until 2020, pursuing more current aircraft platforms appears to be prudent.

Of the attack aircraft analyzed, the S3 performed the best. Main drawbacks are airtanker base compatibility and initial attack effectiveness due to a 2400 gallon tank capacity.

Recommendation #3: - Number of Aircraft Needed for Spare Parts
The committee recommends a plan whereby contractors could acquire three aircraft for each two flyable airtankers. This should allow for adequate availability of spare parts given current supply levels available commercially and through military sale.

Recommendation #4 - Transition Period for Implementation of Aircraft
The committee recommends a transition plan should be developed with industry outlining a timely conversion process. A reasonable transition period will be necessary to enable the industry to convert to a turbine powered fleet. Transition to a fleet of P-3A, C-130B and C-130E aircraft is proposed to occur by contract period as follows:

	1999	2002	2005	2008
P-3A/C-130B	4	4	6	4
C-130E	0	3	4	4

If desirable and practical, a accelerated transition period could be:

	1999	2002	2005
P-3A/C-130B	4	6	8
C-130E	0	5	6

Bases where a C-130E aircraft would reside by 2008 are as follows: Albuquerque, Missoula, Phoenix, Klamath Falls, Redmond, Norton, Redding, Mather, Durango, Hill, Boise, Fresno, Roswell and Pocatello.

Recommendation #5 - Role of MAFFS

The committee reaffirms the need for MAFFS during peak use periods when all available commercial are committed and recommends pursuing the upgrading of eight MAFFS units. Funds are needed for design, development, and acquisition of MAFFS units which will meet established performance and effectiveness criteria. Improved design technology would result in improved fire retardant delivery capability, reliability and performance including improved performance in retardant coverage levels. Redesign cost of approximately $3 million, and acquisition costs of $1 million per unit are estimated, for a total cost of approximately $11 million for eight upgraded units. A case could be made for FEMA funding of MAFFS replacement since justification for its existence is the protection of developed wildland/urban areas.

Recommendation #6: - Type I Helicopters and the CL-215T/CL-415T

The committee recommends a review of the currency of the assumptions within The National Study of Type I and II Helicopters to Support Large Fire Suppression (1992), particularly for Type I helicopters. Based on this review, staffing, as recommended in the Study, is supported at a level that approximates the expected efficient number based on long term fire occurrence information. An examination of large fire occurrence for 1970-1995 for the Forest Service Nationally was made. The information was applied to the modelling and assumptions from the Study. The 50th percentile demand verified that 3-4 Type I helicopters staffed for 45-60 days under an exclusive use contract would be the economic optimum staffing.

The committee recommends work continue examining these platforms in their initial attack support roles. No recommendation is made at this time on the role of the Type I helicopters and the CL-215T/CL-415T based on initial attack efficiency. The committee recommends continued work with Forests to determine initial attack efficiency of both Type I helicopters and the CL-215T/CL-415T.

Recommendation #7: - Airtanker Bases

Restructuring the airtanker base locations and numbers is needed to support the future airtanker fleet and to provide for the most efficient use of the capital investment and maintenance dollars available for physical facilities. Airports with adequate runway lengths, taxiway strength and support facilities will best support the airtanker fleet of the future. Airtanker bases are as critical a link in the system as the aircraft.

The following recommendations are made for airtanker bases. Figure 7 shows the proposed distribution of airtanker bases. Figure 8 shows only the bases where the C-130E or L-382G can operate currently with out a waiver. For all bases closed, a comprehensive closure plan should be developed identifying actions and costs necessary. Total savings in proposed capital imvestments from bases where closure is recommended is $7,500,000 to $9,000,000.

<u>Restructuring the airtanker base configuration is needed to support the future airtanker fleet and to provide for the most efficient use of the capital investment dollars available for physical facilities.</u> These are key concepts to implementation of the recommendations. Below are comments related to

some airtanker bases analyzed where explanatory information was felt necessary to provide for understanding. Prior to actual project work implementation, adequate investigation of the most cost efficient way to implement project objectives should occur following approved agency guidelines.

Alaska Geographic Area

Investments are proposed are for Fairbanks ($1,534,650), Ft. Yukon ($429,260) and Galena ($827,775). Prior analysis by the Alaska Fire Service as documented in their Fire Management Activity Plan justifies these airtanker bases and investments, hence no additional analysis was done in this study.

California Geographic Area

Investments proposed at FRESNO ($0), PORTERVILLE ($1,705,600), REDDING ($72,150), and SANTA BARBARA ($421,200) are recommended for implementation.

BISHOP ($440,050) indicated a high value from the initial attack analysis but historic use is less than predicted. This conflict should be resolved.

CHESTER ($845,000) has currently some re-construction in progress. It does not appear that the P-3A or C-130E models will be compatible due to runway length and/or weight bearing. Initial attack analysis indicates this as an economicly efficient location. Due to time considerations, alternative locations for the airtanker were not examined but should occur including moving airtanker to Mather.

HEMET-RYAN ($1,705,600) was recommended to be moved to San Bernardino Airport (Norton AFB) in Phase 1. The committee recommends funding for Norton be a top priority Nationally. Establishment of Norton mitigates many limitations currently in place at Hemet-Ryan while allowing for increased service as the larger capacity airtankers can operate from Norton.

The committee recommends having two airtanker bases in the Los Angeles basin (Norton and Lancaster) with the capability to handle the future airtanker fleet in a number that is commonly needed to support large fires situations as well as initial attack. Comments on Norton and Lancaster follow.

NORTON ($750,000) was recommended in Phase 1 implementation. The expected investment figure is still under development as more specific information is developed with the expected land transfer to the Forest Service from the Department of Defense. The development of Norton is viewed as a National high priority in the protection of South Zone Forests.

LANCASTER ($370,500) (Fox Field) is a key base in South Zone. Plans exist to extend the runway 2000 feet longer and this will allow for the C-130A/B and P-3A to operate there. The C-130E is still too heavy but there is currently an over-weight waiver for the KC-97 there, so it appears that an exemption for the C-130E is possible.

MATHER AFB ($1,352,999) was recommended in Phase 1 for implementation. The Forest Service needs to acquire land for use. When Mather is ready, it is recommended the Stockton airtanker base facilities be moved to Mather and the Porterville BLM airtanker be moved to Mather. Consider future analysis of the effects of moving of the Chester airtanker to Mather.

MONTAGUE ($226,850) (Siskiyou Reload) is recommended for closing as cost efficient and fire protection effective alternatives exist.

RAMONA ($1,946,100). The committee recommends moving the airtanker to Norton and upgrading the airtanker to a 3000 gallon capacity. The development of Norton is viewed as a National high priority in the protection of South Zone Forests. Positioning of Federal airtankers at Ramona, as

appropriate, will be considered when the airtanker base and airport are improved.

STOCKTON ($208,650) is recommended to be closed and the facilities moved to Mather based on the development timetable for Mather.

Eastern Geographic Area
No airtanker base surveys were available from the two Federal airtanker bases, BEMIDJI and ELY. The committee recommends they be kept open but that no investments be made until an airtanker base survey is completed and approved.

Great Basin Geographic Area
Investments proposed at BATTLE MOUNTAIN ($767,000), BOISE ($2,340,000), CEDAR CITY ($770,990), HILL ($520,000), McCALL ($894,660), POCATELLO ($161,525), STEAD ($0), and TWIN FALLS ($126,419) are recommended for implementation. Note that in Recommendation #7, it states "When practical, move the second airtanker (R2450) at Prescott to Ceder City."

Northern Geographic Area
Investments proposed at COEUR D'ALENE ($160,181), MISSOULA ($423,003) and WEST YELLOWSTONE ($213,542) are recommended for implementation.

BILLINGS ($1,536,600) is recommended for implementation but it appears to the committee that the design standards may be for a base with too high of a capacity. Prior to actual project work implementation, adequate investigation of the most cost efficient way to implement this project should occur using the approved agency guidelines.

GRANGEVILLE ($453,203) is recommended to be closed as an airtanker base for large airtankers. As soon as practical, move the airtanker to McCall and increase the size to 2450 gallon minimum capacity. Local analysis of this base in support of single engine airtankers should occur to determine the long term direction for the facilities.

HELENA ($128,310) was not shown in this study to be needed BUT it is also felt that data was lacking from all users on the benefits of this airtanker base. The committee recommends the base be kept open for now. The committee recommends necessary NFMAS analysis on Federal units within the service area be completed promptly to allow for determination of future status of the base and the airtanker. The committee recommends no investments be made until the adequate NFMAS work is done.

KALISPELL ($105,877) is recommended to be closed with the airtanker moved to Missoula. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and most efficient use of the capital investment dollars available.

Pacific Northwest Geographic Area
Investments proposed at KLAMATH FALLS ($871,966), LA GRANDE ($575,266), REDMOND ($824,142) and TROUTDALE ($146,173) are recommended for implementation.

EVERETT ($499,344) is recommended to be closed. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and for the most efficient use of the capital investment dollars available. Cooperative plans can be developed with British Columbia Forest Service to provide service when needed.

LAKEVIEW ($224,097) is recommended to be closed. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and for the most efficient use of the capital investment dollars available. Local analysis of this base in support of single engine airtankers should occur to determine the long term direction for the facilities.

MEDFORD ($739,430) was analyzed using only the effects on Forest Service protected lands due to lack of current data on State protected lands. The effects on Forest Service protected lands in the Medford airtanker base service area is low considering the recommended airtanker staffing at Klamath Falls (2 airtankers), Redmond (2 airtankers) and Redding (2 airtankers). This analysis showed significant benefits to the alternative of closing Medford and moving the airtanker to LaGrande. The committee recommends the base be closed, if appropriate after evaluation and integration of potential effects on State protected lands, and the airtanker moved to LaGrande. Invest no additional Federal dollars at this time.

OMAK ($863,317) is recommended to be closed. Initial attack and large fire support does not appear to be compromised by this change. This will allow for consolidation of operations and for the most efficient use of the capital investment dollars available. Cooperative plans can be developed with British Columbia Forest Service to provide service when needed.

MOSES LAKE ($500,000 est.) is recommended to be developed as a base which can be activated, as needed, to relieve the workload at Wenatchee and to provide an airtanker base in Central Washington compatible with the C-130E.

WENATCHEE ($846,673 for remodel) was recommended for changes in Phase 1. Specificly, it was recommended to relocate across the airport to a new site. An initial design has been done. The current estimate for the new airtanker base portion of a larger site plan is $3,250,000. Prior to actual project work implementation, adequate investigation of the most cost efficient way to implement project objectives should occur following approved agency guidelines.

Rocky Mountain Geographic Area
Investments proposed at RAPID CITY ($342,290) and GRAND JUNCTION ($1,938,300) are recommended for implementation.

JEFFCO ($1,400,407) is not compatible with P-3A or C-130E operation. The committee recommends no further investment at Jeffco and recommends relocation to Colorado Springs. After relocation, perform local analysis at Jeffco in support of single engine airtankers should occur to determine the long term direction for the facilities.

COLORADO SPR. ($1,500,000 estimate) is recommended to be developed as a replacement for Jeffco.

DURANGO ($1,500,000 estimate) is recommended to be developed as a new airtanker base. Upon development, move one airtanker from Ft. Huachuca to Durango.

Southern Geographic Area
Investments proposed at LAKE CITY ($133,250) and TALLAHASSEE ($181,415) are recommended for implementation.

ALEXANDRIA, CHARLESTON AFB, JACKSON, and SANFORD are proposed as potential locations where temporary airtanker bases could be developed. Note that in respect to many of the standards in the Airtanker Base Planning Guide, there is no appreciable difference between a type of airtanker base or if a base has an airtanker assigned to the base via a contract. The committee recommends no Federal investment until a complete airtanker base survey is completed and approved by the Regional Forester and the Washington Office.

ASHEVILLE ($77,285) is recommended to be continued. Development of a new airtanker base on the airport is proposed with costs under development. An estimate is $3,000,000. The committee recommends no Federal investment until a new complete and comprehensive airtanker base survey is completed and approved by the Regional Forester and the Washington Office.

FT. SMITH ($46,852) is recommended to be continued. Development of a new airtanker base on the airport is proposed with costs under development. An estimate is $3,000,000. The committee recommends no Federal investment until a new complete and comprehensive airtanker base survey is completed and approved by the Regional Forester and the Washington Office.

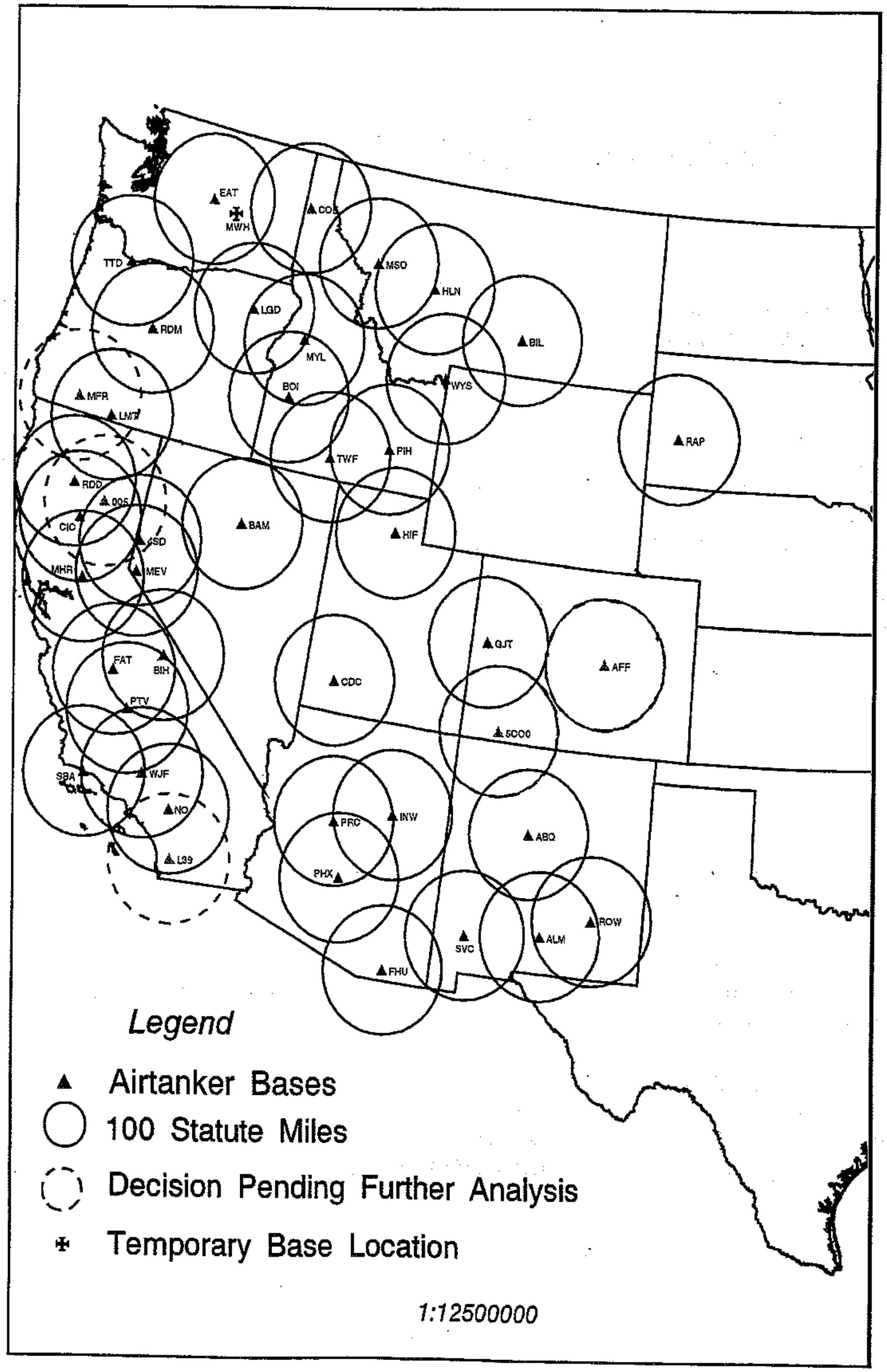
GEORGETOWN is recommended to be closed as future airtankers are not compatible with this airport. This closure should be staged as alternative sites are developed. Invest no additional Federal dollars at this time to improve.

KNOXVILLE ($429,195) is recommended to be closed following upgrading of the airtanker base at Asheville. Invest no additional Federal dollars at this time to improve.

STAUNTON ($124,150) is recommended to be closed as future airtankers are not compatible with this airport. This closure should be staged as alternative sites are developed. Invest no additional Federal dollars at this time to improve.

Southwest Geographic Area
Investments proposed at ALAMOGORDO ($1,619,540), ALBUQUERQUE ($471,429, FT. HUACHUCA ($114,270), PHOENIX ($93,990), PRESCOTT ($952,380), ROSWELL ($185,450), SILVER CITY ($1,093,820), and WINSLOW ($998,400) are recommended for implementation.

Figure 7 - Distribution of Airtanker Bases Based on Committee Recommendations



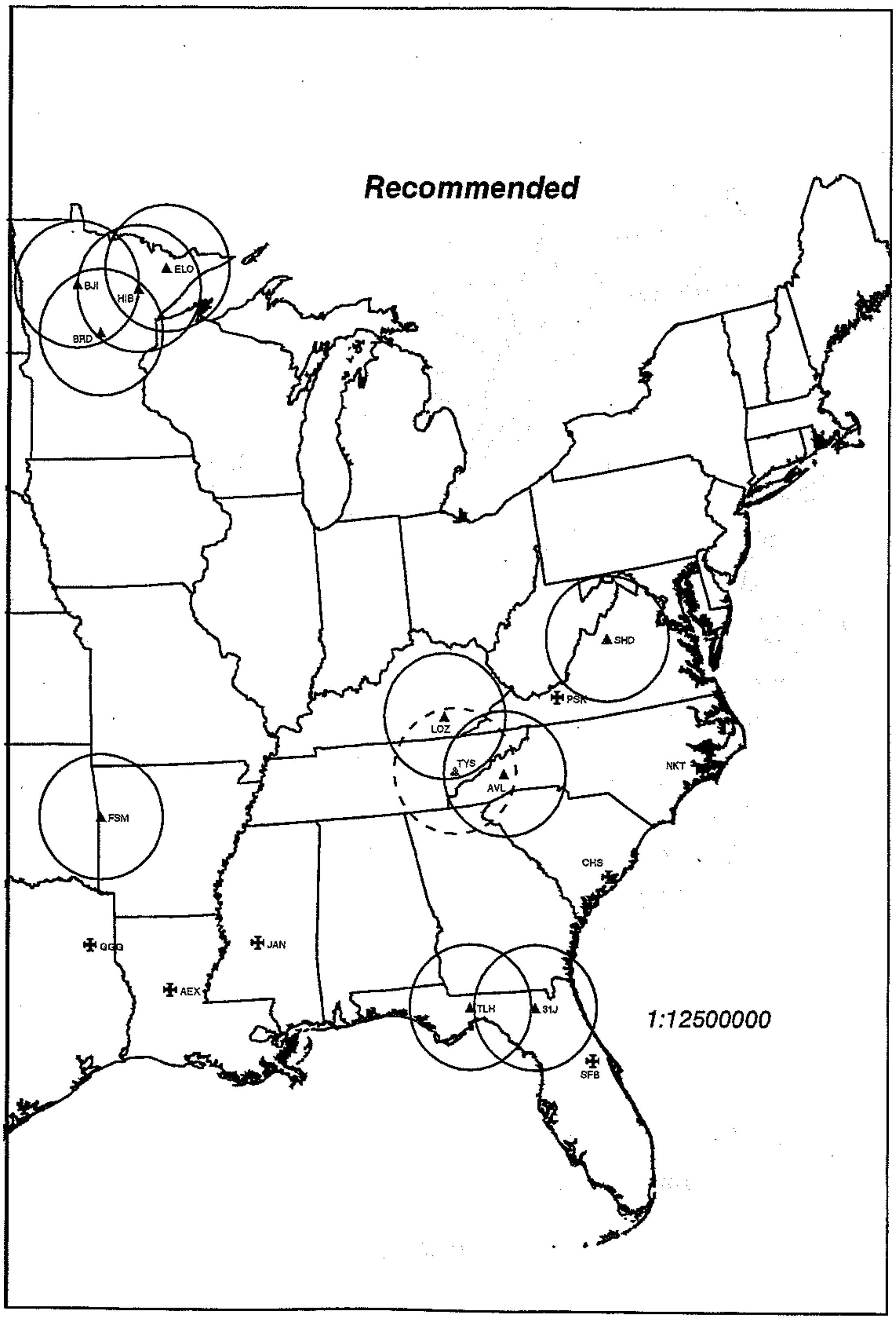
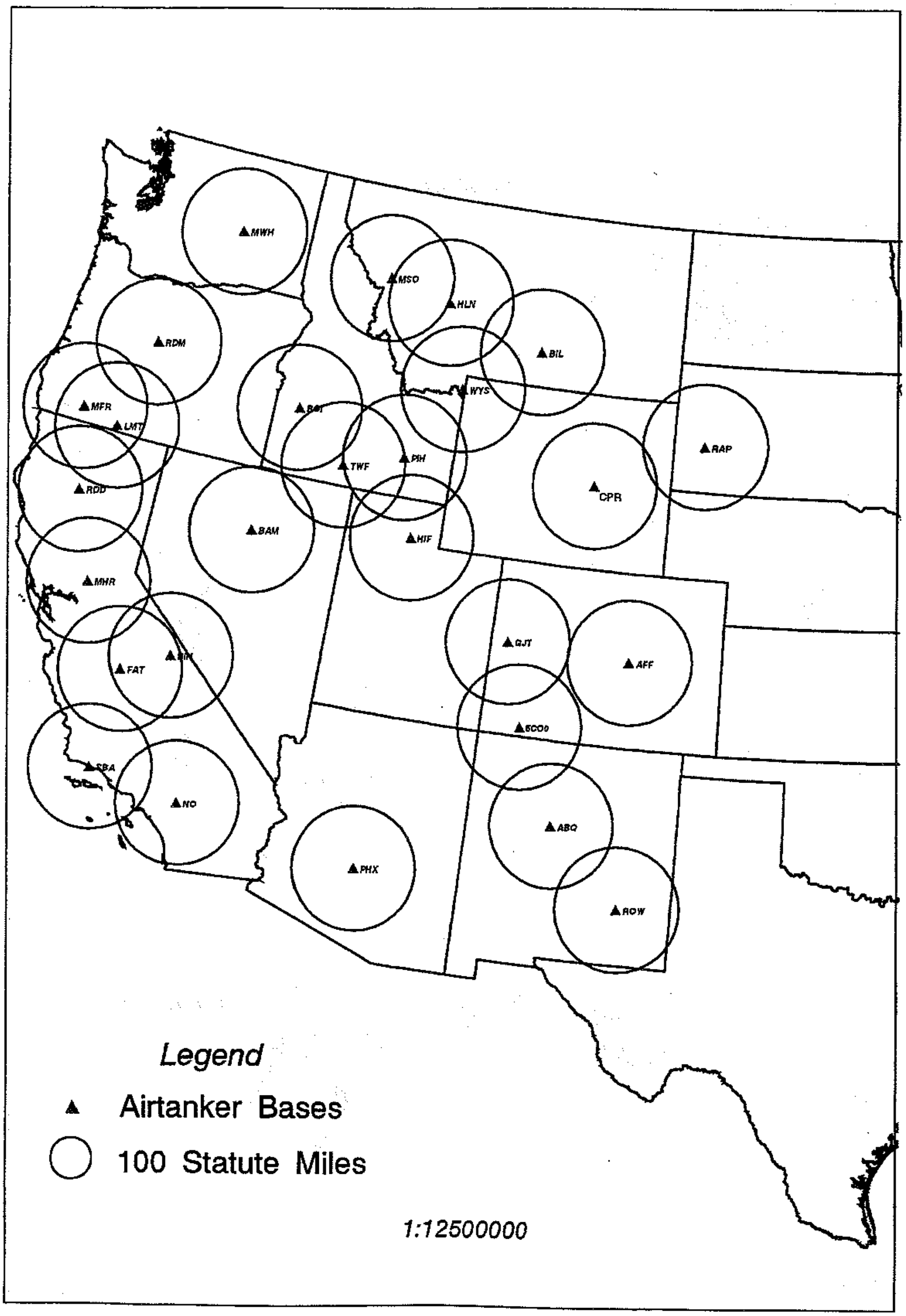
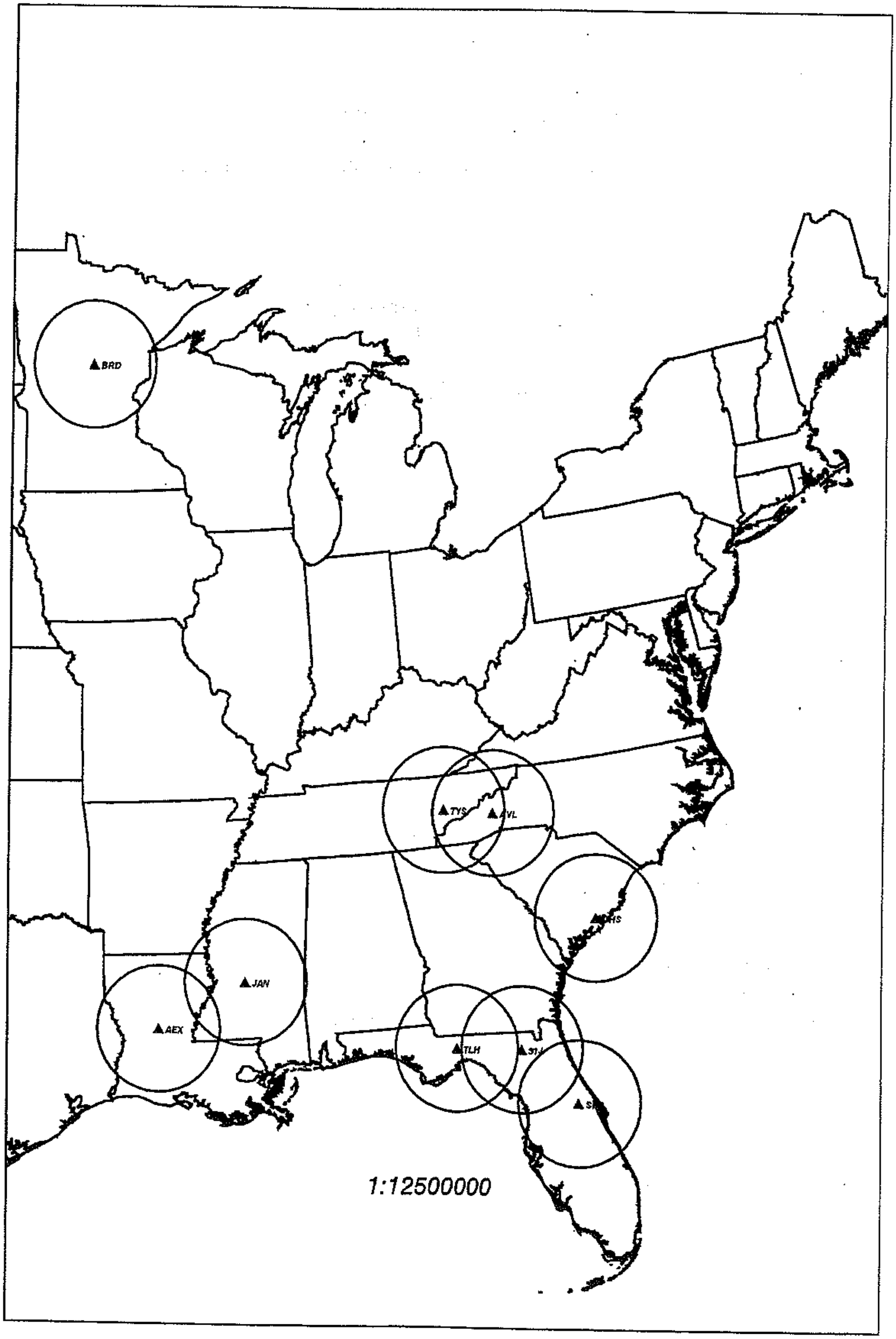

Recommended
ELO
BJI
HIB
BRD
SHD
PSK
LOZ
TYS
AVL
NKT
FSM
CHS
GGG
JAN
AEX
TLH
31J
SFB
1:12500000

Figure 8 - Minimum Airtanker Base Compatibility With C-130E or L-382G

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Recommendation #8 - Capital Improvement Initiative for Airtanker Bases
The committee recommends that a National initiative be developed to fund improvements and investments at airtanker bases. The committee has divided the recommended investments into three priorities. It is recommended that priority 1 projects be completed within 3 years, priority 2 projects be completed within 7 years and priority 3 projects be completed within 10 years.

Table 17 - Prioritization of Proposed Investments at Airtanker Bases

Priority 1 Projects

SO	ASHEVILLE (Estimate)	$3,000,000
NO	BILLINGS	$1,536,600
GB	CEDAR CITY	$770,900
RM	COLORADO SPRINGS (Estimate)	$1,500,000
GB	HILL	$520,000
CA	LANCASTER	$370,500
CA	MATHER AFB	$1,352,999
GB	McCALL	$894,660
CA	NORTON	$750,000
CA	PORTERVILLE	$1,705,600
NW	WENATCHEE	$3,250,000

Priority 1 Total =$15,561,259

Priority 2 Projects:

GB	BATTLE MOUNTAIN	$767,000
CA	BISHOP	$440,050
GB	BOISE	$2,340,000
RM	DURANGO (Estimate)	$1,500,000
AK	FAIRBANKS	$1,534,650
SO	FT. SMITH (Estimate)	$3,000,000
AK	FT. YUKON	$429,260
AK	GALENA	$827,775
RM	GRAND JUNCTION	$1,938,300
NW	LA GRANDE	$575,266
NO	MISSOULA	$423,003
GB	POCATELLO	$161,525
RM	RAPID CITY	$342,290
NW	REDMOND	$824,142
SW	ROSWELL	$185,450
GB	TWIN FALLS	$126,419
NO	WEST YELLOWSTONE	$213,542
SW	WINSLOW	$998,400

Priority 2 Total = $16,627,072

Table 17 (Continued) - Prioritization of Proposed Investments at Airtanker Bases

Priority 3 Projects

SW	ALAMOGORDO	$1,619,540
SW	ALBUQUERQUE	$471,429
NO	COUER D'ALENE	$160,181
SW	FT. HUACHUCA	$114,270
NO	HELENA	$128,310
NW	KLAMATH FALLS	$871,966
SO	LAKE CITY	$133,250
SW	PHOENIX	$93,990
SW	PRESCOTT	$952,380
CA	REDDING	$72,150
CA	SANTA BARBARA	$421,200
SW	SILVER CITY	$1,093,820
SO	TALLAHASSEE	$181,415
NW	TROUTDALE	$146,173

Priority 3 Total = $6,460,074

Grand Total = $38,738,405

Recommendation #9 - Airtanker Location Changes

Through the airtanker base analysis work, several efficiencies where discovered that improve on the Phase 1 report recommendations. It is recommended, when practical, to move the second airtanker (R2450) at Prescott to Ceder City. Additional changes are recommended and have been noted in Recommendation #7 of this report.

Recommendation #10 - Funding, Managing and Controlling of Airtankers

As recommended in Phase 1, the committee reaffirms that large airtankers are National resources and they should be funded, managed and controlled in a manner that is consistent with this objective. Effective strategic management is the responsibility of Geographic Area Coordination Centers and the National Interagency Coordination Center.

The committee further recommends implementation of a system similar to the one in British Columbia to allow for flight following and the tracking of information allowing for more optimum management of the airtanker fleet. Implement the system in all large airtankers, leadplanes and air attack aircraft. Establish a group to further define specifics with the following implementation timeline: study report complete by 6/1/97; system installation in FY98; operational use in FY99.

Recommendation #11 - Night Operations
The committee does not recommend pursuing of night operations for fixed wing airtankers. In review of the historic use of airtankers, it appears that some daylight hours are under utilized. Full utilization of these daylight hours should be achieved before further exploration of night operations is pursued. Night operations have been tested in rotor wing aircraft and the committee recommends pursuing the opportunity as a way to help support night operation on extended attack or large fire operations.

Recommendation #12 - Adherence to Training Standards
The committee recommends establishment of and adherence to minimum training and performance standards for airtanker base personnel.

Recommendation #13 - Maintaining Standards at Airtanker Bases
The committee recommends that if the hosting unit for an airtanker base is unwilling to support minimum base standards defined in the Airtanker Base Planning Guide, then relocation of an assigned airtanker should be pursued. Adequate airtanker base facilities promotes efficient and safe use of airtankers.

Recommendation #14 - Funding Airtankers and Airtanker Bases on an Interagency Basis
The committee recommends funding of airtanker base cost and airtanker availability funded on an interagency basis.

Recommendation #15 - Fire Planning Issues
The committee recommends the Washington Office, in conjunction with the fire planning update project, verify and validate with interagency coordination the assumptions used in the IAA as it relates to airtanker use. Of particular interest is the production rate functions used to determine fireline amounts based on gallons delivered and fire rate-of-spread.

Recommendation #16 - Dispatch Philosophy for Airtankers
The committee recommends dispatch plans provide for the appropriate number of airtankers as is needed to maximize the fireline production "early on" versus minimizing the number of airtankers dispatches requiring extended reloading.

STEP 7. CONCERNS and OPPORTUNITIES

1. The need to provide urban interface protection using airtanker support was mentioned by several geographic areas. This reinforces the desire to have interagency participation in the planning, funding and implementation of the airtanker program.

2. Information from this study should be used in training courses.

3. There is a desire to improve the strategic management of airtankers, leadplanes and air attack platforms. Current practices often result in less than efficient utilization of these critical resources. No one can assure that these resources are being placed at the points of most critical need. Our flight following practices are prone to performance breakdowns and can result in unsatisfactory search and rescue response.

   Strategic management of tactical resources must be coordinated and include as much real time decision support information as is possible. We should run our suppression programs as a business, allocating resources to incidents of greatest need (values at risk) while providing for firefighter safety. The following opportunities exist to improve upon this situation.

   Establish a positive flight following system that neither burdens flight crews or dispatchers. These systems can accomplish flight following while providing no additional burden on flight crews or dispatchers. These will help remove many human performance issues which permeate our current practices. These systems come at a cost, but are reasonable in terms of the performance enhancement including better response for search and rescue.

   Resource tracking can be improved. Dispatchers have a difficult time in many cases determining resource location and status. This is due to a number of reasons including many current practices which beg for automation. A system which provides automatic updates of aircraft location and status can help dispatchers and coordinators have an accurate accounting of where resources are and what they are doing. Opportunities are not missed to assign or reassign the best resource to an emerging incident.

   Strategic management of resources can be improved. Initial attack can be supported by geographic area level and the national center. Lead planes, airtankers and air attack platforms are a limited resource. Their use should be managed wisely. A system which can positively establish an aircraft's location and status is the first step in making this happen. Are aircraft being parked for the next fire? In some cases, that may be the right decision. In others, it is a fatal flaw. Current practices are heavily influenced by local levels of our organizations who have access to the least amount of information concerning the overall situation. Strategic management of the resource should be directed by a level that has responsibility to deal with the overall situation. Any fear by local levels that they are losing control could be reduced by a properly designed system which shares information on each aircraft status, or as much as is appropriate. The information could be viewed by anyone with an interest.

   Additional opportunities or information collection exist. A properly designed system could result in one that can identify the exact location of retardant drops, record hours flown by aircraft and individual flight crews (aiding in determining the appropriateness of phase restrictions) and provide an additional communication link for emergency information. Additional opportunities can be identified.

APPENDICES

APPENDIX A. - Committee Membership, Charter

APPENDIX B. - Aircraft Specifications

APPENDIX C. - Initial Attack Analysis Assumptions and Rules

APPENDIX D. - Summaries of Data Used to Develop Airtanker Base Customer Service Areas

APPENDIX E. - Results of Potential Future Airtankers at Representative Airtanker Bases

APPENDIX F. - Night Operations

APPENDIX G. - Details of Process to Determine Investments Needed at Airtanker Bases

APPENDIX H. - Detailed Airtanker Base Surveys by Geographic Area (Separate Cover)

Alaska Geographic Area
California Geographic Area
Great Basin Geographic Area
Northern Geographic Area
Pacific Northwest Geographic Area
Rocky Mountain Geographic Area
Southern Geographic Area
Southwestern Geographic Area

Committee Membership and Charter

APPENDIX A.

National Air Tanker Study
Committee Membership
Phase 2

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National Air Tanker Study
Committee Membership
Phase 2

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National Air Tanker Study
Committee Membership
Phase 2

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CHARTER FOR NATIONAL AIRTANKER STUDY
Phase 2

The National Airtanker Study (NATS) is chartered by the Steering Committee for the USDA-Forest Service National Shared Forces Task Force Report.

VISION
The National Airtanker Study shall provide to managers information, guidance and support for National and Regional decisions affecting the National large airtanker program and their support components for the next 10-20 years.

MISSION
The National Airtanker Study shall provide analytical support and model development allowing for display of interrelationships and tradeoffs of different airtanker capability and location in support of wildfire initial attack and extended attack. In addition, support and interrelationships to large fire suppression will be obtained. Analytical support and model development shall result in the identification of the most effective and efficient utilization of airtankers. The study will be conducted in two phases.

The goal of Phase 2 is to optimize all reasonable airtanker base and airtanker fleet possibilities and is not constrained by the current fleet. The outcomes of Phase 2 will provide information to guide modernization of the airtanker program and will allow for stabilization of the airtanker supply and agency demand situation. The study will reflect move-up conductivity of the system, optimize dispatch philosophy and the role of the total initial attack organization. The study will clarify the roles of initial attack and large fire support. Specificly, examine airtanker performance, airtanker capability in the 1000 and 5000 gallon size class, night use, the role of MAFFS and the role of Type I helicopters in the application of retardant. A recommendation will be made defining the optimum airtanker numbers, size, and performance criteria by location. The outcome of Phase 2 will provide the basis for the 1999+ contract. Phase 2 will be completed by June 1, 1996.

GUIDING PRINCIPLES and ASSUMPTIONS
Though NATS is a USDA-Forest Service effort, it shall be conducted interagency in scope with committee representation from the USDI-Bureau of Land Management and State wildfire suppression agencies through federal geographic area representatives. Coordination with the USDI-National Park Service, Bureau of Indian Affairs, Fish and Wildlife Service and Office of Aircraft Services shall be through the BLM agency representatives.

Phase 2 will utilize the best available technology.

Traditional methods of operation shall be examined and challenged where appropriate.

CHARTER FOR NATIONAL AIRTANKER STUDY
Phase 2

A structured critical path for the study shall define benchmarks and timeframes.

A study communications plan shall define actions to convey study progress, status and recommendations to effected groups.

The study will examine the cost of institutional barriers to total availability, mobility, flexibility and most cost effective delivery and application of retardant.

The study shall include alternatives for maximizing the cost effectiveness of airtankers.

Airtankers including Type I helicopter types and multi-engine fixed wing platforms will be analyzed in Phase 2.

/s/ J. Chambers
John Chambers
National Shared Forces
Task Force Report
Liaison

Date: 4/1/95

/s/ A. Dunton
Al Dunton
Chief, Division of Fire
Aviation Policy Management

Date: 4/1/95

/s/ D. Carlton
Don Carlton
Chair, Airtanker
Study Committee

Date: 4/1/95

Aircraft Specifications

APPENDIX B.

CURRENT AIRTANKER FLEET

AIRCRAFT SPECIFICATIONS

Private Owned / Private Operated

250 Knots Indicated Speed Restriction Below 10,000 MSL

ACFT. MODEL	NO./TYPE ENGINES	WING SPAN	ACFT. LENGTH	TURN RADIUS	WHEEL LOAD (psi)	EMPTY WEIGHT (lbs)	OPERATING WEIGHT (lbs)	LANDING WEIGHT (lbs)	PAYLOAD CAPACITY (lbs)	RETARDANT CAPACITY (gallons)	TAKE-OFF DISTANCE (ft)	LANDING DISTANCE (ft)	CRUISE SPEED (knots)	RATE OF CLIMB (ft/min)	FUEL BURN (gal/hr)
PB4Y-2 Privateer	4 Recip. R-2600	110'	74' 8"	68'	93	33,000	55,400 57,200	60,000	18,000 19,800	2,000 2,200	3,370 3,660	2,700	198 TAS 184 IAS	910	270
DC-4 Skymaster	4 Recip. R-2000	117' 6"	94' 6"	86' 5"	76	39,000	63,600	61,500	18,000	2,000	3,380	2,650	165 TAS 172 IAS	680	250
SDC-4 Super Skymaster	4 Recip. R-2600	117' 6"	94' 6"	86' 5"	78	41,000	65,370	61,500	19,800	2,200	3,625	2,800	205 TAS 190 IAS	1,000	285
SP-2H	2 Recip. R-3350	98'	92'	71' 6"	92	37,157	62,500	67,000	18,000	2,000	4,080	1,950	201 TAS 187 IAS	1,000	240
P-2V Neptune	2 Recip. R-3350 2 Jet	100'	86'	71' 6"	94	42,500	73,900	67,000	22,050	2,450	4,800	2,160	198 TAS 184 IAS	1,667	440
DC-6A	4 Recip. R-2800	117' 6"	105' 7"	72' 8"	92	49,400	79,600	85,000	22,050	2,450	3,380	1,900	232 TAS 215 IAS	769	420
DC-7B	4 Recip.	117' 6"	105' 7"	72' 8"	106	63,600	101,000	102,000	27,000	3,000	4,250	2,250	253 TAS 235 IAS	770	510
KC-97 Stratoliner	4 Recip. R-4360	141' 3"	110' 4"	84' 10"	117	82,000	124,200 128,340	153,000	27,000 31,140	3,000 3,460	4,175 4,740	2,250	226 TAS 210 IAS	810	630
P-3A Orion	4 Turbine T-56	100'	99'	65'	89	53,000	95,000	105,000	27,000	3,000	4,375	2,250	258 TAS 240 IAS	1,500	680
C-130A Hercules	4 Turbine T-56	132' 7"	106' 10"	88'	70	69,000	108,500	120,000	27,000	3,000	3,650	2,300	254 TAS 236 IAS	1,500	730

CURRENT AIRTANKER FLEET

AVERAGE AIRCRAFT USE RATES 1996

Private Owned / Private Operated

ACFT. MODEL	CONTRACT DAYS 1996	DAILY RATE 1996	FLIGHT RATE 1996	MILITARY EXCESS AIRCRAFT	NUMBER AIRCRAFT AVAILABLE
PB4Y-2 Privateer	124	$2,109	$1,581	Yes	3
DC-4 Skymaster	132	$2,006	$1,321	Yes/No	6
SDC-4 Super	140	$1,929	$1,330	Yes	1
SP-2H	105	$2,388	$1,182	Yes	2
P-2V Neptune	122	$2,473	$1,839	Yes	9
DC-6A	99	$2,489	$1,780	Yes / No	1
DC-7B	140	$2,134	$2,230	No	4
KC-97 Strato	90	$2,800	$2,416	Yes	1
P-3A Orion	110	$2,646	$2,688	Yes	5
C-130A Hercules	104	$3,069	$3,122	Yes	7

CIVILIAN AIRCRAFT EVALUATED

AIRCRAFT SPECIFICATIONS

250 Knots Indicated Speed Restriction Below 10,000 MSL

AIRCRAFT MODEL	NO./TYPE ENGINES	WING SPAN	FUSE. LENGTH	TURN RADIUS	WHEEL LOAD (psi)	EMPTY WEIGHT (lbs)	ZERO FUEL WEIGHT (lbs)	OPERATING WEIGHT (lbs)	LANDING WEIGHT (lbs)	ESTIMATED PAYLOAD (lbs)	ESTIMATED RETARDANT (gallons)	TAKE-OFF DISTANCE (ft)	LANDING DISTANCE (ft)	CRUISE SPEED (knots)	RATE OF CLIMB (ft/min)	FUEL BURN (gal/hr)
PV-2	2 Recip.	75'	51' 9.5"	34'	60	19,400	N/A	32,400	30,000	9,450	1,075	3,075	2,844	194 TAS 180 IAS	690	160
CL-215T	2 Turbine	93' 11"	65' .05"	59' 5"	63-81	26,600	40,250	43,500 land 45,250 water	37,000 land 36,200 water	12,000	1,300 retardant 1,410 water	4,100 land 2,460 water	2,500 land 2,460 water	193 TAS 180 IAS	1,367	224
F-27	2 Turbine	95' 2"	77' 4"	64'	Not available	23,500	39,500	43,450 est. 45,000 max.	41,000	15,300	1,700	4,200	3,700	247 TAS 230 IAS	1,300	262
CL-415T	2 Turbine	93' 11"	65' .05"	59' 5"	63-81	28,500	42,000	43,850 land 46,000 water	37,000 land 36,200 water	13,500	1,500 retardant 1,622 water	4,100 land 2,460 water	2,500 land 2,460 water	193 TAS 180 IAS	1,367	224
CV-580 Convair	2 Turbine	105' 3"	81' 5"	65'	78	29,000	45-47,000	51,635 est. 53,200 max.	52,000	13,500	1,500	4,120	3,100	269 TAS 250 IAS	1,670	414
L-188 Electra	4 Turbine	99'	104' 6"	65'	90	56,275	86,000	96,575 est. 113,000 max.	95,650	27,000	3,000	4,273	4,800	269 TAS 250 IAS	2,000	700
L-382G Hercules	4 Turbine	132' 7"	97' 9"	85'	72	76,000	125,000	134,900 est. 155,000 max.	135,000	49,462	5,000	4,241	2,309	269 TAS 250 IAS	2,008	615
C-130E Hercules	4 Turbine	132' 7"	97' 9"	85'	72	76,000	125,000	134,900 est. 165,000 max.	135,000	45,000	5,000	4,241	2,309	269 TAS 250 IAS	2,008	615
B-737-200	2 Jet	93'	100'	57' 8"	135	57-59,340	85,000	97,100 est. 115,500 max.	98,000	24,300	2,700	8,750	5,050	269 TAS 250 IAS	2,000	778
B-747-200B	4 Jet	195' 8"	231' 4"	102'	170-190	357,125	526,500	574,000 est. 775,000 max.	564,000	153,000	17,000	6,700	4,665	269 TAS 250 IAS	2,985	3,370

MILITARY EXCESS AIRCRAFT EVALUATED

AIRCRAFT SPECIFICATIONS

250 Knots Indicated Speed Restriction Below 10,000 MSL

ACFT. MODEL	NO./TYPE ENGINES	WING SPAN	FUSELAGE LENGTH	TURNING RADIUS	WHEEL LOAD (psi)	EMPTY WEIGHT (lbs)	ZERO FUEL WEIGHT (lbs)	OPERATING WEIGHT (lbs)	LANDING WEIGHT (lbs)	ESTIMATED PAYLOAD (lbs)	ESTIMATED RETARDANT (gal)	TAKE-OFF DISTANCE (ft)	LANDING DISTANCE (ft)	CRUISE SPEED (knots)	RATE OF CLIMB (ft/min)	FUEL BURN (gal/hr)
E-2C Hawkey	2 Turbine	80' 7"	57' 7"	50'	210	27,121	N/A	51,720 est. 52,500 max.	52,000	17,100	1,900	2,900	3,610	269 TAS 250 IAS	2,400	300
S-3 Viking	2 Jet	68' 8"	53' 4"	41' 2"	Not available	21,550	N/A	51,500 est. 52,200 max.	45,900	21,600	2,400	6,100	4,590	269 TAS 250 IAS	3,400	353
A-6 Intruder	2 Jet	53'	54' 9"	44'	205	21,570	N/A	56,000 est. 57,500 max.	45,000	18,000	2,000	8,000	3,200	269 TAS 250 IAS	2,175	809
A-10 Warthog	2 Jet	57' 6"	53' 4"	43' 5"	125	23,000	N/A	46,038 est. 46,200 max.	46,038	16,200	1,800	4,000	Not available	269 TAS 250 IAS	2,800	890
P-3A Orion	4 Turbine	100'	99'	65'	89	53,000	83,500	95,000	105,000	27,000	3,000	4,375	2,250	258 TAS 240 IAS	1,500	680
C-130B Hercules	4 Turbine	132' 7"	106' 10"	88'	70	69,000	97,000	108,500	120,000	27,000	3,000	3,650	2,300	254 TAS 236 IAS	1,500	730
C-130E Hercules	4 Turbine	132' 7"	97' 9"	85'	72	76,000	125,000	134,900 est. 165,000 max.	135,000	45,000	5,000	4,241	2,309	269 TAS 250 IAS	2,008	615

TURBINE REFIT AIRCRAFT EVALUATED

AIRCRAFT SPECIFICATIONS

250 Knots Indicated Speed Restriction Below 10,000 MSL

ACFT. MODEL	NO./TYPE ENGINES	WING SPAN	FUSELAGE LENGTH	TURNING RADIUS	WHEEL LOAD (psi)	EMPTY WEIGHT (lbs)	ZERO FUEL WEIGHT (lbs)	OPERATING WEIGHT (lbs)	LANDING WEIGHT (lbs)	ESTIMATED PAYLOAD (lbs)	ESTIMATED RETARDANT (gal)	TAKE-OFF DISTANCE (ft)	LANDING DISTANCE (ft)	CRUISE SPEED (knots)	RATE OF CLIMB (ft/min)	FUEL BURN (gal/hr)
S-2T	2 Turbine Garrett	69' 8"	42' 0"	44' 8"	102	13,380		25,575	25,575	9,900	1,100	2,792	2,000	230 TAS 214 IAS	2,630	150
C-123T	2 Turbine T-56	110'	76' 4"	70'	87	26,750	N/A	59,250 est. 60,000 max.	59,000	22,500	2,500	1,450	1,360	190 TAS 177 IAS	1,550	268
P-2T	2 Turbine T-56	97' 8"	82' 8"	71' 6"	95	32,143	70,370	65,677 est. 75,500 max.	67,000	24,300	2,700 to 3,000	5,801	3,560	236 TAS 220 IAS	1,335	368
DC-4T	4 Turbine PT6-57	117' 6"	93' 10"	86' 5"	75	32,060	53,060	59,000 est. 65,700 max.	61,500	1,800	2,000	3,680	2,650	215 TAS 200 IAS	765	400

MILITARY EXCESS AIRCRAFT USE RATES

Industry Competitive Bid Procurement
Private Owned / Private Operated

Daily Availability Rates	E-2C Low Range	E-2C High Range	S-3 Low Range	S-3 High Range	A-6 Low Range	A-6 High Range	A-10 Low Range	A-10 High Range	P-3A Low Range	P-3A High range	C-130A Low Range	C-130A High range	C-130E,K Low Range	C-130E,K High Range
Aircraft Procurement														
Military excess, competitive bid	$100,000	$375,000	$100,000	$375,000	$100,000	$375,000	$100,000	$375,000	$100,000	$375,000	$100,000	$375,000	$100,000	$375,000
Acquisition realization factor	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Adjusted procurement cost	$150,000	$562,500	$150,000	$562,500	$150,000	$562,500	$150,000	$562,500	$150,000	$562,500	$150,000	$562,500	$150,000	$562,500
Market purchase price	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inspection & Repair														
Aircraft airworthiness, inspection and repair	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000
Conversion														
Tank fabrication & installation	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000
Avionics modification & installation	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000
Turbine engine modification & installation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Capitalized Value	$545,000	$1,352,500	$545,000	$1,352,500	$545,000	$1,352,500	$545,000	$1,352,500	$545,000	$1,352,500	$545,000	$1,352,500	$545,000	$1,352,500
Capitalization & Depreciation														
Average availability days per year	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Amortization & interest @ 15 yrs .05625%	$456	$1,132	$456	$1,132	$456	$1,132	$456	$1,132	$456	$1,132	$456	$1,132	$456	$1,132
Hull Insurance @ 3% of value per year	$136	$338	$136	$338	$136	$338	$136	$338	$136	$338	$136	$338	$136	$338
Other fixed Costs: Overhead, salaries, benifits, extraordinary maintenance.	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$1,550	$1,550	$2,100	$2,100	$2,650	$2,650	$2,650	$2,650
Residual value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Daily Availability Rate	$2,692	$3,570	$2,692	$3,570	$2,692	$3,570	$2,142	$3,020	$2,692	$3,570	$3,242	$4,120	$3,242	$4,120

MILITARY EXCESS AIRCRAFT USE RATES

"Salvage" Procurement @ $0.70 & $1.00/lb. & 75% Empty Wt. Recovery
Private Owned / Private Operated

Daily Availability Rates	E-2C Low Range (0.70)	E-2C High Range (1.00)	S-3 Low Range (0.70)	S-3 High Range (1.00)	A-6 Low Range (0.70)	A-6 High Range (1.00)	A-10 Low Range (0.70)	A-10 High Range (1.00)	P-3A Low Range (0.70)	P-3A High range (1.00)	C-130A Low Range (0.70)	C-130A High range (1.00)	C-130E,K Low range (0.70)	C-130E,K High Range (1.00)
Aircraft Procurement														
Military excess, competitive bid	$14,239	$20,341	$11,314	$16,163	$11,324	$16,178	$12,075	$17,250	$27,825	$39,750	$36,225	$51,750	$39,900	$57,000
Acquisition realization factor	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Adjusted procurement cost	$21,358	$30,511	$16,971	$24,244	$16,986	$24,266	$18,113	$25,875	$41,738	$59,625	$54,338	$77,625	$59,850	$85,500
Market purchase price	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inspection & Repair														
Aircraft airworthiness, inspection and repair	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000
Conversion														
Tank fabrication & installation	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000
Avionics modification & installation	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000	$20,000	$40,000
Turbine engine modification & installation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Capitalized Value	$416,358	$820,511	$411,971	$814,244	$411,986	$814,266	$413,113	$815,875	$436,738	$849,625	$449,338	$867,625	$454,850	$875,500
Capitalization & Depreciation														
Average availability days per year	120	120	120	120	120	120	120	120	120	120	120	120	$120	120
Amortization & interest @ 15 yrs .05625%	$349	$687	$345	$682	$345	$682	$346	$683	$366	$711	$376	$726	$381	$733
Hull Insurance @ 3% of value per year	$104	$205	$103	$204	$103	$204	$103	$204	$109	$212	$112	$217	$114	$219
Other fixed Costs: Overhead, salaries, benifits, extraordinary maintenance.	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$1,550	$1,550	$2,100	$2,100	$2,650	$2,650	$2,650	$2,650
Residual value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Daily Availability Rate	$2,553	$2,992	$2,548	$2,985	$2,548	$2,985	$1,999	$2,437	$2,575	$3,024	$3,138	$3,593	$3,144	$3,602

MILITARY AIRCRAFT USE RATES

Private Owned / Private Operated

250 Knots Indicated Speed Restriction Below 10,000 MSL

Flight Use Rates (per hour)	**E-2C**	**S-3**	**A-6**	**A-10**	**P-3A**	**C-130A**	**C-130E,K**
Engine Use Rate							
Overhaul cost, per engine	$360,000	$700,000	$700,000	$700,000	$360,000	$360,000	$360,000
Overhaul Interval (hrs.)	4,500	6,000	6,000	6,000	4,500	4,500	4,500
Hot section inspection, per engine	O/C	$210,000	$210,000	$210,000	O/C	O/C	O/C
Hot section interval (hrs.)	O/C	3,000	3,000	3,000	O/C	O/C	O/C
Accessories & components, per engine	$115,000	N/A	N/A	N/A	$115,000	$115,000	$115,000
Aircraft Total Engine Use Rate	**$211**	**$373**	**$373**	**$373**	**$422**	**$422**	**$422**
Flight Crew							
Crew labor / pay (per flight hour)	$70	$70	$70	$70	$70	$70	$70
Number of crewmembers	2	2	2	1	2	3	3
Flight Crew Cost	**$140**	**$140**	**$140**	**$70**	**$140**	**$210**	**$210**
Fuel							
Cost per gallon	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93
Fuel burn (gal/hr)	300	353	809	890	680	730	615
Fuel Cost	**$579**	**$681**	**$1,561**	**$1,718**	**$1,312**	**$1,409**	$1,187
Other Costs							
Repairs & maintenance related to flight	$507	$507	$507	$507	$523	$523	$523
Profit & taxes	$287	$340	$516	$534	$480	$513	$468
Flight Use Rate Total	**$1,725**	**$2,042**	**$3,098**	**$3,202**	**$2,877**	**$3,077**	**$2,811**

CIVILIAN AIRCRAFT USE RATES

Civilian Market Procurement

Private Owned / Private Operated

Daily Availability Rates	CL-215T Low Range	CL-215T High Range	F-27 Low Range	F-27 High Range	CL-415T Low Range	CL-415T High Range	CV-580 Low Range	CV-580 High Range	PV-2 Low Range	PV-2 High Range
Aircraft Procurement										
Military excess, competitive bid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Market purchase price	$11,000,000	$13,000,000	$400,000	$500,000	$17,000,000	$19,000,000	$800,000	$1,375,000	N/A	N/A
Inspection & Repair										
Aircraft airworthiness, inspection and repair	N/A	N/A	$75,000	$150,000	N/A	N/A	$75,000	$150,000	N/A	N/A
Conversion										
Tank fabrication & installation	N/A	N/A	$300,000	$600,000	N/A	N/A	$300,000	$600,000	$80,000	$175,000
Avionics modification & installation	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000
Turbine engine modification & installation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Capitalized Value	**$11,005,000**	**$13,010,000**	**$780,000**	**$1,260,000**	**$17,005,000**	**$19,010,000**	**$1,180,000**	**$2,135,000**	**$85,000**	**$185,000**
Capitalization & Depreciation										
Average availability days per year	120	120	120	120	120	120	120	120	120	120
Amortization & interest @ 15 yrs .05625%	$9,213	$10,891	$653	$1,055	$14,235	$15,914	$988	$1,787	$71	$155
Hull Insurance @ 3% of value per year	$2,751	$3,253	$195	$315	$4,251	$4,753	$295	$534	$21	$46
Other fixed Costs: Overhead, salaries, benifits, extraordinary maintenance.	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100
Residual value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Daily Availability Rate	**$14,064**	**$16,243**	**$2,948**	**$3,470**	**$20,587**	**$22,766**	**$3,383**	**$4,421**	**$2,192**	**$2,301**

Daily Availability Rates	L-188 Low Range	L-188 High range	L-382G Low Range	L-382G High range	C-130E,K Low Range	C-130E,K High Range	B-737-200 Low Range	B-737-200 High Range	B-747-200 Low Range	B-747-200 High Range
Aircraft Procurement										
Military excess, competitive bid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Market purchase price	$850,000	$1,800,000	$6,500,000	$9,500,000	$1,000,000	$3,750,000	$2,500,000	$5,000,000	$15,000,000	$18,000,000
Inspection & Repair										
Aircraft airworthiness, inspection and repair	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000	$75,000	$150,000
Conversion										
Tank fabrication & installation	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	$400,000	$650,000	$400,000	$650,000
Avionics modification & installation	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000
Turbine engine modification & installation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Capitalized Value	**$1,230,000**	**$2,560,000**	**$6,880,000**	**$10,260,000**	**$1,380,000**	**$4,510,000**	**$2,980,000**	**$5,810,000**	**$15,480,000**	**$18,810,000**
Capitalization & Depreciation										
Average availability days per year	120	120	120	120	120	120	120	120	120	120
Amortization & interest @ 15 yrs .05625%	$1,030	$2,143	$5,759	$8,589	$1,155	$3,775	$2,495	$4,864	$12,959	$15,746
Hull Insurance @ 3% of value per year	$308	$640	$1,720	$2,565	$345	$1,128	$745	$1,453	$3,870	$4,703
Other fixed Costs: Overhead, salaries, benifits, extraordinary maintenance.	$2,100	$2,100	$2,650	$2,650	$2,650	$2,650	$2,100	$2,100	$2,650	$2,650
Residual value	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Daily Availability Rate	**$3,437**	**$4,883**	**$10,129**	**$13,804**	**$4,150**	**$7,553**	**$5,340**	**$8,416**	**$19,479**	**$23,099**

CIVILIAN AIRCRAFT USE RATES

Private Owned / Operated

250 Knots Indicated Speed Restriction Below 10,000 MSL

Flight Use Rates (per hour)

	PV-2	CL-215T	F-27	CL-415T	CV580	L-188	L-382G	C-130E,K	B-737-200	B-747-200
Engine Use Rate										
Overhaul cost, per engine	$40,000	$125,000	$400,000	$125,000	$360,000	$360,000	$360,000	$360,000	$700,000	$700,000
Overhaul Interval (hrs.)	2,450	2,500	4,500	2,500	4,500	4,500	4,500	4,500	6,000	600,000
Hot section inspection, per engine	N/C	$12,500	$40,000	$12,500	O/C	O/C	O/C	O/C	$210,000	$210,000
Hot section interval (hrs.)	N/C	1,250	2,250	1,250	O/C	O/C	O/C	O/C	3,000	3,000
Accessories & components, per engine	$10,000	$10,000	$10,000	$10,000	$115,000	$115,000	$115,000	$115,000	N/A	N/A
Aircraft Total Engine Use Rate	**$41**	**$125**	**$218**	**$125**	**$211**	**$422**	**$422**	**$422**	**$373**	**$747**
Flight Crew										
Crew labor / pay (per flight hour)	$70	$70	$70	$70	$70	$70	$70	$70	$70	$70
Number of crewmembers	2	2	2	2	2	2	3	3	2	3
Flight Crew Cost	**$140**	**$140**	**$140**	**$140**	**$140**	**$140**	**$210**	**$210**	**$140**	**$210**
Fuel										
Cost per gallon	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93	$1.93
Fuel burn (gal/hr)	160	224	262	224	414	700	615	615	778	3,370
Fuel Cost	**$309**	**$432**	**$506**	**$432**	**$799**	**$1,351**	**$1,187**	**$1,187**	**$1,502**	**$6,504**
Other Costs										
Repairs & maintenance related to flight	$507	$507	$507	$507	$507	$523	$523	$523	$507	$523
Profit & taxes	$199	$241	$274	$241	$331	$487	$468	$468	$504	$1,597
Flight Use Rate Total	**$1,196**	**$1,445**	**$1,645**	**$1,445**	**$1,989**	**$2,923**	**$2,811**	**$2,811**	**$3,026**	**$9,581**

TURBINE REFIT AIRCRAFT USE RATES

Private Owned / Private Operated

250 Knots Indicated Speed Restriction Below 10,000 MSL

Daily Availability Rates

	C-123T Low Range	C-123T High Range	P-2T Low Range	P-2T High Range	DC-4T Low Range	DC-4T High Range	S-2T Low Range	S-2T High Range
Aircraft Procurement								
Military excess, competitive bid	$50,000	$100,000	N/A	N/A	N/A	N/A	N/A	N/A
Market purchase price	N/A	N/A	N/A	N/A	N/A	N/A	$3,000,000	N/A
Inspection & Repair								
Aircraft airworthiness, inspection and repair	$75,000	$150,000	N/A	N/A	N/A	N/A	N/A	N/A
Conversion								
Tank fabrication & installation	$300,000	$600,000	$300,000	$600,000	$300,000	$600,000	N/A	N/A
Avionics modification & installation	$20,000	$40,000	$5,000	$10,000	$5,000	$10,000	$5,000	$10,000
Turbine engine modification & installation	$1,250,000	$2,500,000	$1,250,000	$2,500,000	$1,250,000	$2,500,000	N/A	$3,500,000
Total Capitalized Value	**$1,695,000**	**$3,390,000**	**$1,555,000**	**$3,110,000**	**$1,555,000**	**$3,110,000**	**$3,005,000**	**$3,510,000**
Capitalization & Depreciation								
Average availability days per year	120	120	120	120	120	120	120	120
Amortization & interest @ 15 yrs .05625%	$1,419	$2,838	$1,302	$2,603	$1,302	$2,603	$2,516	$2,938
Hull Insurance @ 3% of value per year	$424	$848	$389	$778	$389	$778	$751	$878
Other fixed Costs: Overhead, salaries, benefits, extraordinary maintenance.	$2,100	$2,100	$2,100	$2,100	$2,100	$2,100	$1,550	$1,550
Residual value	$0	$0	$0	$0	$0	$0	$0	$0
Daily Availability Rate	**$3,943**	**$5,785**	**$3,790**	**$5,481**	**$3,790**	**$5,481**	**$4,817**	**$5,366**

Flight Use Rates (per hour)

	C-123T	P-2T	DC-4T	S-2T
Engine Use Rate				
Overhaul cost, per engine	$360,000	$360,000	$125,000	$400,000
Overhaul Interval (hrs.)	4,500	4,500	2,500	4,000
Hot section inspection, per engine	N/A	N/A	$12,500	O/C
Hot section interval (hrs.)	N/A	N/A	1,250	O/C
Accessories & components, per engine	$115,000	$115,000	$10,000	$10,000
Aircraft Total Engine Use Rate	**$211**	**$211**	**$250**	**$205**
Flight Crew				
Crew labor / pay (per flight hour)	$70	$70	$70	$70
Number of crewmembers	2	2	2	1
Flight Crew Cost	**$140**	**$140**	**$140**	**$70**
Fuel				
Cost per gallon	$1.93	$1.93	$1.93	$1.93
Fuel burn (gal/hr)	268	368	400	150
Fuel Cost	**$517**	**$710**	**$772**	**$290**
Other Costs				
Repairs & maintenance related to flight	$507	$507	$523	$507
Profit & taxes	$275	$314	$337	$214
Flight Use Rate Total	**$1,650**	**$1,882**	**$2,022**	**$1,286**

FLIGHT USE RATES

(Per Hour)

250 Knots Indicated Speed Restriction Below 10,000 MSL

Aircraft Type	Engine Type	Engine Use Rate	Crew Pay	R&M Cost	Fuel Cost	Other Costs	Total (Per Hour)
P-2T	T-56	211	140	507	710	314	**$1,882**
DC-4T	PT-6	250	140	523	772	337	**$2,022**
C-123T	T-56	211	140	507	517	275	**$1,650**
F-27	Dart	218	140	507	506	274	**$1,645**
E-2C	T-56	211	140	507	579	287	**$1,725**
S-3	Jet	373	140	507	681	340	**$2,042**
A-6	Jet	373	140	507	1,561	516	**$3,098**
A-10	Jet	373	70	507	1,718	534	**$3,202**
P-3A	T-56	422	140	523	1,312	480	**$2,877**
C-130A	T-56	422	210	523	1,409	513	**$3,077**
C-13OE,K	T-56	422	210	523	1,187	468	**$2,811**
CL-215T	PT-6	125	140	507	432	241	**$1,445**
CL-415T	PT-6	125	140	507	432	241	**$1,445**
CV-580	T-56	211	140	507	799	331	**$1,989**
L-188	T-56	422	140	523	1,351	487	**$2,923**
L-382G	T-56	422	210	523	1,187	468	**$2,811**
B-737-200	Jet	373	140	507	1,502	504	**$3,026**
B-747-200B	Jet	747	210	523	6,504	1,597	**$9,581**

FUTURE AIRCRAFT EVALUATED

Private Owned / Private Operated

Speed Unrestricted @ 15,000 ft.

ACFT. MODEL	NO./TYPE ENGINES	ESTIMATED PAYLOAD (lbs)	ESTIMATED RETARDANT (gallons)	CRUISE SPEED (knots)	FUEL BURN (gal/hr)	FLIGHT RATE
CL-415T	2 Turbine	13,500	1,500	191 TAS 152 IAS	228	$1,454
F-27	2 Turbine	15,300	1,700	248 TAS 197 IAS	257	$1,634
CV-580	2 Turbine	13,500	1,500	298 TAS 236 IAS	361	$1,866
E-2C	2 Turbine	17,100	1,900	310 TAS 246 IAS	522	$2,239
S-3	2 Jet	21,600	2,400	450 TAS 358 IAS	657	$2,746
A-6	2 Jet	18,000	2,000	380 TAS 301 IAS	1,119	$3,816
A-10	2 Jet	16,200	1,800	355 TAS 282 IAS	930	$3,371
C-123T	2 Turbine	22,500	2,500	226 TAS 179 IAS	233	$1,569
P-2T	2 Turbine	27,000	3,000	236 TAS 220 IAS	315 est.	$1,759
DC-4T	2 Turbine	1,800	2,000	220 TAS 175 IAS	400 est.	$2,022
P-3A	4 Turbine	27,000	3,000	340 TAS 275 IAS	824	$3,211
L-188	4 Turbine	27,000	3,000	374 TAS 296 IAS	782	$3,113
C-130A	4 Turbine	27,000	3,000	296 TAS 235 IAS	900	$3,471
C-130E,K	4 Turbine	45,000	5,000	317 TAS 252 IAS	597 est.	$2,769
L-382G	4 Turbine	45,000	5,000	317 TAS 252 IAS	597 est.	$2,769
B-737-200	2 Jet	24,300	2,700	435 TAS 345 IAS	1,124	$3,828
B-747-200B	4 Jet	153,000	17,000	414 TAS 326 IAS	4,100	$11,271

CURRENT AIRCRAFT EVALUATED

Speed Unrestricted @ 15,000 MSL

Private Owned / Private Operated

ACFT. MODEL	NO./TYPE ENGINES	ESTIMATED PAYLOAD (lbs)	ESTIMATED RETARDANT (gallons)	CRUISE SPEED (knots)	FUEL BURN (gal/hr)	NOTE
PB4Y-2	4 Recip.	19,800	2,200	208 TAS 165 IAS	270	
DC-4	4 Recip.	18,000	2,000	202 TAS 160 IAS	250	
SDC-4	4 Recip	19,800	2,200	215 TAS 171 IAS	285	
SP-2H	2 Recip.	18,000	2,000	218 TAS 173 IAS	240	12,000 ft. Auto lean, Maintain alt.
P-2V	2 Recip. 2 Jet	22,050	2,450	218 TAS 173 IAS	440	12,000 ft. Auto lean, Maintain alt.
DC-6A	4 Recip.	22,050	2,450	243 TAS 193 IAS	420	
DC-7B	4 Recip.	27,000	3,000	267 TAS 212 IAS	510	
KC-97	Recip.	31,140	3,460	231 TAS 183 IAS	630	
P-3A	4 Turbine	27,000	3,000	340 TAS 275 IAS	840	Max. STC
C-130A	4 Turbine	27,000	3,000	296 TAS 235 IAS	900	

Initial Attack Analysis Assumptions and Rules

APPENDIX C.

Initial Analysis Assumptions and Rules

1. ALL units will use MNIAAPC Version 4.88 as the Initial Attack model. A copy of this version will be distributed for this study.

2. Geographic areas will work with cooperators and adjacent geographic areas within their geographic areas to develop and analyze alternative airtanker configurations within each scenario.

   If a cooperator receives heavy airtanker support exclusively from the agency and if the cooperator does not have the capability to do initial attack analysis on cooperator lands, then the effects of alternatives should be estimated using the effects on agency lands applied appropriately and proportionately to the cooperator lands. Document well the assumptions and display effects on cooperator lands on separate worksheets.

3. 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 presuppression cost to staff the MEL organization as this is constant.

4. 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.

   All airtanker attack times and UMC costs will be calculated using the AutoAT2 program. Units are encouraged to use the spreadsheet. These are 1996 dollars.

   Allow adequate get-away time, drop setup time, time to do drop, and land/taxi times. Utilize information to compute unit mission cost.

   Retardant cost per gallon is assumed to be $0.80.

5. AutoAT2 will use the following naming convention for airtankers in the OST and MRT files where the generic tag format is ATAABBCD. AT will be used to describe the airtanker category. AA is the base ID that the AT is being dispatched from, BB is the reload base ID, C is the airtanker number from the initial attack base and D is the load number. Example: A7RDTD12 is the tag for the second load (2) from the first (1) 3000 gallon reciprocating engine airtanker (A7) where the initial load came from Redmond (RM) and reloading is at Troutdale (TD).

6. Airtanker base identification in NFMAS identification tags will be as defined as follows:

AREA	ABBR	Base
AK	FW	Fairbanks (Ft. Wainwright)
AK	FY	Fort Yukon
AK	GA	Galena
AK	MG	McGrath
AK	PL	Palmer
AK	TN	Tanacross
CA	BI	Bishop
CA	CH	Chester
CA	C1	Chico
CA	CO	Columbia
CA	FR	Fresno
CA	GV	Grass Valley
CA	HR	Hemit-Ryan
CA	HO	Hollister
CA	FF	Lancaster
CA	MA	Mather AFB
CA	MO	Montague
CA	NO	Norton AFM
CA	PO	Paso Roble
CA	PV	Porterville
CA	RM	Ramona
CA	RE	Redding
CA	RH	Rohnerville
CA	SB	Santa Barbara
CA	SR	Santa Rosa
CA	SK	Stockton
CA	UK	Ukiah
EA	BE	Bemidji
EA	BR	Brainard
EA	1A	Ely
EA	3A	Hibbing
EA	2A	Traverse
GB	BM	Battle Mountain
GB	BO	Boise
GB	CC	Cedar City
GB	HI	Hill AFB
GB	MC	McCall
GB	MI	Minden
GB	PT	Pocatello
GB	SL	Salt Lake City
GB	SD	Stead (Reno)
GB	TF	Twin Falls

AREA	ABBR	Base
NR	BL	Billings
NR	A1	Coeur d'Alene
NR	A2	Grangeville
NR	HE	Helena
NR	A3	Kalispell
NR	LE	Lewistown
NR	A4	Missoula
PNW	DP	Deer Park
PNW	PA	Everett
PNW	KF	Klamath Falls
PNW	LG	La Grande
PNW	LV	Lakeview
PNW	MF	Medford
PNW	OM	Omak
PNW	RD	Redmond
PNW	TD	Troutdale
PNW	WE	Wenatchee
RM	GJ	Grand Junction
RM	GR	Greybull
RM	JC	Jeffco
RM	RC	Rapid City
RM	A5	West Yellowstone
S	AV	Ashville
S	FS	Fort Smith
S	GE	Georgetown
S	KI	Kinston
S	KX	Knoxville
S	LC	Lake City
S	LO	London
S	ST	Staunton
S	TA	Tallahassee
SW	AL	Alamogordo
SW	AB	Albuquerque
SW	FH	Fort Huachuca
SW	GC	Grand Canyon
SW	PH	Phoenix
SW	PR	Prescott
SW	RS	Roswell
SW	SC	Silver City
SW	TU	Tucson
SW	WR	White River
SW	WS	Winslow

7. Express all dollars in 1996. Use the following CPI index to move all dollars to 1995. The appropriate factor to use to move dollars to 1995 is listed below.

Year	Factor
1980	1.917
1981	1.748
1982	1.626
1983	1.562
1984	1.496
1985	1.440
1986	1.400
1987	1.359
1988	1.311
1989	1.256
1990	1.207
1991	1.161
1992	1.131
1993	1.097
1994	1.063
1995	1.031
1996	1.000

8. Assume existing dispatch philosophy from preferred IAA alternative. Maintain this dispatch philosophy unless historic use doee not depict the current situation.

9. 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.

10. Document all assumptions, processes, and results. As a minimum, keep all documentation until the end of 1998.

Summaries of Data Used to Develop Airtanker Base Customer Service Areas

APPENDIX D.

Cost/Gallon Based on All Dispatches - Potential Future Fleet Aircraft

AREA	ID	DESCRIPTION			S2T	C123T	P2T	DC2T	E2C	S3	A6	A10	L188	P3	C130A	L382G	C130E,K	C130E,K	F27	CV580	CL215	CL415	B737	B747	PV2
			Airtanker Type		S2T	C123T	P2T	DC2T	E2C	S3	A6	A10	L188	P3	C130A	L382G	C130E,K	C130E,K	F27	CV580	CL215	CL415	B737	B747	PV2
Retardant			Airtanker Gallons		1200	2500	3000	2000	1900	2400	2000	1800	3000	3000	3000	5000	5000	5000	1700	1500	1300	1500	2700	17000	1050
$0.80			Speed (Knots)		230	190	236	215	269	269	269	269	269	269	269	269	269	269	247	269	193	193	269	269	269
			Flight Rate/Hour		$1,286	$1,650	$1,882	$2,022	$1,725	$2,042	$3,098	$3,202	$2,923	$2,877	$3,077	$2,811	$2,811	$2,811	$1,645	$1,989	$1,445	$1,445	$3,026	$9,581	$1,196
	BASE	26-Oct-96	Availability		$5,092	$4,864	$4,636	$4,636	$3,191	$3,191	$3,191	$2,641	$4,160	$3,191	$3,741	$13,398	$5,852	$3,741	$3,209	$3,902	$15,154	$21,677	$6,878	$21,287	$2,247
AREA	ID	DESCRIPTION																							
CA	CH	CHESTER	A6	$2.48	$6.77	$3.66	$3.08	$4.28	$3.33	$2.86	$3.47	$3.40	$2.98	$2.55	$2.82	$4.49	$2.54	$1.99	$3.65	$4.69	$16.47	$20.02	$4.54	$2.64	$3.67
CA	C1	CHICO	A4	$2.33	$5.67	$3.21	$2.71	$3.76	$2.95	$2.57	$3.21	$3.20	$2.70	$2.37	$2.58	$3.76	$2.26	$1.84	$3.23	$4.09	$13.18	$15.86	$3.93	$2.34	$3.02
CA	FR	FRESNO	A3	$2.34	$5.95	$3.33	$2.81	$3.90	$3.06	$2.65	$3.30	$3.28	$2.78	$2.43	$2.66	$3.94	$2.34	$1.89	$3.35	$4.25	$13.97	$16.85	$4.09	$2.42	$3.17
CA	HR	HEMET-RYAN	A4/A4	$1.58	$5.32	$3.00	$2.55	$3.48	$2.76	$2.40	$2.93	$2.90	$2.50	$2.19	$2.39	$3.57	$2.14	$1.73	$3.01	$3.80	$12.47	$15.06	$3.67	$2.21	$2.93
CA	FF	LANCASTER	A4/A4	$1.69	$5.68	$3.22	$2.72	$3.78	$2.97	$2.59	$3.25	$3.25	$2.72	$2.39	$2.61	$3.76	$2.27	$1.85	$3.25	$4.11	$13.14	$15.79	$3.95	$2.35	$3.01
CA	PV	PORTERVILLE	A4/A4	$2.25	$8.03	$4.26	$3.54	$4.99	$3.85	$3.27	$4.00	$3.90	$3.42	$2.90	$3.22	$5.27	$2.89	$2.23	$4.23	$5.49	$19.82	$24.14	$5.31	$3.02	$4.27
CA	RM	RAMONA	A4	$2.55	$6.81	$3.70	$3.10	$4.32	$3.36	$2.89	$3.53	$3.46	$3.01	$2.59	$2.85	$4.51	$2.56	$2.01	$3.69	$4.74	$16.51	$20.04	$4.58	$2.66	$4.01
CA	RE	REDDING	A3	$1.63	$3.08	$1.99	$1.74	$2.28	$1.89	$1.72	$2.13	$2.17	$1.79	$1.65	$1.76	$2.15	$1.53	$1.35	$2.03	$2.45	$6.27	$7.35	$2.34	$1.56	$2.29
CA	SB	SANTA BARBARA	A3	$2.10	$5.15	$2.93	$2.49	$3.41	$2.71	$2.37	$2.91	$2.89	$2.47	$2.17	$2.37	$3.45	$2.10	$1.72	$2.95	$3.72	$11.92	$14.35	$3.58	$2.17	$3.31
GB	BO	BOISE	A6	$1.70	$2.51	$1.83	$1.61	$2.14	$1.78	$1.67	$2.24	$2.38	$1.78	$1.70	$1.79	$1.72	$1.43	$1.35	$1.92	$2.26	$4.10	$4.49	$2.10	$1.45	$1.71
GB	HI	HILL	A3	$1.94	$2.69	$2.00	$1.74	$2.39	$1.96	$1.84	$2.57	$2.78	$1.97	$1.91	$2.00	$1.78	$1.54	$1.47	$2.12	$2.51	$4.13	$4.37	$2.30	$1.55	$1.63
GB	MI	MINDEN	A3	$2.30	$3.45	$2.44	$2.08	$2.95	$2.36	$2.20	$3.14	$3.39	$2.37	$2.27	$2.40	$2.20	$1.80	$1.69	$2.59	$3.12	$5.74	$6.22	$2.86	$1.83	$1.86
GB	MC	McCALL	A3	$1.70	$3.10	$2.03	$1.77	$2.34	$1.93	$1.76	$2.23	$2.29	$1.85	$1.71	$1.82	$2.15	$1.55	$1.38	$2.08	$2.51	$6.16	$7.16	$2.38	$1.58	$1.74
GB	PT	POCATELLO	A7	$1.72	$3.32	$2.24	$1.93	$2.66	$2.15	$1.98	$2.67	$2.82	$2.11	$1.98	$2.10	$2.20	$1.68	$1.54	$2.34	$2.83	$6.11	$6.90	$2.63	$1.71	$1.63
GB	SD	STEAD	A6	$2.22	$3.71	$2.50	$2.13	$2.99	$2.39	$2.20	$3.04	$3.23	$2.35	$2.21	$2.35	$2.41	$1.84	$1.68	$2.62	$3.18	$6.81	$7.66	$2.95	$1.87	$1.71
NO	BL	BILLINGS	A4	$2.26	$4.22	$2.74	$2.32	$3.28	$2.61	$2.37	$3.26	$3.44	$2.53	$2.36	$2.52	$2.72	$1.98	$1.77	$2.86	$3.51	$8.17	$9.32	$3.26	$2.02	$1.95
NO	A1	COUER D'ALENE	A7	$1.64	$3.23	$2.17	$1.88	$2.55	$2.07	$1.91	$2.52	$2.64	$2.02	$1.89	$2.01	$2.18	$1.64	$1.48	$2.25	$2.71	$6.09	$6.95	$2.54	$1.67	$1.66
NO	A2	GRANGEVILLE	A4	$2.19	$5.48	$3.07	$2.60	$3.57	$2.82	$2.45	$2.99	$2.95	$2.55	$2.23	$2.44	$3.67	$2.18	$1.76	$3.07	$3.89	$12.91	$15.60	$3.76	$2.26	$3.75
NO	HE	HELENA	A6	$3.08	$10.79	$5.55	$4.57	$6.54	$4.97	$4.17	$5.12	$4.95	$4.36	$3.64	$4.08	$7.00	$3.67	$2.74	$5.50	$7.22	$27.27	$33.34	$7.00	$3.85	$5.62
NO	A3	KALISPELL	A6	$5.96	$20.87	$10.19	$8.25	$12.08	$8.98	$7.35	$8.97	$8.51	$7.69	$6.20	$7.08	$13.35	$6.46	$4.54	$10.01	$13.43	$54.86	$67.51	$13.07	$6.84	$11.69
NO	A4	MISSOULA	A7	$1.66	$2.57	$1.80	$1.59	$2.08	$1.74	$1.61	$2.07	$2.16	$1.70	$1.61	$1.69	$1.80	$1.41	$1.30	$1.86	$2.20	$4.62	$5.23	$2.08	$1.43	$2.76
NO	A5	WEST YELLOW.	A6	$2.46	$7.68	$4.25	$3.53	$5.05	$3.89	$3.36	$4.33	$4.35	$3.54	$3.09	$3.40	$4.96	$2.89	$2.31	$4.29	$5.51	$18.07	$21.73	$5.26	$3.00	$4.32
NW	KF	KLAMATH FALLS	A3/A4	$1.83	$6.15	$3.52	$2.95	$4.17	$3.25	$2.85	$3.68	$3.73	$3.00	$2.66	$2.90	$4.00	$2.45	$2.02	$3.58	$4.53	$13.97	$16.68	$4.31	$2.54	$4.20
NW	LG	LA GRANDE	A3	$2.09	$3.52	$2.37	$2.03	$2.81	$2.27	$2.08	$2.83	$3.00	$2.22	$2.09	$2.22	$2.31	$1.76	$1.60	$2.47	$3.00	$6.50	$7.34	$2.78	$1.79	$1.68
NW	MF	MEDFORD	A3	$2.30	$5.64	$3.20	$2.70	$3.75	$2.95	$2.58	$3.23	$3.23	$2.70	$2.38	$2.59	$3.74	$2.26	$1.85	$3.23	$4.09	$13.04	$15.67	$3.92	$2.34	$3.74
NW	RD	REDMOND	A3/A6	$1.66	$6.16	$3.48	$2.92	$4.10	$3.20	$2.79	$3.54	$3.56	$2.93	$2.58	$2.82	$4.04	$2.43	$1.98	$3.52	$4.47	$14.27	$17.13	$4.27	$2.52	$3.68
NW	WE	WENATHCEE	A3/A6	$1.75	$5.95	$3.40	$2.86	$4.02	$3.14	$2.75	$3.51	$3.55	$2.89	$2.56	$2.79	$3.90	$2.38	$1.95	$3.45	$4.37	$13.60	$16.26	$4.16	$2.46	$3.58
RM	GJ	GRAND JCT.	A6	$1.79	$3.07	$2.07	$1.80	$2.42	$1.98	$1.82	$2.38	$2.49	$1.93	$1.80	$1.91	$2.09	$1.58	$1.43	$2.14	$2.57	$5.77	$6.59	$2.42	$1.60	$2.51
RM	JC	JEFFCO	A4	$2.51	$5.56	$3.27	$2.75	$3.88	$3.04	$2.68	$3.51	$3.59	$2.84	$2.54	$2.76	$3.62	$2.30	$1.93	$3.34	$4.20	$12.29	$14.57	$3.98	$2.37	$2.77
SO	AV	ASHEVILLE	A4	$2.07	$3.98	$2.52	$2.16	$2.98	$2.39	$2.16	$2.84	$2.96	$2.29	$2.10	$2.25	$2.64	$1.85	$1.63	$2.60	$3.19	$8.06	$9.36	$3.01	$1.89	$2.01
SO	FS	FT. SMITH	A7	$1.86	$4.81	$2.86	$2.43	$3.36	$2.67	$2.37	$3.03	$3.09	$2.49	$2.24	$2.42	$3.19	$2.05	$1.74	$2.91	$3.64	$10.54	$12.50	$3.46	$2.12	$3.04
SO	KX	KNOXVILLE	A6/A4	$1.48	$4.76	$2.85	$2.42	$3.35	$2.66	$2.36	$3.03	$3.10	$2.49	$2.24	$2.42	$3.15	$2.04	$1.74	$2.90	$3.62	$10.38	$12.29	$3.44	$2.11	$2.46
SW	AL	ALAMOGORDO	A6	$2.74	$6.89	$3.84	$3.20	$4.54	$3.52	$3.05	$3.88	$3.89	$3.21	$2.80	$3.07	$4.49	$2.64	$2.12	$3.87	$4.95	$16.17	$19.45	$4.73	$2.74	$3.52
SW	AB	ALBUQUERQUE	A4/A6	$2.09	$7.11	$4.01	$3.34	$4.77	$3.68	$3.21	$4.18	$4.23	$3.39	$2.98	$3.27	$4.58	$2.74	$2.23	$4.07	$5.19	$16.38	$19.59	$4.94	$2.85	$4.29
SW	FH	FT. HUACHUCA	A7	$1.12	$4.54	$2.88	$2.43	$3.45	$2.72	$2.46	$3.36	$3.53	$2.63	$2.43	$2.60	$2.92	$2.07	$1.82	$2.99	$3.69	$9.05	$10.43	$3.44	$2.11	$2.78
SW	PH	PHOENIX	A3	$1.68	$2.97	$1.97	$1.72	$2.28	$1.88	$1.73	$2.19	$2.27	$1.81	$1.69	$1.79	$2.05	$1.52	$1.37	$2.03	$2.43	$5.74	$6.63	$2.31	$1.55	$1.66
SW	PR	PRESCOTT	A3/A6	$1.46	$4.66	$2.83	$2.40	$3.34	$2.65	$2.37	$3.09	$3.17	$2.50	$2.27	$2.44	$3.07	$2.04	$1.75	$2.90	$3.60	$9.95	$11.72	$3.41	$2.09	$2.36
SW	RS	ROSWELL	A6	$2.31	$5.52	$3.15	$2.66	$3.69	$2.91	$2.54	$3.19	$3.20	$2.67	$2.35	$2.56	$3.66	$2.23	$1.83	$3.18	$4.02	$12.70	$15.23	$3.85	$2.31	$3.61
SW	SC	SILVER CITY	A7/A4	$1.31	$4.73	$2.84	$2.42	$3.35	$2.66	$2.37	$3.06	$3.14	$2.50	$2.26	$2.43	$3.12	$2.04	$1.74	$2.91	$3.62	$10.22	$12.07	$3.43	$2.10	$2.42
SW	WS	WINSLOW	A7/A6	$1.62	$6.16	$3.53	$2.96	$4.18	$3.26	$2.85	$3.69	$3.74	$3.01	$2.67	$2.91	$4.01	$2.46	$2.02	$3.58	$4.54	$14.00	$16.71	$4.32	$2.54	$3.10
			Avg->	$2.09	$5.46	$3.17	$2.67	$3.73	$2.93	$2.58	$3.30	$3.35	$2.72	$2.42	$2.63	$3.59	$2.24	$1.86	$3.21	$4.05	$12.29	$14.65	$3.86	$2.31	$3.13
			Initial Relative Ranking->	9.8	7.2	9.0	9.4	8.5	9.2	9.4	8.9	8.8	9.3	9.6	9.4	8.6	9.7	10.0	8.9	8.3	1.9	0.0	8.4	9.6	9.0
			Intermediate Relative Ranking->	9.4	0.0	6.4	7.7	4.8	7.0	8.0	6.0	5.9	7.6	8.5	7.9	5.2	8.9	10.0	6.2	3.9			4.4	8.7	4.4
			Final Relative Ranking->	9.0			6.3		5.1	6.7	3.4	3.2	6.1	7.5	6.5	2.1	8.3	10.0		0.0			0.9		

Cost/Chain Based on All Dispatches - Potential Future Fleet Aircraft

			Airtanker Type		S2T	C123T	P2T	DC2T	E2C	S3	A6	A10	L188	P3	C130A	L382G	C130E,K	C130E,K	F27	CV580	CL215	CL415	B737	B747	PV2
Retardant			Airtanker Gallons		1200	2500	3000	2000	1900	2400	2000	1800	3000	3000	3000	5000	5000	5000	1700	1500	1300	1500	2700	17000	1050
$0.80			Speed (Knots)		230	190	236	215	269	269	269	269	269	269	269	269	269	269	247	269	193	193	269	269	269
			Flight Rate/Hour		$1,286	$1,650	$1,882	$2,022	$1,725	$2,042	$3,098	$3,202	$2,923	$2,877	$3,077	$2,811	$2,811	$2,811	$1,645	$1,989	$1,445	$1,445	$3,026	$9,581	$1,196
	BASE	26-Oct-96	Availability		$5,092	$4,864	$4,636	$4,636	$3,191	$3,191	$3,191	$2,641	$4,160	$3,191	$3,741	$13,398	$5,852	$3,741	$3,209	$3,902	$15,154	$21,677	$6,878	$21,287	$2,247
CA	CH	CHESTER	A6	$1,378	$3,876	$2,057	$1,705	$2,352	$1,863	$1,568	$1,792	$1,722	$1,576	$1,343	$1,475	$2,453	$1,367	$1,063	$2,054	$2,583	$9,238	$11,196	$2,426	$1,369	$2,365
CA	C1	CHICO	A4	$1,012	$2,484	$1,360	$1,134	$1,542	$1,240	$1,054	$1,196	$1,158	$1,053	$913	$992	$1,570	$917	$735	$1,364	$1,683	$5,713	$6,879	$1,567	$908	$1,574
CA	FR	FRESNO	A3	$793	$2,282	$1,245	$1,016	$1,412	$1,142	$961	$1,099	$1,080	$939	$823	$889	$1,339	$794	$642	$1,271	$1,546	$4,994	$5,935	$1,377	$753	$1,523
CA	HR	HEMET-RYAN	A4/A4	$924	$2,815	$1,547	$1,300	$1,753	$1,412	$1,205	$1,362	$1,314	$1,210	$1,049	$1,140	$1,821	$1,064	$853	$1,545	$1,914	$6,549	$7,911	$1,803	$1,065	$1,763
CA	FF	LANCASTER	A4/A4	$891	$3,012	$1,652	$1,375	$1,871	$1,507	$1,281	$1,453	$1,408	$1,277	$1,109	$1,204	$1,895	$1,110	$891	$1,658	$2,043	$6,895	$8,292	$1,895	$1,096	$1,919
CA	PV	PORTERVILLE	A4/A4	$693	$2,480	$1,289	$1,065	$1,482	$1,159	$969	$1,113	$1,061	$981	$824	$913	$1,583	$851	$646	$1,279	$1,632	$6,088	$7,419	$1,551	$864	$1,461
CA	RM	RAMONA	A4	$1,958	$5,266	$2,793	$2,321	$3,194	$2,525	$2,127	$2,429	$2,327	$2,146	$1,825	$2,007	$3,372	$1,870	$1,450	$2,779	$3,506	$12,672	$15,391	$3,318	$1,888	$3,176
CA	RE	REDDING	A3	$1,628	$3,731	$2,267	$1,900	$2,505	$2,147	$1,866	$2,079	$2,095	$1,787	$1,653	$1,729	$2,161	$1,533	$1,358	$2,362	$2,703	$6,896	$7,891	$2,316	$1,393	$2,863
CA	SB	SANTA BARBARA	A3	$1,910	$5,279	$2,929	$2,415	$3,310	$2,701	$2,290	$2,603	$2,561	$2,242	$1,978	$2,127	$3,146	$1,913	$1,567	$2,991	$3,615	$11,416	$13,546	$3,233	$1,818	$3,565
GB	BO	BOISE	A6	$509	$863	$568	$476	$615	$545	$481	$529	$544	$451	$433	$443	$470	$385	$361	$600	$653	$1,314	$1,416	$531	$333	$742
GB	HI	HILL	A3	$647	$1,399	$890	$703	$969	$852	$730	$823	$868	$654	$637	$647	$597	$517	$495	$966	$1,033	$1,869	$1,885	$751	$388	$1,278
GB	MI	MINDEN	A3	$754	$1,759	$1,081	$837	$1,185	$1,024	$865	$986	$1,040	$772	$745	$760	$727	$597	$561	$1,172	$1,268	$2,498	$2,573	$916	$439	$1,563
GB	MC	McCALL	A3	$514	$1,178	$718	$595	$792	$680	$589	$658	$668	$558	$519	$541	$653	$472	$422	$752	$853	$2,096	$2,369	$713	$419	$926
GB	PT	POCATELLO	A7	$529	$1,263	$777	$632	$854	$735	$633	$710	$729	$590	$556	$575	$649	$488	$443	$821	$915	$2,100	$2,315	$735	$414	$1,035
GB	SD	STEAD	A6	$739	$1,424	$869	$704	$956	$818	$703	$790	$810	$657	$616	$639	$734	$543	$490	$915	$1,025	$2,415	$2,679	$827	$463	$1,151
NO	BL	BILLINGS	A4	$665	$1,267	$757	$622	$838	$707	$608	$683	$689	$581	$534	$560	$710	$491	$430	$785	$901	$2,377	$2,720	$765	$442	$958
NO	A1	COUER D'ALENE	A7	$821	$1,959	$1,205	$989	$1,325	$1,139	$985	$1,102	$1,125	$926	$868	$901	$1,047	$776	$701	$1,267	$1,421	$3,355	$3,742	$1,165	$674	$1,576
NO	A2	GRANGEVILLE	A4	$826	$2,077	$1,136	$954	$1,289	$1,035	$883	$999	$962	$887	$766	$835	$1,343	$779	$622	$1,134	$1,408	$4,859	$5,875	$1,328	$781	$1,294
NO	HE	HELENA	A6	$1,026	$3,686	$1,867	$1,520	$2,161	$1,667	$1,375	$1,597	$1,520	$1,391	$1,154	$1,288	$2,300	$1,190	$880	$1,853	$2,389	$9,159	$11,172	$2,256	$1,206	$2,140
NO	A3	KALISPELL	A6	$2,250	$7,988	$3,867	$3,111	$4,535	$3,403	$2,757	$3,248	$3,049	$2,822	$2,266	$2,581	$4,997	$2,397	$1,670	$3,803	$5,046	$20,789	$25,549	$4,836	$2,482	$4,364
NO	A4	MISSOULA	A7	$467	$1,062	$681	$573	$742	$651	$573	$632	$645	$542	$514	$530	$599	$466	$428	$715	$793	$1,751	$1,940	$661	$412	$875
NO	A5	WEST YELLOW.	A6	$1,004	$2,713	$1,447	$1,171	$1,650	$1,312	$1,095	$1,260	$1,231	$1,076	$929	$1,013	$1,596	$907	$714	$1,465	$1,808	$6,142	$7,345	$1,626	$870	$1,748
NW	KF	KLAMATH FALLS	A3/A4	$1,217	$4,530	$2,490	$2,018	$2,817	$2,282	$1,917	$2,194	$2,170	$1,862	$1,641	$1,766	$2,595	$1,562	$1,273	$2,548	$3,072	$9,697	$11,452	$2,698	$1,457	$3,081
NW	LG	LA GRANDE	A3	$644	$1,525	$924	$733	$1,018	$873	$742	$842	$873	$680	$643	$664	$715	$545	$497	$987	$1,094	$2,433	$2,634	$842	$437	$1,278
NW	MF	MEDFORD	A3	$837	$2,359	$1,300	$1,059	$1,471	$1,197	$1,008	$1,151	$1,138	$980	$865	$930	$1,362	$825	$674	$1,333	$1,607	$5,043	$5,958	$1,415	$771	$1,610
NW	RD	REDMOND	A3/A6	$553	$2,283	$1,247	$1,014	$1,414	$1,142	$960	$1,099	$1,082	$936	$821	$887	$1,328	$789	$639	$1,273	$1,545	$4,968	$5,893	$1,370	$744	$1,530
NW	WE	WENATHCEE	A3/A6	$659	$2,523	$1,389	$1,127	$1,571	$1,275	$1,072	$1,226	$1,213	$1,041	$918	$988	$1,446	$874	$713	$1,423	$1,714	$5,387	$6,360	$1,505	$815	$1,721
RM	GJ	GRAND JCT.	A6	$552	$1,053	$656	$550	$720	$621	$543	$602	$610	$518	$484	$503	$602	$444	$400	$684	$771	$1,858	$2,099	$653	$400	$831
RM	JC	JEFFCO	A4	$795	$1,787	$997	$822	$1,124	$914	$777	$881	$866	$762	$672	$723	$1,073	$653	$535	$1,012	$1,222	$3,879	$4,605	$1,098	$624	$1,199
SO	AV	ASHVILLE	A4	$592	$1,154	$686	$574	$761	$640	$554	$619	$617	$537	$489	$516	$689	$464	$401	$704	$820	$2,285	$2,659	$722	$433	$839
SO	FS	FT. SMITH	A7	$532	$1,549	$880	$721	$987	$815	$693	$785	$782	$669	$600	$639	$889	$565	$475	$906	$1,072	$3,171	$3,711	$934	$522	$1,096
SO	KX	KNOXVILLE	A6/A4	$423	$1,419	$808	$670	$906	$746	$638	$720	$711	$624	$556	$595	$853	$537	$448	$824	$983	$2,996	$3,538	$879	$509	$977
SW	AL	ALAMOGORDO	A6	$819	$2,172	$1,168	$953	$1,330	$1,062	$891	$1,021	$996	$878	$760	$827	$1,299	$746	$592	$1,181	$1,455	$4,915	$5,883	$1,318	$720	$1,400
SW	AB	ALBUQUERQUE	A4/A6	$644	$2,274	$1,227	$996	$1,395	$1,115	$934	$1,072	$1,049	$918	$797	$865	$1,340	$776	$618	$1,243	$1,525	$5,086	$6,068	$1,369	$742	$1,483
SW	FH	FT. HUACHUCA	A7	$688	$1,700	$995	$794	$1,107	$929	$786	$894	$913	$735	$678	$710	$863	$599	$525	$1,046	$1,194	$3,062	$3,449	$966	$509	$1,323
SW	PH	PHOENIX	A3	$932	$2,099	$1,292	$1,069	$1,422	$1,227	$1,064	$1,188	$1,210	$1,004	$940	$976	$1,146	$847	$764	$1,359	$1,530	$3,628	$4,064	$1,265	$743	$1,683
SW	PR	PRESCOTT	A3/A6	$551	$2,057	$1,181	$959	$1,321	$1,097	$931	$1,057	$1,062	$889	$806	$853	$1,133	$742	$633	$1,225	$1,432	$4,032	$4,661	$1,215	$666	$1,508
SW	RS	ROSWELL	A6	$659	$1,662	$917	$758	$1,037	$840	$713	$810	$791	$703	$616	$665	$1,014	$605	$491	$928	$1,132	$3,692	$4,409	$1,029	$585	$1,092
SW	SC	SILVER CITY	A7/A4	$424	$1,642	$938	$773	$1,051	$868	$741	$837	$831	$719	$644	$686	$961	$613	$515	$962	$1,140	$3,385	$3,971	$1,002	$572	$1,154
SW	WS	WINSLOW	A7/A6	$771	$3,210	$1,764	$1,431	$1,996	$1,615	$1,358	$1,554	$1,534	$1,321	$1,163	$1,252	$1,850	$1,111	$904	$1,803	$2,177	$6,904	$8,164	$1,918	$1,040	$2,175
			Avg->	$856	$2,422	$1,347	$1,103	$1,519	$1,238	$1,048	$1,192	$1,176	$1,022	$904	$971	$1,423	$868	$713	$1,375	$1,656	$5,190	$6,140	$1,470	$819	$1,646
			Initial Relative Ranking->	9.7	6.9	8.8	9.3	8.5	9.0	9.4	9.1	9.1	9.4	9.6	9.5	8.7	9.7	10.0	8.8	8.3	1.8	0.0	8.6	9.8	8.3
			Intermediate Relative Ranking->	9.2		6.3	7.7	5.3	6.9	8.0	7.2	7.3	8.2	8.9	8.5	5.8	9.1	10.0	6.1	4.5			5.6	9.4	4.5
			Final Relative Ranking->	8.5			5.9		4.4	6.4	4.9	5.1	6.7	8.0	7.3	2.5	8.4	10.0	3.0	0.0			2.0		

Cost/Gallon Based on All Dispatches - Current Fleet Aircraft and Aircraft Categories

			Airtanker Type		T3000	R2000	R2200	R2450	R3000	DC4	SDC4	PB4Y2	SP2H	P2V	DC6A	DC7B	P3A	C130A
Retardant			Airtanker Gallons		3000	2000	2200	2450	3000	2000	2000	2000	2000	2450	2450	3000	3000	3000
$0.80			Speed (Knots)		256	192	196	201	253	185	205	198	201	198	232	253	258	254
			Flight Rate/Hour		$2,861	$1,356	$1,541	$1,819	$2,230	$1,321	$1,330	$1,581	$1,182	$1,839	$1,780	$2,230	$2,688	$3,122
	BASE	26-Oct-96	Availability		$2,887	$2,096	$2,253	$2,475	$2,134	$2,006	$1,929	$2,109	$2,388	$2,473	$2,489	$2,134	$2,646	$3,069
AREA	ID	DESCRIPTION																
CA	CH	CHESTER	A6	$2.48	$2.44	$2.51	$2.48	$2.48	$2.03	$2.45	$2.37	$2.56	$2.64	$2.48	$2.44	$2.03	$2.31	$2.55
CA	C1	CHICO	A4	$2.33	$2.28	$2.32	$2.31	$2.31	$1.92	$2.28	$2.20	$2.39	$2.39	$2.32	$2.25	$1.92	$2.17	$2.40
CA	FR	FRESNO	A3	$2.34	$2.34	$2.38	$2.36	$2.37	$1.96	$2.34	$2.26	$2.45	$2.46	$2.38	$2.31	$1.96	$2.22	$2.45
CA	HR	HEMET-RYAN	A4/A4	$1.58	$2.11	$2.15	$2.13	$2.13	$1.78	$2.11	$2.04	$2.20	$2.23	$2.14	$2.09	$1.78	$2.00	$2.20
CA	FF	LANCASTER	A4/A4	$1.69	$2.31	$2.35	$2.33	$2.34	$1.94	$2.31	$2.23	$2.42	$2.41	$2.35	$2.27	$1.94	$2.19	$2.42
CA	PV	PORTERVILLE	A4/A4	$2.25	$2.76	$2.85	$2.82	$2.81	$2.27	$2.78	$2.69	$2.91	$3.02	$2.82	$2.76	$2.27	$2.60	$2.89
CA	RM	RAMONA	A4	$2.55	$2.47	$2.54	$2.52	$2.51	$2.06	$2.49	$2.41	$2.60	$2.67	$2.52	$2.47	$2.06	$2.34	$2.59
CA	RE	REDDING	A3	$1.63	$1.62	$1.62	$1.61	$1.62	$1.43	$1.60	$1.56	$1.67	$1.62	$1.63	$1.57	$1.43	$1.56	$1.69
CA	SB	SANTA BARBARA	A3	$2.10	$2.10	$2.13	$2.12	$2.12	$1.78	$2.10	$2.03	$2.19	$2.20	$2.13	$2.07	$1.78	$2.00	$2.19
GB	BO	BOISE	A6	$1.70	$1.71	$1.67	$1.68	$1.70	$1.51	$1.67	$1.60	$1.76	$1.59	$1.71	$1.60	$1.51	$1.65	$1.80
GB	HI	HILL	A3	$1.94	$1.93	$1.87	$1.88	$1.91	$1.68	$1.88	$1.79	$2.00	$1.75	$1.94	$1.78	$1.68	$1.85	$2.04
GB	MI	MINDEN	A3	$2.30	$2.29	$2.23	$2.24	$2.27	$1.96	$2.23	$2.12	$2.38	$2.08	$2.30	$2.10	$1.96	$2.18	$2.43
GB	MC	McCALL	A3	$1.70	$1.69	$1.68	$1.68	$1.69	$1.48	$1.66	$1.61	$1.74	$1.66	$1.70	$1.62	$1.48	$1.63	$1.77
GB	PT	POCATELLO	A7	$1.72	$1.98	$1.95	$1.95	$1.97	$1.71	$1.94	$1.86	$2.05	$1.87	$1.99	$1.86	$1.71	$1.90	$2.09
GB	SD	STEAD	A6	$2.22	$2.22	$2.17	$2.18	$2.21	$1.90	$2.17	$2.07	$2.31	$2.07	$2.23	$2.06	$1.90	$2.11	$2.34
NO	BL	BILLINGS	A4	$2.26	$2.35	$2.32	$2.32	$2.35	$2.00	$2.30	$2.20	$2.45	$2.22	$2.37	$2.20	$2.00	$2.24	$2.49
NO	A1	COUER D'ALENE	A7	$1.64	$1.88	$1.86	$1.86	$1.88	$1.64	$1.85	$1.77	$1.95	$1.80	$1.89	$1.78	$1.64	$1.80	$1.98
NO	A2	GRANGEVILLE	A4	$2.19	$2.14	$2.19	$2.17	$2.17	$1.81	$2.14	$2.08	$2.24	$2.27	$2.18	$2.13	$1.81	$2.04	$2.24
NO	HE	HELENA	A6	$3.08	$3.43	$3.58	$3.53	$3.52	$2.77	$3.48	$3.36	$3.65	$3.82	$3.53	$3.46	$2.77	$3.22	$3.62
NO	A3	KALISPELL	A6	$5.96	$5.76	$6.10	$6.00	$5.96	$4.49	$5.90	$5.68	$6.20	$6.68	$5.97	$5.91	$4.49	$5.36	$6.09
NO	A4	MISSOULA	A7	$1.66	$1.60	$1.57	$1.57	$1.59	$1.42	$1.57	$1.51	$1.64	$1.53	$1.60	$1.52	$1.42	$1.54	$1.67
NO	A5	WEST YELLOW.	A6	$2.46	$2.98	$3.04	$3.01	$3.02	$2.45	$2.98	$2.86	$3.15	$3.10	$3.04	$2.91	$2.45	$2.81	$3.15
NW	KF	KLAMATH FALLS	A3/A4	$1.83	$2.59	$2.61	$2.60	$2.61	$2.16	$2.57	$2.47	$2.72	$2.64	$2.63	$2.51	$2.16	$2.45	$2.73
NW	LG	LA GRANDE	A3	$2.09	$2.09	$2.05	$2.05	$2.08	$1.80	$2.04	$1.95	$2.17	$1.96	$2.10	$1.95	$1.80	$1.99	$2.20
NW	MF	MEDFORD	A3	$2.30	$2.30	$2.33	$2.32	$2.32	$1.93	$2.29	$2.21	$2.41	$2.39	$2.33	$2.25	$1.93	$2.18	$2.41
NW	RD	REDMOND	A3/A6	$1.66	$2.49	$2.53	$2.52	$2.52	$2.09	$2.49	$2.40	$2.62	$2.59	$2.54	$2.44	$2.09	$2.36	$2.63
NW	WE	WENATHCEE	A3/A6	$1.75	$2.48	$2.51	$2.50	$2.51	$2.08	$2.47	$2.38	$2.61	$2.55	$2.52	$2.41	$2.08	$2.35	$2.61
RM	GJ	GRAND JCT.	A6	$1.79	$1.80	$1.77	$1.77	$1.79	$1.57	$1.76	$1.70	$1.86	$1.72	$1.80	$1.70	$1.57	$1.72	$1.88
RM	JC	JEFFCO	A4	$2.51	$2.49	$2.50	$2.49	$2.50	$2.09	$2.47	$2.37	$2.61	$2.50	$2.52	$2.39	$2.09	$2.36	$2.62
SO	AV	ASHVILLE	A4	$2.07	$2.08	$2.07	$2.06	$2.08	$1.78	$2.05	$1.97	$2.17	$2.02	$2.10	$1.98	$1.78	$1.99	$2.19
SO	FS	FT. SMITH	A7	$1.86	$2.19	$2.20	$2.19	$2.20	$1.86	$2.17	$2.09	$2.29	$2.21	$2.22	$2.12	$1.86	$2.08	$2.30
SO	KX	KNOXVILLE	A6/A4	$1.48	$2.19	$2.20	$2.19	$2.20	$1.86	$2.17	$2.09	$2.29	$2.20	$2.22	$2.11	$1.86	$2.09	$2.30
SW	AL	ALAMOGORDO	A6	$2.74	$2.70	$2.75	$2.73	$2.74	$2.24	$2.70	$2.60	$2.85	$2.82	$2.75	$2.65	$2.24	$2.55	$2.85
SW	AB	ALBUQUERQUE	A4/A6	$2.09	$2.90	$2.93	$2.92	$2.93	$2.39	$2.89	$2.77	$3.06	$2.97	$2.95	$2.81	$2.39	$2.74	$3.06
SW	FH	FT. HUACHUCA	A7	$1.12	$2.41	$2.39	$2.39	$2.41	$2.04	$2.37	$2.26	$2.52	$2.31	$2.44	$2.27	$2.04	$2.29	$2.55
SW	PH	PHOENIX	A3	$1.68	$1.67	$1.66	$1.66	$1.67	$1.47	$1.64	$1.59	$1.73	$1.63	$1.68	$1.60	$1.47	$1.61	$1.75
SW	PR	PRESCOTT	A3/A6	$1.46	$2.23	$2.23	$2.22	$2.24	$1.89	$2.20	$2.12	$2.33	$2.21	$2.25	$2.13	$1.89	$2.12	$2.34
SW	RS	ROSWELL	A6	$2.31	$2.28	$2.31	$2.29	$2.30	$1.92	$2.27	$2.19	$2.39	$2.36	$2.31	$2.23	$1.92	$2.16	$2.39
SW	SC	SILVER CITY	A7/A4	$1.31	$2.21	$2.21	$2.21	$2.22	$1.88	$2.19	$2.10	$2.31	$2.21	$2.24	$2.13	$1.88	$2.10	$2.32
SW	WS	WINSLOW	A7/A6	$1.62	$2.59	$2.62	$2.60	$2.62	$2.16	$2.58	$2.48	$2.72	$2.65	$2.64	$2.51	$2.16	$2.46	$2.73
			Avg->	$2.09	$2.35	$2.37	$2.36	$2.37	$1.98	$2.34	$2.25	$2.46	$2.40	$2.39	$2.28	$1.98	$2.23	$2.47

Cost/Chain Based on All Dispatches - Current Fleet Aircraft and Aircraft Categories

Retardant $0.80			Airtanker Type		T3000	R2000	R2200	R2450	R3000	DC4	SDC4	PB4Y2	SP2H	P2V	DC6A	DC7B	P3A	C130A
			Airtanker Gallons		3000	2000	2200	2450	3000	2000	2000	2000	2000	2450	2450	3000	3000	3000
			Speed (Knots)		256	192	196	201	253	185	205	198	201	198	232	253	258	254
			Flight Rate/Hour		$2,861	$1,356	$1,541	$1,819	$2,230	$1,321	$1,330	$1,581	$1,182	$1,839	$1,780	$2,230	$2,688	$3,122
	BASE	26-Oct-96	Availability		$2,887	$2,096	$2,253	$2,475	$2,134	$2,006	$1,929	$2,109	$2,388	$2,473	$2,489	$2,134	$2,646	$3,069
CA	CH	CHESTER	A6	$1,378	$1,276	$1,461	$1,416	$1,378	$1,096	$1,437	$1,387	$1,459	$1,557	$1,380	$1,359	$1,096	$1,217	$1,320
CA	C1	CHICO	A4	$1,012	$874	$1,012	$979	$950	$766	$1,000	$964	$1,009	$1,067	$952	$933	$766	$838	$901
CA	FR	FRESNO	A3	$793	$793	$986	$941	$899	$705	$981	$937	$979	$1,025	$903	$871	$705	$763	$816
CA	HR	HEMET-RYAN	A4/A4	$924	$1,002	$1,133	$1,101	$1,074	$877	$1,116	$1,081	$1,131	$1,199	$1,075	$1,060	$877	$961	$1,033
CA	FF	LANCASTER	A4/A4	$891	$1,062	$1,237	$1,196	$1,159	$933	$1,223	$1,179	$1,233	$1,302	$1,161	$1,137	$933	$1,019	$1,094
CA	PV	PORTERVILLE	A4/A4	$693	$777	$878	$853	$833	$656	$860	$831	$878	$944	$834	$825	$656	$738	$807
CA	RM	RAMONA	A4	$1,958	$1,730	$1,958	$1,902	$1,856	$1,482	$1,923	$1,859	$1,957	$2,092	$1,858	$1,835	$1,482	$1,649	$1,791
CA	RE	REDDING	A3	$1,628	$1,628	$2,051	$1,954	$1,860	$1,527	$2,059	$1,972	$2,033	$2,081	$1,868	$1,790	$1,527	$1,592	$1,656
CA	SB	SANTA BARBARA	A3	$1,910	$1,910	$2,341	$2,240	$2,147	$1,709	$2,329	$2,231	$2,326	$2,431	$2,154	$2,084	$1,709	$1,842	$1,963
GB	BO	BOISE	A6	$509	$433	$570	$539	$509	$420	$577	$549	$563	$567	$512	$483	$420	$427	$437
GB	HI	HILL	A3	$647	$647	$967	$896	$824	$637	$987	$924	$949	$947	$831	$762	$637	$640	$652
GB	MI	MINDEN	A3	$754	$754	$1,158	$1,069	$979	$737	$1,183	$1,102	$1,135	$1,136	$988	$899	$737	$745	$763
GB	MC	McCALL	A3	$514	$514	$668	$633	$599	$485	$673	$641	$661	$674	$602	$572	$485	$503	$522
GB	PT	POCATELLO	A7	$529	$554	$759	$713	$667	$529	$768	$726	$748	$757	$672	$629	$529	$544	$562
GB	SD	STEAD	A6	$739	$613	$840	$789	$739	$584	$850	$803	$828	$840	$744	$697	$584	$601	$622
NO	BL	BILLINGS	A4	$665	$526	$684	$649	$614	$491	$688	$654	$677	$693	$617	$586	$491	$513	$536
NO	A1	COUER D'ALENE	A7	$821	$862	$1,152	$1,087	$1,023	$821	$1,164	$1,104	$1,138	$1,155	$1,029	$970	$821	$846	$875
NO	A2	GRANGEVILLE	A4	$826	$731	$826	$803	$784	$638	$814	$788	$825	$876	$785	$774	$638	$701	$754
NO	HE	HELENA	A6	$1,026	$1,084	$1,247	$1,207	$1,174	$900	$1,221	$1,174	$1,247	$1,346	$1,176	$1,159	$900	$1,024	$1,129
NO	A3	KALISPELL	A6	$2,250	$2,097	$2,372	$2,302	$2,250	$1,666	$2,303	$2,213	$2,376	$2,613	$2,251	$2,235	$1,666	$1,958	$2,202
NO	A4	MISSOULA	A7	$467	$511	$657	$624	$592	$490	$663	$634	$650	$659	$594	$565	$490	$503	$517
NO	A5	WEST YELLOW.	A6	$1,004	$891	$1,106	$1,056	$1,010	$778	$1,098	$1,047	$1,099	$1,158	$1,014	$978	$778	$853	$920
NW	KF	KLAMATH FALLS	A3/A4	$1,217	$1,588	$2,024	$1,924	$1,830	$1,421	$2,020	$1,921	$2,007	$2,092	$1,838	$1,759	$1,421	$1,531	$1,633
NW	LG	LA GRANDE	A3	$644	$644	$931	$867	$804	$619	$946	$888	$916	$924	$810	$749	$619	$633	$653
NW	MF	MEDFORD	A3	$837	$837	$1,056	$1,006	$958	$750	$1,053	$1,004	$1,048	$1,093	$962	$924	$750	$807	$860
NW	RD	REDMOND	A3/A6	$553	$793	$996	$949	$905	$705	$992	$945	$988	$1,033	$909	$873	$705	$763	$816
NW	WE	WENATHCEE	A3/A6	$659	$889	$1,131	$1,076	$1,023	$796	$1,129	$1,075	$1,122	$1,169	$1,028	$984	$796	$857	$914
RM	GJ	GRAND JCT.	A6	$552	$479	$612	$582	$552	$454	$616	$588	$605	$617	$555	$529	$454	$469	$486
RM	JC	JEFFCO	A4	$795	$650	$795	$762	$731	$581	$792	$757	$790	$826	$733	$708	$581	$626	$667
SO	AV	ASHVILLE	A4	$592	$479	$592	$566	$542	$442	$593	$568	$588	$606	$544	$523	$442	$466	$488
SO	FS	FT. SMITH	A7	$532	$584	$744	$707	$672	$532	$744	$709	$737	$763	$675	$646	$532	$566	$598
SO	KX	KNOXVILLE	A6/A4	$423	$540	$661	$633	$607	$488	$659	$631	$656	$683	$609	$588	$488	$522	$553
SW	AL	ALAMOGORDO	A6	$819	$729	$891	$854	$819	$639	$884	$845	$886	$934	$822	$795	$639	$699	$752
SW	AB	ALBUQUERQUE	A4/A6	$644	$766	$951	$908	$868	$674	$945	$901	$944	$992	$872	$840	$674	$735	$790
SW	FH	FT. HUACHUCA	A7	$688	$672	$935	$876	$818	$631	$945	$890	$922	$939	$824	$769	$631	$656	$685
SW	PH	PHOENIX	A3	$932	$932	$1,225	$1,158	$1,093	$886	$1,235	$1,176	$1,210	$1,231	$1,099	$1,042	$886	$914	$946
SW	PR	PRESCOTT	A3/A6	$551	$790	$1,038	$982	$927	$727	$1,043	$989	$1,027	$1,057	$932	$884	$727	$767	$807
SW	RS	ROSWELL	A6	$659	$593	$712	$684	$659	$526	$707	$678	$709	$744	$661	$642	$526	$570	$610
SW	SC	SILVER CITY	A7/A4	$424	$627	$786	$750	$715	$571	$786	$750	$780	$808	$718	$689	$571	$608	$642
SW	WS	WINSLOW	A7/A6	$771	$1,125	$1,426	$1,357	$1,292	$1,005	$1,423	$1,354	$1,415	$1,476	$1,298	$1,244	$1,005	$1,084	$1,157
			Avg->	$856	$875	$1,089	$1,040	$993	$784	$1,086	$1,037	$1,081	$1,128	$997	$960	$784	$844	$898

Airtanker Base Attributes - Great Basin Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year	D-F Fires/ Year	G Fires/ Year	<-----AIRTANKER BASE----- BM	BO	CC	HI	MI	MC	PT	SD	TF ----->	
GB	01	FS	Ashley	J1	4.0	4	$1,048	35.4	0.29	0.00	0.00	0.00	0.00	7.65	0.00	0.00	0.00	0.00	0.00	
GB	02	FS	Boise	J2	2.1	2	$1,563	49.5	0.96	0.28	0.00	19.76	0.00	0.00	0.00	27.71	0.00	0.00	0.00	
GB	03	FS	Bridger-Teton	J3	4.0	4	$1,173	20.3	0.23	0.04	0.00	0.00	0.00	0.00	0.00	0.00	2.93	0.00	0.00	
GB	05	FS	Caribou	J5	3.7	4	$329	19.2	1.20	0.00	0.00	0.00	0.00	3.41	0.00	0.00	8.91	0.00	0.00	
GB	07	FS	Dixie	J7	2.2	2	$1,132	47.2	0.63	0.09	0.00	0.00	4.04	1.66	0.00	0.00	0.00	0.00	0.00	
GB	08	FS	Fish Lake	J8	2.4	2	$135	20.2	0.71	0.05	0.00	0.00	1.37	4.05	0.00	0.00	0.00	0.00	0.00	
GB	09	FS	Humboldt	J9	3.0	3	$148	9.3	3.43	0.05	0.00	3.77	0.00	6.48	0.00	0.00	1.84	0.52	0.00	
GB	10	FS	Manti-La Sal	K0	2.9	3	$2,789	38.7	0.36	0.00	0.00	0.00	0.00	1.16	0.00	0.00	0.00	0.00	0.00	
GB	12	FS	Payette	K2	3.0	3	$454	89.5	4.07	0.38	0.00	0.00	0.00	0.00	0.00	30.94	0.00	0.00	0.00	
GB	13	FS	Salmon	K3	3.2	3	$583	25.7	1.52	0.69	0.00	20.38	0.00	0.00	0.00	0.00	8.86	0.00	0.00	
GB	14	FS	Sawtooth	K4	2.2	2	$958	26.6	1.24	0.00	0.00	6.48	0.00	0.71	0.00	0.00	6.85	0.00	0.00	
GB	15	FS	Targhee	K5	3.2	3	$371	23.1	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	7.69	0.00	0.00	
GB	17	FS	Toiyabe	K7	5.2	5	$1,161	36.4	2.22	0.66	0.00	0.00	0.00	0.00	8.97	0.00	0.00	2.45	0.00	
GB	18	FS	Unita	K8	3.5	3	$979	44.8	3.67	0.00	0.00	0.00	0.00	27.61	0.00	0.00	1.66	0.00	0.00	
GB	19	FS	Wasatch-Cache	K9	2.7	3	$1,581	61.0	0.77	0.26	0.00	0.00	0.00	14.60	0.00	0.00	2.34	0.00	0.00	
Idaho	81	BLM	Boise	BO	1.7	2	$156	22.0	17.28	0.89	0.00	64.08	0.00	0.00	0.00	0.00	30.76	0.00	2.49	
Idaho	82	BLM	Burley	BU	3.0	3	$257	27.9	8.74	0.26	0.00	6.95	0.00	0.00	0.00	0.00	11.97	0.00	1.50	
Idaho	83	BLM	Idaho Falls	IF	2.3	2	$331	22.3	5.33	0.36	0.00	0.00	0.00	10.71	0.00	0.00	19.22	0.00	0.00	
Idaho	84	BLM	Salmon	SA	2.0	2	$8,084	29.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.22	0.00	0.00	0.00	
Idaho	85	BLM	Shoshone	SH	1.6	2	$221	40.7	7.62	2.07	0.00	6.42	0.00	0.00	0.00	0.00	6.24	0.00	0.00	
Nevada	95	BLM	Battle Mountain	BM	2.1	2	$39	3.0	4.99	0.69	2.74	0.00	0.00	0.00	12.14	0.00	0.00	1.76	0.00	
Nevada	96	BLM	Carson City	CC	2.9	3	$164	28.3	6.33	0.55	0.56	0.00	0.00	0.00	38.40	0.00	0.00	99.90	0.00	
Nevada	97	BLM	Elko	EK	3.0	3	$62	13.1	14.19	1.68	0.00	12.70	0.00	37.50	9.64	0.00	5.78	0.00	0.00	
Nevada	98	BLM	Ely	EL	2.4	2	$332	12.1	1.85	0.10	0.21	0.00	0.33	6.77	4.76	0.00	0.00	0.00	0.00	
Nevada	99	BLM	Las Vegas	LV	2.6	3	$102	25.5	4.27	0.00	0.00	0.00	0.00	0.00	8.35	0.00	0.00	0.00	0.00	
Nevada	80	BLM	Winnemucca	WI	3.0	3	$70	10.2	10.31	0.95	1.07	0.00	0.00	0.00	13.81	0.00	0.00	10.06	0.00	
Utah	92	BLM	Ceder City	CD	3.0	3	$274	14.7	1.49	0.00	0.00	0.00	0.00	17.53	0.00	0.00	0.91	0.00	0.00	
Utah	91	BLM	Moab	MO	2.0	2	$157	10.6	2.99	0.23	0.00	0.00	0.00	0.00	8.15	0.00	0.00	0.00	0.00	
Utah	93	BLM	Richfield	RI	3.0	3	$144	10.5	6.48	0.00	0.00	0.00	0.00	7.24	0.00	0.00	2.96	0.00	0.00	
Utah	94	BLM	Salt Lake	SL	2.2	2	$29	17.2	6.39	1.16	0.00	0.00	0.00	12.42	0.00	0.00	4.33	0.00	0.00	
Utah	90	BLM	Vernal	VE	2.0	2	$76	15.0	1.60	0.00	0.00	0.00	0.00	1.59	0.00	0.00	1.59	0.00	0.00	
NO	17	FS	Nez Perce	B7	3.9	4	$975	60.7	3.91	0.01	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	
CA	03	FS	Eldorado	M3	3.7	4	$9,571	131.4	0.07	0.03	0.00	0.00	0.00	0.00	1.53	0.00	0.00	0.00	0.00	
CA	06	FS	Lassen	M6	4.0	4	$1,584	111.4	1.12	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	
CA	11	FS	Plumus	N1	3.0	3	$9,795	173.3	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.57	0.00	
CA	16	FS	Stanislaus	N6	3.4	3	$3,507	161.5	0.44	0.05	0.00	0.00	0.00	0.00	37.07	0.00	0.00	0.00	0.00	
CA	17	FS	Tahoe	N7	2.7	3	$3,025	189.1	1.49	0.05	0.00	0.00	0.00	0.00	31.49	0.00	0.00	0.00	0.00	
CA	19	FS	LTBMU	N9	2.0	2	$10,009	546.7	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.07	0.00	
NW	01	FS	Wallow-Whitman	Q6	2.7	3	$1,141	69.8	0.74	0.36	0.00	0.00	0.00	0.00	0.00	2.92	0.00	0.00	0.00	
CA	BA	BLM	Bakersfield	BA	2.3	2	$254	36.0	4.19	0.50	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	
WY	RA	BLM	Rawlins	RA	3.3	3	$365	5.2	1.56	0.03	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	
WY	RS	BLM	Rock Springs	RS	2.5	2	$111	8.6	3.06	0.21	0.00	0.00	0.00	5.86	0.00	0.00	0.00	0.00	0.00	
CA	SU	BLM	Susanville	SU	2.6	3	$190	27.6	3.02	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.44	0.00	
OR	VA	BLM	Vale	VA	1.5	1	$53	14.6	11.76	1.37	0.82	16.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
							Total Large	Fires	153.33	14.44	5.40	157.45	5.74	167.97	176.33	73.97	124.84	129.77	3.99	Totals 841.5

Airtanker Base Attributes - Great Basin Geographic Area

	D-F Fires/ Year	G Fires/ Year	<----AIRTANKER BASE---- BM	BO	CC	HI	MI	MC	PT	SD	TF ---->	Totals
Forest Service + Other D-F Fires Serviced			0.00	0.82	0.53	6.84	1.23	2.77	0.81	0.73	0.00	13.7
BLM D-F Fires Serviced			1.87	32.18	0.05	25.66	23.77	0.00	22.48	12.26	1.08	118.3
Forest Service + Other G Fires Serviced			0.00	0.14	0.06	0.31	0.18	0.27	0.07	0.14	0.00	1.2
BLM G Fires Serviced			0.22	3.36	0.00	2.23	2.08	0.00	2.11	1.18	0.04	11.2
Total Large Fires Serviced			2.09	36.49	0.65	35.03	27.27	3.04	25.47	14.31	1.13	144.3
Forest Service Large Fire Dispatches			0.0	33.3	15.8	134.0	38.0	70.5	19.5	32.4	0.0	343.5
BLM Large Fire Dispatches			9.3	180.0	0.2	115.2	106.7	0.0	101.6	68.0	5.0	581.1
Total Large Fire Dispatches			9.3	213.4	16.0	249.2	144.7	70.5	121.1	100.5	5.0	924.7
Forest Service + Other Initial Attack Dispatches			0.0	33.5	5.4	60.5	79.9	61.8	41.1	11.2	0.0	293.2
BLM Initial Attack Dispatches			5.4	107.1	0.3	100.6	95.8	12.2	83.8	115.2	4.0	520.4
Total Initial Attack Dispatches			5.4	140.5	5.7	161.1	175.7	74.0	124.8	126.3	4.0	813.7
Total Dispatches			14.7	353.9	21.7	410.3	320.5	144.5	245.9	226.8	8.9	1738.3
Airtanker Type			RLD	A6	RLD	A3	A3	A3	A7	A6	RLD	
Airtanker Gallons			2800	2450	2800	3000	3000	3000	3000	2450	2800	
Speed (Knots)				201		256	256	256	253	201		
Flight Rate/Hour				$1,819		$2,861	$2,861	$2,861	$2,230	$1,819		
Availability				$2,475		$2,887	$2,887	$2,887	$2,134	$2,475		
Contract Days				67		65	84	57	85	86		
Availability/Total Dispatches				$469		$457	$757	$1,139	$738	$939		
UMC Based on Initial Attack Dispatches			$4,085	$3,706	$3,711	$5,361	$6,146	$3,947	$4,423	$4,495	$3,155	
Cost per Dispatch				$4,175		$5,819	$6,903	$5,086	$5,161	$5,434		
Average Round Trip Flight Time (Minutes)				58		62	79	32	54	84		
Average Distance to Rep Locs (Miles)				97		134	173	64	115	145		
IA Only Cost/Gallon Delivered				$1.99		$2.18	$2.51	$2.06	$1.96	$2.52		
IA + Large Fire Cost/Gallon Delivered				$1.70		$1.94	$2.30	$1.70	$1.72	$2.22		
IA Cost/Chain Delivered				$452		$596	$672	$399	$454	$612		
Weighted CL			2.3	2.4	2.3	3.1	3.0	2.5	2.5	3.0	2.2	
Weighted FFF+NVC/Ac. Burned			$72	$458	$848	$509	$1,542	$2,158	$348	$1,067	$194	
Weighted Fires/MM Ac./Year			9	28	39	26	84	64	24	41	24	

Airtanker Base Attributes - California Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year	D-F Fires/ Year	G Fires/ Year	<---AIRTANKER BASE BI	CH	C1	FR	HR	FF	MO	PO	PV	RM	RB	SB	SK--->	Totals
CA	01	FS	Angles	M1	6.6	8	$911	163.2	2.71	0.73	0.00	0.00	0.00	0.00	0.00	27.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CA	02	FS	Cleveland	M2	7.3	8	$1,802	205.9	4.63	0.21	0.00	0.00	0.00	0.00	43.80	0.00	0.00	0.00	0.00	19.43	0.00	0.00	0.00	
CA	03	FS	Eldorado	M3	3.7	4	$9,571	131.4	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CA	04	FS	Inyo	M4	2.7	3	$1,672	57.0	1.13	0.02	3.20	0.00	0.00	2.01	0.00	0.00	0.00	0.00	1.59	0.00	0.00	0.00	0.00	
CA	05	FS	Klamath	M5	2.8	3	$2,530	90.1	0.73	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CA	06	FS	Lassen	M6	4.0	4	$1,584	111.4	1.12	0.00	0.00	29.07	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	0.00	0.00	
CA	07	FS	Los Padres	M7	5.9	6	$981	46.7	3.79	0.47	0.00	0.00	0.00	0.00	0.00	29.65	0.00	0.00	0.00	0.00	0.00	59.26	0.00	
CA	08	FS	Mendocino	M8	4.7	5	$3,221	60.9	0.41	0.04	0.00	0.00	6.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.69	0.00	0.00	
CA	09	FS	Modoc	M9	2.7	3	$1,257	67.9	0.63	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.76	0.00	0.00	
CA	10	FS	Six Rivers	N0	4.0	4	$5,180	59.7	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	
CA	11	FS	Plumus	N1	3.0	3	$9,795	173.3	0.81	0.00	0.00	0.00	28.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.48	0.00	0.00	
CA	12	FS	San Bernardino	N2	3.5	3	$1,196	341.6	6.24	0.66	0.00	0.00	0.00	0.00	81.43	21.76	0.00	0.00	0.00	15.59	0.00	0.00	0.00	
CA	13	FS	Sequoia	N3	2.6	3	$2,139	166.4	2.64	0.19	0.00	0.00	0.00	11.04	0.00	7.84	0.00	0.00	58.61	0.00	0.00	0.00	0.00	
CA	14	FS	Shasta-Trinity	N4	6.9	8	$5,035	94.4	3.18	0.09	0.00	14.26	17.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	161.25	0.00	0.00	
CA	15	FS	Sierra	N5	3.3	3	$3,560	123.0	1.37	0.04	0.00	0.00	0.00	32.73	0.00	0.00	0.00	0.00	3.50	0.00	0.00	0.00	0.00	
CA	16	FS	Stanislaus	N6	3.4	3	$3,507	161.5	0.44	0.05	0.00	0.00	0.00	22.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.68	
CA	17	FS	Tahoe	N7	2.7	3	$3,025	189.1	1.49	0.05	0.00	0.00	10.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CA	19	FS	Lake Tahoe LMU	N9	2.0	2	$10,009	546.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
CA	BA	BLM	Bakersfield	BA	2.3	2	$254	36.0	4.19	0.50	0.00	0.00	0.00	1.28	0.00	0.00	0.00	0.00	2.30	0.00	0.00	0.92	0.00	
CA	DD	BLM	Desert	DD	1.6	1	$640	13.7	3.78	0.09	0.05	0.00	0.00	1.13	6.93	14.68	0.00	0.00	3.98	1.12	0.00	0.00	0.00	
CA	SU	BLM	Susanville	SU	2.6	3	$190	27.6	3.02	0.33	0.00	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	
Column Totals									45.18	4.33	3.25	46.62	63.59	70.91	132.16	100.95	0	0	69.98	36.14	178.3	60.18	6.68	768.8
Forest Service + Other D-F Fires Serviced											0.53	1.16	0.95	2.03	7.49	5.38	0.00	0.00	2.39	2.24	4.03	2.53	0.02	28.8
BLM D-F Fires Serviced											0.01	2.43	0.00	1.34	0.94	1.99	0.00	0.00	2.68	0.15	0.59	0.86	0.00	11.0
Forest Service + Other G Fires Serviced											0.01	0.01	0.04	0.08	0.60	1.03	0.00	0.00	0.15	0.15	0.18	0.31	0.00	2.6
BLM G Fires Serviced											0.00	0.27	0.00	0.15	0.02	0.05	0.00	0.00	0.27	0.00	0.06	0.10	0.00	0.9
Total Large Fires Serviced											0.55	3.86	0.98	3.60	9.04	8.45	0.00	0.00	5.49	2.55	4.86	3.80	0.03	43.2
Forest Service Large Fire Dispatches											11.6	21.5	26.9	38.4	131.6	144.0	0.0	0.0	38.9	74.2	78.7	71.5	0.9	638.2
BLM Large Fire Dispatches											0.0	13.7	0.0	6.2	3.0	6.3	0.0	0.0	9.1	1.0	2.7	4.0	0.0	45.9
Total Large Fire Dispatches											11.6	35.2	26.9	44.6	134.6	150.2	0.0	0.0	48.0	75.2	81.4	75.5	0.9	684.1
Forest Service + Other Initial Attack Dispatches											3.2	43.3	63.6	68.5	125.2	86.3	0.0	0.0	63.7	35.0	177.5	59.3	6.7	732.3
BLM Initial Attack Dispatches											0.1	3.3	0.0	2.4	6.9	14.7	0.0	0.0	6.3	1.1	0.8	0.9	0.0	36.5
Total Initial Attack Dispatches											3.3	46.6	63.6	70.9	132.2	101.0	0.0	0.0	70.0	36.1	178.3	60.2	6.7	768.8
Total Dispatches											14.9	81.8	90.5	115.5	266.8	251.2	0.0	0.0	118.0	111.3	259.7	135.7	7.5	1452.8
Airtanker Type											RLD	A6	A4	A3	A4/A4	A4/A4	RLD	CDF	A4/A4	A4	A3	A3	RLD	
Airtanker Gallons											2288	2450	2000	3000	4000	4000	2288	2000	4000	2000	3000	3000	2288	
Speed (Knots)												201	192	256	192	192			192	192	256	256		
Flight Rate/Hour												$1,819	$1,356	$2,861	$1,356	$1,356			$1,356	$1,356	$2,861	$2,861		
Availability												$2,475	$2,096	$2,887	$4,192	$4,192			$4,192	$2,096	$2,887	$2,887		
Contract Days												106	90	123	254	248			186	144	108	122		
Availability/Total Dispatches												$3,207	$2,085	$3,075	$3,992	$4,139			$6,607	$2,711	$1,200	$2,596		
UMC Based on Initial Attack Dispatches											$3,041	$2,870	$2,571	$3,947	$2,309	$2,632			$2,402	$2,380	$3,682	$3,708	$4,127	
Cost per Dispatch												$6,077	$4,656	$7,021	$6,301	$6,772			$9,009	$5,091	$4,883	$6,304		
Average Round Trip Flight Time (Minutes)												30	43	32	31	46			35	35	27	27		
Average Distance to Rep Locs (Miles)												46	67	64	46	72			54	52	51	53		
IA Only Cost/Gallon Delivered												$3.47	$2.77	$2.98	$2.59	$3.23			$3.39	$5.37	$1.81	$3.19		
IA + Large Fire Cost/Gallon Delivered												$2.48	$2.33	$2.34	$1.58	$1.69			$2.25	$2.55	$1.63	$2.10		
IA Cost/Chain Delivered												$651	$559	$446	$608	$693			$370	$915	$1,227	$1,124		
Weighted CL											2.7	4.8	4.2	3.2	4.7	4.7			2.6	5.5	6.6	5.8	3.4	
Weighted FFF+NVC/Ac. Burned											$1,656	$2,541	$6,627	$3,162	$1,368	$1,049			$2,053	$1,505	$4,960	$970	$3,507	
Weighted Fires/MM Ac./Year											56	100	142	137	279	146			149	258	95	47	162	

Airtanker Base Attributes - Northern Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year/	D-F Fires/ Year	G Fires/ Year	A1 CDL	A2 GRV	A3 KAL	A4 MIS	A5 WYS	HE	BL
NO	04	FS	Idaho-Panhandle	A4	4.0	4	$5,667	25.4	0.30	0.01	12.51	0.02	2.16	1.54	0.00	0.00	0.00
NO	05	FS	Clearwater	A5	3.5	3	$3,010	55.0	0.56	0.00	0.00	1.30	0.00	0.88	0.00	0.00	0.00
NO	10	FS	Flathead	B0	4.0	4	$1,988	21.7	0.55	0.00	0.00	0.00	0.55	0.28	0.00	0.00	0.00
NO	12	FS	Helena	B2	3.1	3	$978	26.6	0.19	0.01	0.00	0.00	0.00	0.00	0.00	3.41	0.00
NO	16	FS	Lolo	B6	3.2	3	$2,943	60.5	0.22	0.00	0.28	0.00	1.50	13.00	0.00	0.00	0.00
NO	17	FS	Nez Perce	B7	3.9	4	$975	60.7	3.91	0.01	0.00	7.36	0.00	3.52	0.00	0.00	0.00
GB	03	FS	Bridger-Teton	J3	4.0	4	$1,173	20.3	0.23	0.04	0.00	0.00	0.00	0.00	2.97	0.00	0.03
GB	13	FS	Salmon	K3	3.2	3	$583	25.7	1.52	0.69	0.00	0.00	0.00	11.78	0.03	1.52	0.00
GB	15	FS	Targhee	K5	3.2	3	$371	23.1	0.00	0.06	0.00	0.00	0.00	0.00	10.52	0.00	0.00
NW	01	FS	Okanogan	P8	3.0	3	$1,144	46.7	0.08	0.02	0.55	0.00	0.00	0.00	0.00	0.00	0.00
NW	01	FS	Umatilla	Q4	2.6	3	$989	84.6	0.02	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.00
NW	01	FS	Wallowa-Whitman	Q6	2.7	3	$1,141	69.8	0.74	0.36	0.00	1.63	0.00	0.00	0.00	0.00	0.00
NW	01	FS	Wenatchee	Q7	3.4	3	$1,353	72.4	0.73	0.18	1.56	0.00	0.00	0.00	0.00	0.00	0.00
NW	01	FS	Colville	R1	4.0	4	$1,492	38.5	0.17	0.01	1.26	0.00	0.00	0.00	0.00	0.00	0.00
RM	02	FS	Big Horn	D2	3.6	4	$1,419	18.1	0.56	0.08	0.00	0.00	0.00	0.00	0.51	0.00	3.75
RM	03	FS	Black Hills	D3	2.0	2	$1,095	111.5	0.00	0.00	0.00	0.00	0.00	0.00	1.36	0.00	1.11
Idaho	83	BLM	Idaho Falls	IF	2.3	2	$331	22.3	5.33	0.36	0.00	0.00	0.00	0.00	3.73	0.00	0.00
Idaho	84	BLM	Salmon	SA	2.0	2	$8,084	29.2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
GB	CA	BLM	Casper	CA	2.6	3	$204	8.8	2.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00	1.94
MT	LE	BLM	Lewistown	LE	1.8	2	$234	9.5	3.50	0.10	0.00	0.00	0.00	0.00	0.00	0.46	7.31
MT	MC	BLM	Miles City	MC	1.9	2	$63	25.5	6.35	2.74	0.00	0.00	0.00	0.00	0.00	0.00	6.81
WY	WO	BLM	Worland	WO	2.4	2	$223	6.4	0.60	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.98
NW	CO	BIA	Colville BIA	CO	3.0	3	$381	136.5	5.44	0.42	3.25	0.00	0.00	0.00	0.00	0.00	0.00

(A1 CDL through BL: AIRTANKER BASE)

	A1 CDL	A2 GRV	A3 KAL	A4 MIS	A5 WYS	HE	BL	Totals
Column Totals (D-F Fires/Year 33.08; G Fires/Year 5.19)	19.41	10.34	4.21	31	20.12	5.39	21.93	112.4
Forest Service + Other D-F Fires Serviced	6.66	1.10	0.43	3.20	0.09	0.36	0.50	12.3
BLM D-F Fires Serviced	0.00	0.00	0.00	0.00	1.60	0.21	12.32	14.1
Forest Service + Other G Fires Serviced	0.64	0.12	0.00	0.61	0.03	0.09	0.07	1.6
BLM G Fires Serviced	0.00	0.00	0.00	0.00	0.11	0.01	2.89	3.0
Total Large Fires Serviced	7.29	1.22	0.43	3.81	1.83	0.67	15.78	31.0
Forest Service Large Fire Dispatches	167.7	44.2	7.8	140.2	5.0	18.5	22.6	406.0
BLM Large Fire Dispatches	0.0	0.0	0.0	0.0	7.0	1.1	95.8	103.9
Total Large Fire Dispatches	167.7	44.2	7.8	140.2	12.0	19.5	118.4	509.9
Forest Service + Other Initial Attack Dispatches	16.2	10.3	4.2	31.0	15.4	4.9	4.9	86.9
BLM Initial Attack Dispatches	0.0	0.0	0.0	0.0	4.7	0.5	17.0	22.2
Total Initial Attack Dispatches	16.2	10.3	4.2	31.0	20.1	5.4	21.9	109.2
Total Dispatches	183.9	54.6	12.0	171.2	32.1	24.9	140.3	619.0
Airtanker Type	A7	A4	A6	A6	A7	A6	A4	
Airtanker Gallons	3000	2000	2450	2450	3000	2450	2000	
Speed (Knots)	253	192	201	201	253	201	206	
Flight Rate/Hour	$2,230	$1,356	$1,819	$1,819	$2,230	$1,819	$1,356	
Availability	$2,134	$2,096	$2,475	$2,475	$2,134	$2,475	$2,096	
Contract Days	66	54	55	55	44	44	69	
Availability/Total Dispatches	$766	$2,074	$11,299	$795	$2,923	$4,368	$1,031	
UMC Based on Initial Attack Dispatches	$4,157	$2,305	$3,307	$3,270	$4,460	$3,171	$3,493	
Cost per Dispatch	$4,923	$4,380	$14,606	$4,066	$7,383	$7,539	$4,524	
Average Round Trip Flight Time (Minutes)	47	31	44	43	55	40	84	
Average Distance to Rep Locs (Miles)	98	46	73	70	117	64	149	
IA Only Cost/Gallon Delivered	$4.29	$6.63	$14.55	$3.13	$3.04	$9.54	$5.04	
IA + Large Fire Cost/Gallon Delivered	$1.64	$2.19	$5.96	$1.66	$2.46	$3.08	$2.26	
IA Cost/Chain Delivered	$693	$435	$509	$460	$496	$431	$514	
Weighted CL	4.5	3.7	3.7	3.3	3.0	3.0	2.2	
Weighted FFF+NVC/Ac. Burned	$4,800	$1,266	$4,216	$1,951	$941	$803	$425	
Weighted Fires/MM Ac./Year	60	61	37	45	29	25	21	

Airtanker Base Attributes - Pacific Northwest Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year	D-F Fires/ Year	G Fires/ Year	<---AIRTANKER BASE PA	KF	LG	LV	MF	OM	RD	TD	WE--->
NW	01	FS	Deschutes	P1	2.0	2	$1,647	85.3	0.52	0.04	0.00	1.53	0.00	0.00	0.00	0.00	3.56	0.00	0.00
NW	02	FS	Fremont	P2	2.3	2	$2,642	63.3	0.70	0.12	0.00	6.61	0.00	4.63	0.00	0.00	2.35	0.00	0.00
NW	03	FS	Gifford Pinchot	P3	4.0	4	$3,903	34.4	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	5.92
NW	04	FS	Malheur	P4	3.1	3	$1,673	106.5	0.00	0.06	0.00	0.00	5.26	0.00	0.00	0.00	1.68	0.00	0.00
NW	05	FS	Mt. Baker-Snoq.	P5	4.0	4	$5,627	19.4	0.16	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.32
NW	06	FS	Mt. Hood	P6	3.5	3	$7,843	50.6	0.50	0.02	0.00	0.00	0.00	0.00	0.00	0.00	3.03	0.05	1.33
NW	07	FS	Ochoco	P7	2.3	2	$1,729	108.4	0.76	0.05	0.00	0.00	1.09	0.00	0.00	0.00	16.08	0.00	0.00
NW	08	FS	Okanogan	P8	3.0	3	$1,144	46.7	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	2.47
NW	10	FS	Rogue River	Q0	3.8	4	$4,485	87.4	0.04	0.00	0.00	0.30	0.00	0.00	24.01	0.00	0.00	0.00	0.00
NW	11	FS	Siskiyou	Q1	4.0	4	$1,968	27.4	0.57	0.10	0.00	0.50	0.00	0.00	0.53	0.00	0.00	0.00	0.00
NW	14	FS	Umatilla	Q4	2.6	3	$989	84.6	0.02	0.04	0.00	0.00	43.03	0.00	0.00	0.00	2.75	0.00	0.00
NW	15	FS	Umpqua	Q5	4.0	4	$7,326	93.4	0.42	0.00	0.00	0.03	0.00	0.00	0.49	0.00	0.00	0.00	0.00
NW	16	FS	Wallow-Whitman	Q6	2.7	3	$1,141	69.8	0.74	0.36	0.00	0.00	5.92	0.00	0.00	0.00	0.00	0.00	0.00
NW	17	FS	Wenatchee	Q7	3.4	3	$1,353	72.4	0.73	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	52.78
NW	18	FS	Willamette	Q8	4.0	4	$8,854	84.2	2.86	0.00	0.00	0.00	0.00	0.00	4.65	0.00	19.43	0.00	0.00
NW	20	FS	Winema	R0	2.6	3	$1,715	70.2	0.63	0.07	0.00	8.98	0.00	0.00	1.33	0.00	0.00	0.00	0.00
NW	21	FS	Colville	R1	4.0	4	$1,492	38.5	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67
NW	12	FS	Payette	K2	3.0	3	$454	89.5	4.07	0.38	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
NW	05	FS	Klamath	M5	2.8	3	$2,530	90.1	0.73	0.58	0.00	3.08	0.00	0.00	7.44	0.00	0.00	0.00	0.00
NW	09	FS	Modoc	M9	2.7	3	$1,257	67.9	0.63	0.25	0.00	4.13	0.00	0.21	0.00	0.00	0.00	0.00	0.00
NW	10	FS	Six Rivers	N0	4.0	4	$5,180	59.7	2.80	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00
CA	14	FS	Shasta-Trinity	N4	6.9	8	$5,035	131.4	3.18	0.09	0.00	40.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	LA	BLM	Lakeview	LA	2.8	3	$66	57.3	0.60	0.40	0.00	2.30	0.00	0.14	0.00	0.00	4.30	0.00	0.00
CA	SU	BLM	Susanville	SU	2.6	3	$190	27.6	3.02	0.33	0.00	3.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OR	VA	BLM	Vale	VA	1.5	1	$53	14.6	11.76	1.37	0.00	0.00	7.52	0.00	0.00	0.00	0.00	0.00	0.00
NW	CO	BIA	Colville BIA	CO	3.0	3	$381	136.5	5.44	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.86
							Column Totals		41.61	4.89	0.02	71.45	63.27	4.98	38.91	0.2	53.36	2.27	72.35

	PA	KF	LG	LV	MF	OM	RD	TD	WE	Totals
Column Totals										306.8
Forest Service + Other D-F Fires Serviced	0.00	5.34	4.56	0.27	1.40	0.00	11.55	0.14	13.85	37.1
BLM D-F Fires Serviced	0.00	3.22	11.76	0.01	0.00	0.00	0.38	0.00	0.00	15.4
Forest Service + Other G Fires Serviced	0.00	0.68	0.67	0.05	0.47	0.00	0.76	0.00	0.62	3.3
BLM G Fires Serviced	0.00	0.47	1.37	0.01	0.00	0.00	0.26	0.00	0.00	2.1
Total Large Fires Serviced	0.00	9.71	18.36	0.34	1.87	0.01	12.95	0.14	14.47	57.8
Forest Service Large Fire Dispatches	0.0	91.7	140.5	10.7	72.4	0.2	126.5	2.2	149.3	593.6
BLM Large Fire Dispatches	0.0	9.2	54.4	0.1	0.0	0.0	1.4	0.0	0.0	65.1
Total Large Fire Dispatches	0.0	100.9	194.9	10.8	72.4	0.2	127.9	2.2	149.3	658.7
Forest Service + Other Initial Attack Dispatches	0.0	65.8	55.8	4.8	38.9	0.2	49.1	2.3	65.5	282.3
BLM Initial Attack Dispatches	0.0	5.7	7.5	0.1	0.0	0.0	4.3	0.0	0.0	17.6
Total Initial Attack Dispatches	0.0	71.5	63.3	5.0	38.9	0.2	53.4	2.3	65.5	300.0
Total Dispatches	0.0	172.4	258.2	15.8	111.3	0.4	181.3	4.5	214.8	958.6
Airtanker Type	RLD	A3/A4	A3	RLD	A3	RLD	A3/A6	RLD	A3/A6	
Airtanker Gallons	2738	5000	3000	2738	3000	2738	6000	2738	5450	
Speed (Knots)		224	256		256		229		229	
Flight Rate/Hour		$2,109	$2,861		$2,861		$2,340		$2,340	
Availability		$4,983	$2,887		$2,887		$5,362		$5,362	
Contract Days		177	95		109		194		216	
Availability/Total Dispatches		$5,117	$1,062		$2,828		$5,738		$5,393	
UMC Based on Initial Attack Dispatches	$3,550	$4,013	$5,221	$3,428	$4,077	$3,815	$4,218	$3,707	$4,130	
Cost per Dispatch		$9,130	$6,283		$6,904		$9,956		$9,523	
Average Round Trip Flight Time (Minutes)		57	59		35		47		50	
Average Distance to Rep Locs (Miles)		107	127		71		87		94	
IA Only Cost/Gallon Delivered		$3.27	$3.19		$4.05		$3.95		$4.00	
IA + Large Fire Cost/Gallon Delivered		$1.83	$2.09		$2.30		$1.66		$1.75	
IA Cost/Chain Delivered		$1,070	$535		$494		$469		$572	
Weighted CL	4.0	5.0	2.5	2.3	3.6	3.0	3.1	4.0	3.8	
Weighted FFF+NVC/Ac. Burned	$5,627	$3,586	$958	$2,511	$4,548	$1,144	$4,530	$3,990	$1,900	
Weighted Fires/MM Ac./Year	19	103	77	63	86	47	87	35	80	

Airtanker Base Attributes - Rocky Mountain Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year/	D-F Fires/ Year	G Fires/ Year	<---AIRTANKER BASE---> GJ	JC	RC	Totals
RM	02	FS	Big Horn	D2	3.6	4	$1,419	18.1	0.56	0.08	0.00	0.00	0.00	
RM	03	FS	Black Hills	D3	2.0	2	$1,095	111.5	0.13	0.03	0.00	0.00	0.00	
RM	06	FS	Medicine Bow	D6	3.0	3	$372	37.5	0.44	0.00	0.71	0.76	0.00	
RM	10	FS	Arap.-Roosevelt	E0	3.3	3	$501	30.4	0.78	0.04	1.43	5.21	0.00	
RM	12	FS	Pike-San Isabel	E2	2.7	3	$1,153	61.5	0.23	0.00	0.99	6.96	0.00	
RM	15	FS	White River	E5	3.5	3	$646	23.5	0.47	0.03	1.16	0.00	0.00	
Colo		BLM	Craig	CR	2.5	2	$263	35.4	7.05	0.00	35.87	12.51	0.00	
Colo		BLM	Grand Junction	GJ	2.2	2	$500	42.6	2.21	0.00	15.22	0.00	0.00	
Colo		BLM	Montrose	MR	2.5	2	$387	31.0	1.16	0.00	5.06	0.00	0.00	
GB	07	FS	Dixie	J7	2.2	2	$1,132	47.2	0.63	0.09	1.45	0.00	0.00	
GB	08	FS	Fish Lake	J8	2.4	2	$135	20.2	0.71	0.05	0.18	0.00	0.00	
GB	10	FS	Manti-La Sal	K0	2.9	3	$2,789	38.7	0.36	0.00	2.56	0.00	0.00	
GB	18	FS	Unita	K8	3.5	3	$979	44.8	3.67	0.00	5.00	0.00	0.00	
Utah	91	BLM	Moab	MO	2.0	2	$157	10.6	2.99	0.23	9.25	0.00	0.00	
Utah	93	BLM	Richfield	RI	3.0	3	$144	10.5	6.48	0.00	4.28	0.00	0.00	
GB	CA	BLM	Casper	CA	2.6	3	$204	8.8	2.08	0.03	0.00	0.32	0.00	
WY	RA	BLM	Rawlins	RA	3.3	3	$365	5.2	1.56	0.03	0.00	2.45	0.00	
WY	RS	BLM	Rock Springs	RS	2.5	2	$111	8.6	3.06	0.21	0.48	0.00	0.00	
								Column Totals	34.57	0.82	83.64	28.21	0	111.9

	GJ	JC	RC	Totals
Forest Service + Other D-F Fires Serviced	4.45	2.86	0.13	7.4
BLM D-F Fires Serviced	12.53	1.40	0.00	13.9
Forest Service + Other G Fires Serviced	0.18	0.03	0.03	0.2
BLM G Fires Serviced	0.44	0.03	0.00	0.5
Total Large Fires Serviced	17.60	4.31	0.16	22.1
Forest Service Large Fire Dispatches	104.0	68.1	7.1	179.2
BLM Large Fire Dispatches	65.1	8.7	0.0	73.9
Total Large Fire Dispatches	169.1	76.8	7.1	253.0
Forest Service + Other Initial Attack Dispatches	69.6	25.4	0.0	95.1
BLM Initial Attack Dispatches	14.0	2.8	0.0	16.8
Total Initial Attack Dispatches	83.6	28.2	0.0	111.9
Total Dispatches	252.8	105.0	7.1	364.9
Airtanker Type	A6	A4	RLD	
Airtanker Gallons	2450	2000	2200	
Speed (Knots)	201	192		
Flight Rate/Hour	$1,819	$1,356		
Availability	$2,475	$2,096		
Contract Days	86	92		
Availability/Total Dispatches	$842	$1,837		
UMC Based on Initial Attack Dispatches	$3,556	$3,175		
Cost per Dispatch	$4,398	$5,011		
Average Round Trip Flight Time (Minutes)	53	70		
Average Distance to Rep Locs (Miles)	88	114		
IA Only Cost/Gallon Delivered	$2.49	$5.01		
IA + Large Fire Cost/Gallon Delivered	$1.79	$2.51		
IA Cost/Chain Delivered	$447	$504		
Weighted CL	2.5	2.8		
Weighted FFF+NVC/Ac. Burned	$451	$538		
Weighted Fires/MM Ac./Year	33	38		

Airtanker Base Attributes - Southern Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	Int. New Cov. Lvl	FFF+ NVC/ Acre Burned	Fires/ MM Ac. Year/	D-F Fires/ Year	G Fires/ Year	<-----AIRTANKER BASE-----> AV	FS	KX	LO	ST	Totals
SO	02	FS	Daniel Boone	S2	2.0	2	$402	267.8	2.70	0.00	69.26	0.00	103.89	4.78	0.00	
SO	03	FS	Chatt.-Oconee	S3	2.0	2	$1,065	166.7	0.84	0.05	3.79	0.00	13.29	0.00	0.00	
SO	04	FS	Cherokee	S4	2.0	2	$539	227.5	1.60	0.00	3.59	0.00	4.31	0.00	0.00	
SO	08	FS	George Wash.	S8	2.0	2	$573	41.3	0.92	0.00	1.89	0.00	2.48	0.00	4.20	
SO	09	FS	Ocachita	S9	2.0	2	$1,130	68.1	1.39	0.00	0.00	12.82	0.00	0.00	0.00	
SO	10	FS	Ozark-St. Francis	T0	2.1	2	$1,411	62.9	0.37	0.00	0.00	44.05	0.00	0.00	0.00	
SO	11	FS	NF of North Car.	T1	2.0	2	$1,201	117.4	0.15	0.00	9.72	0.00	12.90	0.00	0.00	
SO	14	FS	Jefferson	T4	2.0	2	$503	47.9	1.28	0.00	1.71	0.00	3.14	0.00	0.75	
								Column Totals	9.25	0.05	89.96	56.87	140.01	4.78	4.95	305.9

	AV	FS	KX	LO	ST	Totals
Forest Service + Other D-F Fires Serviced	2.62	1.76	4.17	0.07	0.62	9.3
BLM D-F Fires Serviced	0.00	0.00	0.00	0.00	0.00	0.0
Forest Service + Other G Fires Serviced	0.01	0.00	0.04	0.00	0.00	0.1
BLM G Fires Serviced	0.00	0.00	0.00	0.00	0.00	0.0
Total Large Fires Serviced	2.63	1.76	4.21	0.07	0.62	9.3
Forest Service Large Fire Dispatches	59.5	25.8	44.1	1.4	11.6	142.3
BLM Large Fire Dispatches	0.0	0.0	0.0	0.0	0.0	0.0
Total Large Fire Dispatches	59.5	25.8	44.1	1.4	11.6	142.3
Forest Service + Other Initial Attack Dispatches	90.0	56.9	140.0	4.8	5.0	296.6
BLM Initial Attack Dispatches	0.0	0.0	0.0	0.0	0.0	0.0
Total Initial Attack Dispatches	90.0	56.9	140.0	4.8	5.0	296.6
Total Dispatches	149.5	82.7	184.1	6.1	16.5	438.9
Airtanker Type	A4	A7	A6/A4	RLD	RLD	
Airtanker Gallons	2000	3000	4450	2362	2362	
Speed (Knots)	192	253	197			
Flight Rate/Hour	$1,356	$2,230	$1,588			
Availability	$2,096	$2,134	$4,571			
Contract Days	78	62	135			
Availability/Total Dispatches	$1,094	$1,601	$3,351			
UMC Based on Initial Attack Dispatches	$3,053	$3,987	$3,235	$2,446	$2,402	
Cost per Dispatch	$4,147	$5,588	$6,587			
Average Round Trip Flight Time (Minutes)	64	43	55			
Average Distance to Rep Locs (Miles)	104	87	90			
IA Only Cost/Gallon Delivered	$2.43	$2.10	$1.72			
IA + Large Fire Cost/Gallon Delivered	$2.07	$1.86	$1.48			
IA Cost/Chain Delivered	$436	$380	$415			
Weighted CL	2.0	2.1	2.0	2.0	2.0	
Weighted FFF+NVC/Ac. Burned	$527	$1,348	$548	$402	$562	
Weighted Fires/MM Ac./Year	237	64	234	268	42	

Airtanker Base Attributes - Southwestern Geographic Area

GA	NO	AG	Unit Name	ID	New Cov. Lvl	New Cov. Lvl	NVC/ Acre Burned	Fires/ MM Ac. Year/	D-F Fires/ Year	G Fires/ Year	AL	AB	FH	PH	PR	RS	SC	WS
											<--------------		----------AIRTANKER BASE					------------->
SW	01	FS	Apache-Sitgraves	G1	4.0	4	$1,399	100.9	4.07	0.00	0.00	0.00	0.83	5.26	7.86	0.00	11.45	20.34
SW	02	FS	Carson	G2	2.6	3	$2,018	31.6	0.61	0.00	0.00	4.52	0.00	0.00	0.00	0.00	0.00	0.00
SW	03	FS	Cibola	G3	2.0	2	$847	42.9	2.22	0.00	1.61	15.16	0.00	0.00	0.00	0.00	0.66	0.00
SW	04	FS	Coconino	G4	2.9	3	$1,786	265.0	1.25	0.00	0.00	0.00	0.00	0.94	5.07	0.00	0.00	3.30
SW	05	FS	Coronado	G5	1.6	2	$550	71.6	0.49	0.31	0.00	0.00	18.80	3.36	0.27	0.00	2.02	0.00
SW	06	FS	Gila	G6	2.8	3	$929	97.2	9.14	0.26	15.19	20.01	10.53	0.00	0.00	0.00	104.78	5.70
SW	07	FS	Kiabab	G7	2.7	3	$2,031	125.8	0.26	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.18
SW	08	FS	Lincoln	G8	2.1	2	$428	56.2	1.00	0.00	5.89	0.23	0.00	0.00	0.00	4.18	0.94	0.00
SW	09	FS	Prescott	G9	3.4	3	$524	80.8	0.90	0.20	0.00	0.00	0.00	4.35	32.25	0.00	0.00	1.03
SW	10	FS	Santa Fe	H0	3.3	3	$1,579	70.7	0.16	0.07	0.71	3.10	0.00	0.00	0.00	0.24	0.00	0.00
SW	12	FS	Tonto	H2	5.0	5	$472	113.1	7.76	0.17	0.00	0.00	1.03	140.09	49.42	0.00	0.00	44.87
RM	12	FS	Pike-San Isabel	E2	2.7	3	$1,153	61.5	0.23	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00
NM	AB	BLM	Albuquerque	AB	2.0	2	$556	10.6	0.11	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
AZ	AZ	BLM	Arizona Strip	AZ	2.1	2	$61	8.0	2.74	0.61	0.00	0.00	0.00	0.00	8.73	0.00	0.00	0.00
CA	DD	BLM	Desert	DD	1.6	1	$640	13.7	3.78	0.09	0.00	0.00	0.00	0.00	7.46	0.00	0.00	0.00
NM	LC	BLM	Las Cruces	LC	1.0	1	$70	3.2	2.19	0.03	3.17	0.00	0.00	0.00	0.00	0.17	0.25	0.00
AZ	PH	BLM	Pheonix	PH	2.3	2	$187	9.0	1.15	0.00	0.00	0.00	0.00	3.22	12.18	0.00	0.00	0.22
NM	RO	BLM	Roswell	RO	2.0	2	$67	14.2	4.84	0.11	0.00	0.00	0.00	0.00	0.00	2.74	0.00	0.00
AZ	SF	BLM	Safford	SF	1.8	2	$82	23.8	2.24	0.08	0.00	0.00	5.87	0.00	0.00	0.00	0.27	0.00

	D-F Fires/ Year	G Fires/ Year	AL	AB	FH	PH	PR	RS	SC	WS	Totals
Column Totals	45.14	1.93	26.57	44.16	37.06	157.22	124.39	7.33	120.37	75.64	592.7
Forest Service + Other D-F Fires Serviced			1.65	4.08	1.10	5.38	4.01	0.38	7.36	4.13	28.1
BLM D-F Fires Serviced			1.93	0.11	2.14	0.24	7.42	4.94	0.25	0.02	17.1
Forest Service + Other G Fires Serviced			0.04	0.09	0.26	0.17	0.21	0.00	0.20	0.05	1.0
BLM G Fires Serviced			0.03	0.00	0.08	0.00	0.70	0.11	0.01	0.00	0.9
Total Large Fires Serviced			3.64	4.28	3.58	5.79	12.34	5.44	7.81	4.19	47.1
Forest Service Large Fire Dispatches			34.6	46.8	22.2	97.3	45.1	7.4	77.9	36.2	367.5
BLM Large Fire Dispatches			9.8	0.3	4.5	1.0	18.5	25.3	0.6	0.0	60.1
Total Large Fire Dispatches			44.4	47.1	26.7	98.2	63.6	32.7	78.5	36.2	427.6
Forest Service + Other Initial Attack Dispatches			23.4	43.2	31.2	154.0	96.0	4.4	119.9	75.4	547.5
BLM Initial Attack Dispatches			3.2	1.0	0.0	3.2	28.4	2.9	0.3	0.2	39.1
Total Initial Attack Dispatches			26.6	44.2	31.2	157.2	124.4	7.3	120.1	75.6	586.6
Total Dispatches			71.0	91.3	57.9	255.5	188.0	40.1	198.6	111.8	1014.2
Airtanker Type			A6	A4/A6	A3/A7	A3	A3/A6	A6	A7/A4	A7/A6	
Airtanker Gallons			2450	4450	6000	3000	5450	2450	5000	5450	
Speed (Knots)			201	197	255	256	229	201	223	228	
Flight Rate/Hour			$1,819	$1,588	$2,546	$2,861	$2,340	$1,819	$1,793	$2,025	
Availability			$2,475	$4,571	$2,511	$2,887	$5,362	$2,475	$4,230	$4,609	
Contract Days			87	111	33	91	129	38	142	115	
Availability/Total Dispatches			$3,033	$5,559	$1,430	$1,028	$3,680	$2,347	$3,024	$4,740	
UMC Based on Initial Attack Dispatches			$3,689	$3,762	$5,274	$4,006	$4,277	$3,302	$3,550	$4,089	
Cost per Dispatch			$6,722	$9,321	$6,704	$5,034	$7,957	$5,649	$6,574	$8,829	
Average Round Trip Flight Time (Minutes)			57	75	68	34	54	44	52	57	
Average Distance to Rep Locs (Miles)			96	126	147	67	102	72	96	108	
IA Only Cost/Gallon Delivered			$4.81	$3.43	$1.32	$1.89	$1.81	$6.58	$1.71	$2.04	
IA + Large Fire Cost/Gallon Delivered			$2.74	$2.09	$1.12	$1.68	$1.46	$2.31	$1.31	$1.62	
IA Cost/Chain Delivered			$449	$520	$270	$742	$592	$385	$458	$715	
Weighted CL			2.4	2.5	2.5	4.8	3.7	2.1	2.9	4.4	
Weighted FFF+NVC/Ac. Burned			$728	$1,048	$714	$508	$565	$322	$961	$816	
Weighted Fires/MM Ac./Year			73	68	87	110	87	40	96	115	

Results of Potential Future Airtankers at Representative Airtanker Bases

APPENDIX E.

ALBUQUERQUE SERVICE AREA - NF (CARSON, CIBOLA, GILA, LINCOLN, SANTA FE) BLM - (ALBUQUERQUE)
26-Oct-96 64 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:11 AM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
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0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
T2450	AB	17	73	22254	16532	38786	-1821		$40,607	
	G2	44	209	335366	69391	404757	-17045		$421,802	
	G3	71	264	185982	103315	289297	-4531		$293,828	
	G8	51	679	264224	50545	314769	-8304		$323,073	
	H0	111	737	1242160	94880	1337040	-26788		$1,363,828	
					DAILY	T2450->	$2,475	$158,400		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1962	$2,049,986	$334,663	$2,384,649	($58,489)	$158,400	$2,601,538	$0
P2T	AB	17	73	22115	16959	39074	-1821		$40,895	
	G2	44	131	239830	71172	311002	-7697		$318,699	
	G3	71	264	185980	107834	293814	-4531		$298,345	
	G8	51	679	264198	50575	314773	-8303		$323,076	
	H0	111	736	1238367	90670	1329037	-26765		$1,355,802	
					DAILY	P2T->	$4,636	$296,704		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1883	$1,950,490	$337,210	$2,287,700	($49,117)	$296,704	$2,633,521	($31,983)
E2C	AB	17	73	22553	15806	38359	-1821		$40,180	
	G2	44	315	459789	67859	527648	-25120		$552,768	
	G3	71	264	186148	100276	286424	-4532		$290,956	
	G8	51	679	264085	50047	314132	-8300		$322,432	
	H0	111	1170	1751979	97212	1849191	-42900		$1,892,091	
					DAILY	E2C->	$3,131	$200,384		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	2501	$2,684,554	$331,200	$3,015,754	($82,673)	$200,384	$3,298,811	($697,273)
S3	AB	17	73	22313	16400	38713	-1821		$40,534	
	G2	44	209	333967	69342	403309	-17024		$420,333	
	G3	71	264	185977	100931	286908	-4531		$291,439	
	G8	51	679	264094	50500	314594	-8300		$322,894	
	H0	111	737	1241758	94126	1335884	-26787		$1,362,671	
					DAILY	S3->	$3,131	$200,384		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1962	$2,048,109	$331,299	$2,379,408	($58,463)	$200,384	$2,638,255	($36,717)
A10	AB	17	73	22162	16735	38897	-1821		$40,718	
	G2	44	439	609939	73846	683785	-39930		$723,715	
	G3	71	264	186315	111666	297981	-4532		$302,513	
	G8	51	679	264104	50889	314993	-8300		$323,293	
	H0	111	1170	1752073	98693	1850766	-42901		$1,893,667	
					DAILY	A10->	$2,581	$165,184		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	2625	$2,834,593	$351,829	$3,186,422	($97,484)	$165,184	$3,449,090	($847,552)
L188	AB	17	73	21860	17522	39382	-1821		$41,203	
Civilian	G2	44	131	239075	75575	314650	-7680		$322,330	
Purchase	G3	71	264	185978	114562	300540	-4531		$305,071	
	G8	51	679	264135	51018	315153	-8302		$323,455	
	H0	111	734	1231517	88195	1319712	-26724		$1,346,436	
					DAILY	L188->	$4,160	$266,240		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1881	$1,942,565	$346,872	$2,289,437	($49,058)	$266,240	$2,604,735	($3,197)

ALBUQUERQUE SERVICE AREA - NF (CARSON, CIBOLA, GILA, LINCOLN, SANTA FE) BLM - (ALBUQUERQUE)

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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
P3A	AB	17	73	21875	17533	39408	-1821		$41,229	
Military	G2	44	131	239349	75836	315185	-7684		$322,869	
Purchase	G3	71	264	185985	114773	300758	-4531		$305,289	
	G8	51	679	264188	50791	314979	-8303		$323,282	
	H0	111	734	1231794	88313	1320107	-26726		$1,346,833	
					DAILY	P3A->	$3,131	$200,384		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1881	$1,943,191	$347,246	$2,290,437	($49,065)	$200,384	$2,539,886	$61,652
C130E	AB	17	73	21301	19028	40329	-1821		$42,150	
Military	G2	44	108	210832	82589	293421	-4920		$298,341	
Purchase	G3	71	264	186105	136048	322153	-4531		$326,684	
	G8	51	679	264066	50794	314860	-8300		$323,160	
	H0	111	279	687960	84551	772511	-6370		$778,881	
					DAILY	C130E->	$3,681	$235,584		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1403	$1,370,264	$373,010	$1,743,274	($25,942)	$235,584	$2,004,800	$596,738
C130E	AB	17	73	21301	19028	40329	-1821		$42,150	
Civilian	G2	44	108	210832	82589	293421	-4920		$298,341	
Purchase	G3	71	264	186105	136048	322153	-4531		$326,684	
	G8	51	679	264066	50794	314860	-8300		$323,160	
	H0	111	279	687960	84551	772511	-6370		$778,881	
					DAILY	C130E->	$5,852	$374,528		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1403	$1,370,264	$373,010	$1,743,274	($25,942)	$374,528	$2,143,744	$457,794
L382G	AB	17	73	21301	19028	40329	-1821		$42,150	
	G2	44	108	210832	82589	293421	-4920		$298,341	
	G3	71	264	186105	136048	322153	-4531		$326,684	
	G8	51	679	264066	50794	314860	-8300		$323,160	
	H0	111	279	687960	84551	772511	-6370		$778,881	
					DAILY	C130,E,K->	$11,967	$765,888		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1403	$1,370,264	$373,010	$1,743,274	($25,942)	$765,888	$2,535,104	$66,434
CV580	AB	17	73	22588	15678	38266	-1821		$40,087	
	G2	44	421	590039	69069	659108	-39567		$698,675	
	G3	71	264	186187	116791	302978	-4532		$307,510	
	G8	51	680	265104	50590	315694	-8368		$324,062	
	H0	111	1170	1752188	98428	1850616	-42901		$1,893,517	
					DAILY	CV580->	$3,902	$249,728		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	2608	$2,816,106	$350,556	$3,166,662	($97,189)	$249,728	$3,513,579	($912,041)
B737	AB	17	73	21923	17351	39274	-1821		$41,095	
	G2	44	209	333683	74893	408576	-17001		$425,577	
	G3	71	264	186021	112622	298643	-4531		$303,174	
	G8	51	679	264166	51292	315458	-8302		$323,760	
	H0	111	736	1238827	93915	1332742	-26768		$1,359,510	
					DAILY	B737-200->	$6,878	$440,192		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1961	$2,044,620	$350,073	$2,394,693	($58,423)	$440,192	$2,893,308	($291,770)

ALBUQUERQUE SERVICE AREA - NF (CARSON, CIBOLA, GILA, LINCOLN, SANTA FE) BLM - (ALBUQUERQUE)
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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
C130A	AB	17	73	21817	17673	39490	-1821		$41,311	
	G2	44	131	239409	76733	316142	-7687		$323,829	
	G3	71	264	185996	117042	303038	-4531		$307,569	
	G8	51	679	264190	50853	315043	-8303		$323,346	
	H0	111	734	1231795	88538	1320333	-26726		$1,347,059	
					DAILY	C130A->	$3,681	$235,584		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	1881	$1,943,207	$350,839	$2,294,046	($49,068)	$235,584	$2,578,698	$22,840
S2T	AB	17	73	22861	15010	37871	-1821		$39,692	
	G2	44	421	591716	65645	657361	-39587		$696,948	
	G3	71	264	186243	113211	299454	-4532		$303,986	
	G8	51	679	264186	50435	314621	-8303		$322,924	
	H0	111	1170	1752226	97944	1850170	-42901		$1,893,071	
					DAILY	S2T->	$5,092	$325,888		
					AVAILABILITY		$0	$0		
ROW TOTALS		294	2607	$2,817,232	$342,245	$3,159,477	($97,144)	$325,888	$3,582,509	($980,971)

BOISE SERVICE AREA - NF (BOISE, HUMBOLDT, SALMON, SAWTOOTH) -BLM (BOISE, BURLEY, SHOSHONE, ELKO)
26-Oct-96
07:16 AM
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= TYPE OF 2ND AIRTANKER

B/C FROM NO AT'S (1) and

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
R2450	BO	117	38476	903784	681483	1585267	-3945128		$5,530,395	
	EK	97	28524	665777	444445	1110222	-660766		$1,770,988	
	IF	58	11338	503287	306071	809358	-2513136		$3,322,494	
	J2	130	3388	1522934	649464	2172398	-3120856		$5,293,254	
	J9	23	6074	560717	141698	702415	-215997		$918,412	
	K3	109	8837	4582910	439782	5022692	-259255		$5,281,947	
	K4	53	2248	1507214	152499	1659713	-494026		$2,153,739	
	SA	38	524	142436	56570	199006	-442280		$641,286	
	SH	62	36093	390400	428071	818471	-7146145		$7,964,616	
	VA	76	36292	285431	251786	537217	-1063995		$1,601,212	
	WI	84	18561	625371	345326	970697	-317508		$1,288,205	
					DAILY	R2450->	$2,475	$158,400		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	190355	$11,690,261	$3,897,195	$15,587,456	($20,179,092)	$158,400	$35,924,948	$0
P2T	BO	117	38416	897180	689894	1587074	-3940019		$5,527,093	
	EK	97	28511	664635	448590	1113225	-660573		$1,773,798	
	IF	58	11338	503287	306071	809358	-2513136		$3,322,494	
	J2	130	3031	1426805	651091	2077896	-3114324		$5,192,220	
	J9	23	6254	579873	142819	722692	-220588		$943,280	
	K3	109	8522	4459469	435591	4895060	-253865		$5,148,925	
	K4	53	2243	1502392	154602	1656994	-492613		$2,149,607	
	SA	38	524	142386	56479	198865	-442291		$641,156	
	SH	62	36093	389335	429136	818471	-7146145		$7,964,616	
	VA	76	36262	280405	259930	540335	-1063335		$1,603,670	
	WI	84	18548	622258	344756	967014	-317328		$1,284,342	
					DAILY	P2T->	$4,636	$296,704		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	189742	$11,468,025	$3,918,959	$15,386,984	($20,164,217)	$296,704	$35,847,905	$77,043
E2C	BO	117	39102	902109	675386	1577495	-3960895		$5,538,390	
	EK	97	28567	669336	401748	1071084	-661404		$1,732,488	
	IF	58	11360	505313	300464	805777	-2517731		$3,323,508	
	J2	130	3388	1525719	611793	2137512	-3120728		$5,258,240	
	J9	23	6097	564255	140445	704700	-216594		$921,294	
	K3	109	8900	4611688	438751	5050439	-278997		$5,329,436	
	K4	53	2248	1503494	146066	1649560	-494421		$2,143,981	
	SA	38	560	144493	56491	200984	-437954		$638,938	
	SH	62	36093	390241	428230	818471	-7146145		$7,964,616	
	VA	76	36411	294509	240758	535267	-1066463		$1,601,730	
	WI	84	18559	622580	337151	959731	-317486		$1,277,217	
					DAILY	E2C->	$3,131	$200,384		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	191285	$11,733,737	$3,777,283	$15,511,020	($20,218,818)	$200,384	$35,930,222	($5,274)
S3	BO	117	38466	893756	674175	1567931	-3944482		$5,512,413	
	EK	97	28550	669580	418800	1088380	-661135		$1,749,515	
	IF	58	11352	504621	302283	806904	-2516222		$3,323,126	
	J2	130	3029	1418443	626634	2045077	-3114192		$5,159,269	
	J9	23	6049	554745	144610	699355	-215650		$915,005	
	K3	109	8417	4428168	431234	4859402	-261867		$5,121,269	
	K4	53	2246	1500921	146499	1647420	-493728		$2,141,148	
	SA	38	524	141982	55871	197853	-442365		$640,218	
	SH	62	36093	391112	427359	818471	-7146145		$7,964,616	
	VA	76	36299	289276	247674	536950	-1064145		$1,601,095	
	WI	84	18553	622283	348463	970746	-317395		$1,288,141	
					DAILY	S3->	$3,131	$200,384		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	189578	$11,414,887	$3,823,602	$15,238,489	($20,177,326)	$200,384	$35,616,199	$308,749

BOISE SERVICE AREA - NF (BOISE, HUMBOLDT, SALMON, SAWTOOTH) -BLM (BOISE, BURLEY, SHOSHONE, ELKO)

26-Oct-96
07:16 AM

64 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
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= TYPE OF 2ND AIRTANKER

B/C FROM
NO AT'S (1)
and

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
A10	BO	117	39038	895923	728816	1624739	-3957253		$5,581,992	
	EK	97	28596	660036	449128	1109164	-661857		$1,771,021	
	IF	58	11364	504862	304593	809455	-2518318		$3,327,773	
	J2	130	3388	1521126	636819	2157945	-3120749		$5,278,694	
	J9	23	6097	563138	145132	708270	-216600		$924,870	
	K3	109	8900	4610452	442281	5052733	-278997		$5,331,730	
	K4	53	2248	1501307	153285	1654592	-494398		$2,148,990	
	SA	38	560	144460	57283	201743	-437954		$639,697	
	SH	62	36093	380491	437961	818452	-7146145		$7,964,597	
	VA	76	36411	284262	264284	548546	-1066463		$1,615,009	
	WI	84	18559	621447	357748	979195	-317489		$1,296,684	
					DAILY	A10->	$2,581	$165,184		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	191254	$11,687,504	$3,977,330	$15,664,834	($20,216,223)	$165,184	$36,046,241	($121,293)
L188 Civialian Purchase	BO	117	38348	919849	713230	1633079	-3936329		$5,569,408	
	EK	97	28510	661234	463570	1124804	-660546		$1,785,350	
	IF	58	11338	503074	305871	808945	-2513063		$3,322,008	
	J2	130	2939	1393744	656000	2049744	-3112405		$5,162,149	
	J9	23	6250	579011	143855	722866	-220556		$943,422	
	K3	109	7849	4221173	427647	4648820	-240961		$4,889,781	
	K4	53	2242	1496231	154247	1650478	-492444		$2,142,922	
	SA	38	524	141970	56588	198558	-442370		$640,928	
	SH	62	36093	384041	434548	818589	-7146145		$7,964,734	
	VA	76	36260	277145	269168	546313	-1063313		$1,609,626	
	WI	84	18545	619003	363191	982194	-317301		$1,299,495	
					DAILY	L188->	$4,160	$266,240		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	188898	$11,196,475	$3,987,915	$15,184,390	($20,145,433)	$266,240	$35,596,063	$328,885
P3A Military Purchase	BO	117	38358	893759	725935	1619694	-3936848		$5,556,542	
	EK	97	28524	662739	461574	1124313	-660761		$1,785,074	
	IF	58	11338	503186	305831	809017	-2513097		$3,322,114	
	J2	130	3030	1421058	655093	2076151	-3114110		$5,190,261	
	J9	23	6254	579127	145629	724756	-220588		$945,344	
	K3	109	8151	4328129	434158	4762287	-255278		$5,017,565	
	K4	53	2243	1498279	155017	1653296	-492515		$2,145,811	
	SA	38	524	142125	56666	198791	-442345		$641,136	
	SH	62	36093	384682	433789	818471	-7146145		$7,964,616	
	VA	76	36262	276900	269597	546497	-1063343		$1,609,840	
	WI	84	18546	619557	359634	979191	-317308		$1,296,499	
					DAILY	P3A->	$3,131	$200,384		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	189323	$11,309,541	$4,002,923	$15,312,464	($20,162,338)	$200,384	$35,675,186	$249,762
C130E Military Purchase	BO	117	37844	929697	648837	1578534	-3845582		$5,424,116	
	EK	97	28452	657270	470158	1127428	-659850		$1,787,278	
	IF	58	11356	503837	300042	803879	-2516789		$3,320,668	
	J2	130	3519	1619867	671491	2291358	-3158229		$5,449,587	
	J9	23	6075	568035	129227	697262	-215894		$913,156	
	K3	109	6856	3840043	419618	4259661	-212751		$4,472,412	
	K4	53	1958	1324475	158579	1483054	-438617		$1,921,671	
	SA	38	523	141853	56726	198579	-442400		$640,979	
	SH	62	36093	385465	433403	818868	-7146145		$7,965,013	
	VA	76	36088	265438	282666	548104	-1059638		$1,607,742	
	WI	84	18532	620343	371856	992199	-317143		$1,309,342	
					DAILY	C130,E,K->	$3,681	$235,584		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	187296	$10,856,323	$3,942,603	$14,798,926	($20,013,038)	$235,584	$35,047,548	$877,400

BOISE SERVICE AREA - NF (BOISE, HUMBOLDT, SALMON, SAWTOOTH) -BLM (BOISE, BURLEY, SHOSHONE, ELKO)
26-Oct-96 64 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:16 AM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
= TYPE OF 2ND AIRTANKER

B/C FROM NO AT'S (1) and

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
C130E	BO	117	37844	929697	648837	1578534	-3845582		$5,424,116	
Civilian	EK	97	28452	657270	470158	1127428	-659850		$1,787,278	
Purchase	IF	58	11356	503837	300042	803879	-2516789		$3,320,668	
	J2	130	3519	1619867	671491	2291358	-3158229		$5,449,587	
	J9	23	6075	568035	129227	697262	-215894		$913,156	
	K3	109	6856	3840043	419618	4259661	-212751		$4,472,412	
	K4	53	1958	1324475	158579	1483054	-438617		$1,921,671	
	SA	38	523	141853	56726	198579	-442400		$640,979	
	SH	62	36093	385465	433403	818868	-7146145		$7,965,013	
	VA	76	36088	265438	282666	548104	-1059638		$1,607,742	
	WI	84	18532	620343	371856	992199	-317143		$1,309,342	
					DAILY	C130,E,K->	$5,852	$374,528		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	187296	$10,856,323	$3,942,603	$14,798,926	($20,013,038)	$374,528	$35,186,492	$738,456
L382G	BO	117	37844	929697	648837	1578534	-3845582		$5,424,116	
	EK	97	28452	657270	470158	1127428	-659850		$1,787,278	
	IF	58	11356	503837	300042	803879	-2516789		$3,320,668	
	J2	130	3519	1619867	671491	2291358	-3158229		$5,449,587	
	J9	23	6075	568035	129227	697262	-215894		$913,156	
	K3	109	6856	3840043	419618	4259661	-212751		$4,472,412	
	K4	53	1958	1324475	158579	1483054	-438617		$1,921,671	
	SA	38	523	141853	56726	198579	-442400		$640,979	
	SH	62	36093	385465	433403	818868	-7146145		$7,965,013	
	VA	76	36088	265438	282666	548104	-1059638		$1,607,742	
	WI	84	18532	620343	371856	992199	-317143		$1,309,342	
					DAILY	C130,E,K->	$11,967	$765,888		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	187296	$10,856,323	$3,942,603	$14,798,926	($20,013,038)	$765,888	$35,577,852	$347,096
CV580	BO	117	39161	931823	709455	1641278	-3992678		$5,633,956	
	EK	97	28602	668197	408426	1076623	-661972		$1,738,595	
	IF	58	11369	505889	303247	809136	-2519407		$3,328,543	
	J2	130	3498	1593527	625914	2219441	-3122437		$5,341,878	
	J9	23	6244	576961	141378	718339	-220492		$938,831	
	K3	109	8982	4615446	455858	5071304	-258688		$5,329,992	
	K4	53	2252	1507528	147595	1655123	-495062		$2,150,185	
	SA	38	561	144684	57245	201929	-437924		$639,853	
	SH	62	36093	385339	433132	818471	-7146145		$7,964,616	
	VA	76	36303	282285	258423	540708	-1064274		$1,604,982	
	WI	84	18564	626735	337017	963752	-317540		$1,281,292	
					DAILY	CV580->	$3,902	$249,728		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	191629	$11,838,414	$3,877,690	$15,716,104	($20,236,619)	$249,728	$36,202,451	($277,503)
B737	BO	117	38408	886040	714512	1600552	-3939554		$5,540,106	
	EK	97	28525	662756	460918	1123674	-660780		$1,784,454	
	IF	58	11348	503909	305701	809610	-2515298		$3,324,908	
	J2	130	3030	1420474	648647	2069121	-3114023		$5,183,144	
	J9	23	6047	552349	151628	703977	-215614		$919,591	
	K3	109	8274	4370668	434598	4805266	-254824		$5,060,090	
	K4	53	2243	1496998	153545	1650543	-492466		$2,143,009	
	SA	38	524	142078	56581	198659	-442353		$641,012	
	SH	62	36093	385779	432692	818471	-7146145		$7,964,616	
	VA	76	36276	279761	265822	545583	-1063644		$1,609,227	
	WI	84	18547	619855	361986	981841	-317308		$1,299,149	
					DAILY	B737-200->	$6,878	$440,192		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	189315	$11,320,667	$3,986,630	$15,307,297	($20,162,009)	$440,192	$35,909,498	$15,450

BOISE SERVICE AREA - NF (BOISE, HUMBOLDT, SALMON, SAWTOOTH) -BLM (BOISE, BURLEY, SHOSHONE, ELKO)

26-Oct-96
07:16 AM

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B/C FROM NO AT'S (1) and

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
C130A	BO	117	38358	893358	732145	1625503	-3936848		$5,562,351	
	EK	97	28524	662146	468687	1130833	-660770		$1,791,603	
	IF	58	11338	503189	306113	809302	-2513110		$3,322,412	
	J2	130	3030	1420774	658500	2079274	-3114110		$5,193,384	
	J9	23	6254	578900	146536	725436	-220588		$946,024	
	K3	109	8274	4370955	435583	4806538	-254826		$5,061,364	
	K4	53	2243	1497982	155748	1653730	-492515		$2,146,245	
	SA	38	524	142154	56808	198962	-442341		$641,303	
	SH	62	36093	383837	434634	818471	-7146145		$7,964,616	
	VA	76	36261	275805	273293	549098	-1063320		$1,612,418	
	WI	84	18546	619332	362039	981371	-317308		$1,298,679	
					DAILY	C130A->	$3,681	$235,584		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	189445	$11,348,432	$4,030,086	$15,378,518	($20,161,881)	$235,584	$35,775,983	$148,965

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
S2T	BO	117	39607	956054	701465	1657519	-4012288		$5,669,807	
	EK	97	28621	660926	398190	1059116	-662210		$1,721,326	
	IF	58	11356	505085	306475	811560	-2517069		$3,328,629	
	J2	130	3534	1625216	615591	2240807	-3123248		$5,364,055	
	J9	23	6244	578581	141939	720520	-220499		$941,019	
	K3	109	8981	4650718	443091	5093809	-262605		$5,356,414	
	K4	53	2268	1516427	148999	1665426	-499684		$2,165,110	
	SA	38	576	147130	58613	205743	-436183		$641,926	
	SH	62	36093	387724	430747	818471	-7146145		$7,964,616	
	VA	76	36353	290088	241424	531512	-1065315		$1,596,827	
	WI	84	18571	634125	329373	963498	-317617		$1,281,115	
					DAILY	S2T->	$5,092	$325,888		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		847	192204	$11,952,074	$3,815,907	$15,767,981	($20,262,863)	$325,888	$36,356,732	($431,784)

KLAMATH FALLS SERVICE AREA - NF (KLAMATH, MODOC, SHASTA-TRINITY DESCHUTES, FREMONT, ROGUE RIVER, UMPQUA, WINEMA)
BLM (LAKEVIEW, SUSANVILLE)

26-Oct-96 109 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
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R2000 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
T3000	LA	62	6887	318294	61892	380186	-74793		$454,979	
	M5	154	6729	6706006	1328050	8034056	-10138279		$18,172,335	
	M9	113	3504	2266771	283592	2550363	-1844438		$4,394,801	
	N4	208	2948	5021519	2569672	7591191	-5056687		$12,647,878	
	P1	137	717	525955	90168	616123	-566244		$1,182,367	
	P2	76	1295	1951459	83908	2035367	-1276008		$3,311,375	
	Q0	55	22	69108	120077	189185	-19491		$208,676	
	Q1	30	2401	971125	63063	1034188	-3300528		$4,334,716	
	Q5	92	195	585185	166081	751266	-629364		$1,380,630	
	R0	73	2283	1378807	68114	1446921	-2461336		$3,908,257	
	SU	80	5453	395865	119706	515571	-521349		$1,036,920	
					DAILY	T3000->	$2,887	$314,683		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32434	$20,190,094	$4,954,323	$25,144,417	($25,888,517)	$457,211	$51,490,145	$0
P2T	LA	62	6889	320114	61025	381139	-74803		$455,942	
	M5	154	6729	6705573	1328814	8034387	-10138621		$18,173,008	
	M9	113	3505	2274781	289176	2563957	-1845299		$4,409,256	
	N4	208	2948	5020053	2566475	7586528	-5056826		$12,643,354	
	P1	137	719	523590	90016	613606	-566720		$1,180,326	
	P2	76	1299	1956748	79985	2036733	-1277772		$3,314,505	
	Q0	55	22	69109	120103	189212	-19491		$208,703	
	Q1	30	2401	971624	63062	1034686	-3301051		$4,335,737	
	Q5	92	195	585238	165933	751171	-629364		$1,380,535	
	R0	73	2288	1382683	65634	1448317	-2464930		$3,913,247	
	SU	80	5454	396994	117185	514179	-521379		$1,035,558	
					DAILY	P2T->	$4,636	$505,324		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32449	$20,206,507	$4,947,408	$25,153,915	($25,896,256)	$647,852	$51,698,023	($207,878)
E2C	LA	62	7387	334377	59230	393607	-77445		$471,052	
	M5	154	6731	6719674	1326164	8045838	-10144052		$18,189,890	
	M9	113	4370	2980159	307251	3287410	-2141481		$5,428,891	
	N4	208	2964	5056449	2544066	7600515	-5079689		$12,680,204	
	P1	137	712	520504	90772	611276	-562619		$1,173,895	
	P2	76	1312	2011159	79735	2090894	-1290360		$3,381,254	
	Q0	55	22	69090	119779	188869	-19491		$208,360	
	Q1	30	2784	1093083	64136	1157219	-4318916		$5,476,135	
	Q5	92	195	585196	164925	750121	-629364		$1,379,485	
	R0	73	2290	1384815	63445	1448260	-2465191		$3,913,451	
	SU	80	5463	405229	112511	517740	-522020		$1,039,760	
					DAILY	E2C->	$3,131	$341,279		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	34230	$21,159,735	$4,932,014	$26,091,749	($27,250,628)	$483,807	$53,826,184	($2,336,039)
S3	LA	62	8093	353608	58418	412026	-83633		$495,659	
	M5	154	6736	6725049	1326361	8051410	-10145494		$18,196,904	
	M9	113	3517	2297396	293849	2591245	-1849561		$4,440,806	
	N4	208	2950	5030555	2537179	7567734	-5057957		$12,625,691	
	P1	137	625	506559	90140	596699	-456260		$1,052,959	
	P2	76	1266	1933106	79707	2012813	-1276943		$3,289,756	
	Q0	55	22	69087	119890	188977	-19491		$208,468	
	Q1	30	2784	1093065	63638	1156703	-4318217		$5,474,920	
	Q5	92	195	585072	165416	750488	-629364		$1,379,852	
	R0	73	2288	1386681	64575	1451256	-2466036		$3,917,292	
	SU	80	5458	399902	114881	514783	-521639		$1,036,422	
					DAILY	S3->	$3,131	$341,279		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	33934	$20,380,080	$4,914,054	$25,294,134	($26,824,595)	$483,807	$52,602,536	($1,112,391)

KLAMATH FALLS SERVICE AREA - NF (KLAMATH, MODOC, SHASTA-TRINITY DESCHUTES, FREMONT, ROGUE RIVER, UMPQUA, WINEMA)
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26-Oct-96 109 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
A10	LA	62	8898	374496	61790	436286	-85555		$521,841	
	M5	154	6732	6721988	1327909	8049897	-10145172		$18,195,069	
	M9	113	4370	2981253	312134	3293387	-2142065		$5,435,452	
	N4	208	2966	5048233	2589663	7637896	-5082416		$12,720,312	
	P1	137	713	521213	92250	613463	-563215		$1,176,678	
	P2	76	1312	2009228	87006	2096234	-1289984		$3,386,218	
	Q0	55	22	69135	119970	189105	-19491		$208,596	
	Q1	30	2784	1093015	64427	1157442	-4318952		$5,476,394	
	Q5	92	195	585011	165767	750778	-629364		$1,380,142	
	R0	73	2291	1384931	67464	1452395	-2465417		$3,917,812	
	SU	80	5464	405562	116340	521902	-522124		$1,044,026	
					DAILY	A10->	$2,581	$281,329		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	35747	$21,194,065	$5,004,720	$26,198,785	($27,263,755)	$423,857	$53,886,397	($2,396,252)
L188 Civilian Purchase	LA	62	6877	316753	61699	378452	-74749		$453,201	
	M5	154	6729	6706775	1327912	8034687	-10138531		$18,173,218	
	M9	113	3503	2257952	279546	2537498	-1843444		$4,380,942	
	N4	208	2944	5002404	2553600	7556004	-5048116		$12,604,120	
	P1	137	718	526320	90403	616723	-566296		$1,183,019	
	P2	76	1291	1927623	83164	2010787	-1272148		$3,282,935	
	Q0	55	22	69109	120078	189187	-19491		$208,678	
	Q1	30	2383	914549	62379	976928	-3252217		$4,229,145	
	Q5	92	195	585164	166070	751234	-629364		$1,380,598	
	R0	73	2283	1377492	68106	1445598	-2461110		$3,906,708	
	SU	80	5452	394201	119115	513316	-521246		$1,034,562	
					DAILY	L188->	$4,160	$453,440		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32397	$20,078,342	$4,932,072	$25,010,414	($25,826,712)	$595,968	$51,433,094	$57,051
P3A Military Purchase	LA	62	6889	320358	62041	382399	-74804		$457,203	
	M5	154	6729	6706887	1327979	8034866	-10138545		$18,173,411	
	M9	113	3504	2263610	281350	2544960	-1844070		$4,389,030	
	N4	208	2947	5017707	2549596	7567303	-5055472		$12,622,775	
	P1	137	717	526287	90480	616767	-566343		$1,183,110	
	P2	76	1300	1957448	85870	2043318	-1278562		$3,321,880	
	Q0	55	22	69111	120118	189229	-19491		$208,720	
	Q1	30	2383	914973	62657	977630	-3252603		$4,230,233	
	Q5	92	195	585233	166173	751406	-629416		$1,380,822	
	R0	73	2284	1381170	69233	1450403	-2461806		$3,912,209	
	SU	80	5453	395318	118954	514272	-521310		$1,035,582	
					DAILY	P3A->	$3,131	$341,279		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32423	$20,138,102	$4,934,451	$25,072,553	($25,842,422)	$483,807	$51,398,782	$91,363
C130E Military Purchase	LA	62	5581	278146	64448	342594	-66630		$409,224	
	M5	154	6729	6709236	1327482	8036718	-10138393		$18,175,111	
	M9	113	2697	1789674	276238	2065912	-1578713		$3,644,625	
	N4	208	2818	4628101	2483464	7111565	-4848922		$11,960,487	
	P1	137	705	499185	90352	589537	-555127		$1,144,664	
	P2	76	1225	1840410	86657	1927067	-1257510		$3,184,577	
	Q0	55	22	69139	120370	189509	-19491		$209,000	
	Q1	30	2374	906898	61611	968509	-3226985		$4,195,494	
	Q5	92	195	585212	165896	751108	-629364		$1,380,472	
	R0	73	2262	1307453	68835	1376288	-2444998		$3,821,286	
	SU	80	5441	386962	121396	508358	-520506		$1,028,864	
					DAILY	C130E->	$3,681	$401,229		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	30049	$19,000,416	$4,866,749	$23,867,165	($25,286,639)	$543,757	$49,697,561	$1,792,584

KLAMATH FALLS SERVICE AREA - NF (KLAMATH, MODOC, SHASTA-TRINITY DESCHUTES, FREMONT, ROGUE RIVER, UMPQUA, WINEMA)
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26-Oct-96 109 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:02 AM 68 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
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R2000 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
C130E	LA	62	5581	278146	64448	342594	-66630		$409,224	
Civilian	M5	154	6729	6709236	1327482	8036718	-10138393		$18,175,111	
Purchase	M9	113	2697	1789674	276238	2065912	-1578713		$3,644,625	
	N4	208	2818	4628101	2483464	7111565	-4848922		$11,960,487	
	P1	137	705	499185	90352	589537	-555127		$1,144,664	
	P2	76	1225	1840410	86657	1927067	-1257510		$3,184,577	
	Q0	55	22	69139	120370	189509	-19491		$209,000	
	Q1	30	2374	906898	61611	968509	-3226985		$4,195,494	
	Q5	92	195	585212	165896	751108	-629364		$1,380,472	
	R0	73	2262	1307453	68835	1376288	-2444998		$3,821,286	
	SU	80	5441	386962	121396	508358	-520506		$1,028,864	
					DAILY	C130E->	$5,852	$637,868		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	30049	$19,000,416	$4,866,749	$23,867,165	($25,286,639)	$780,396	$49,934,200	$1,555,945
L382G	LA	62	5581	278146	64448	342594	-66630		$409,224	
	M5	154	6729	6709236	1327482	8036718	-10138393		$18,175,111	
	M9	113	2697	1789674	276238	2065912	-1578713		$3,644,625	
	N4	208	2818	4628101	2483464	7111565	-4848922		$11,960,487	
	P1	137	705	499185	90352	589537	-555127		$1,144,664	
	P2	76	1225	1840410	86657	1927067	-1257510		$3,184,577	
	Q0	55	22	69139	120370	189509	-19491		$209,000	
	Q1	30	2374	906898	61611	968509	-3226985		$4,195,494	
	Q5	92	195	585212	165896	751108	-629364		$1,380,472	
	R0	73	2262	1307453	68835	1376288	-2444998		$3,821,286	
	SU	80	5441	386962	121396	508358	-520506		$1,028,864	
					DAILY	C130,E,K->	$11,967	$1,304,403		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	30049	$19,000,416	$4,866,749	$23,867,165	($25,286,639)	$1,446,931	$50,600,735	$889,410
CV580	LA	62	8921	384103	65428	449531	-85678		$535,209	
	M5	154	6732	6719790	1328775	8048565	-10143805		$18,192,370	
	M9	113	4690	3213765	319448	3533213	-2237860		$5,771,073	
	N4	208	2969	5076897	2571219	7648116	-5089578		$12,737,694	
	P1	137	717	523746	91066	614812	-565224		$1,180,036	
	P2	76	1313	2016335	83456	2099791	-1290801		$3,390,592	
	Q0	55	22	69096	119975	189071	-19491		$208,562	
	Q1	30	2840	1130783	64508	1195291	-4516310		$5,711,601	
	Q5	92	267	669491	165965	835456	-1004457		$1,839,913	
	R0	73	2292	1389853	63848	1453701	-2466161		$3,919,862	
	SU	80	5469	411237	112278	523515	-522464		$1,045,979	
					DAILY	CV580->	$3,902	$425,318		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	36232	$21,605,096	$4,985,966	$26,591,062	($27,941,829)	$567,846	$55,100,737	($3,610,592)
B737	LA	62	6897	320348	61559	381907	-74835		$456,742	
	M5	154	6732	6718531	1327603	8046134	-10143270		$18,189,404	
	M9	113	3504	2266248	282774	2549022	-1844370		$4,393,392	
	N4	208	2947	5012319	2565438	7577757	-5052593		$12,630,350	
	P1	137	721	528143	90272	618415	-568528		$1,186,943	
	P2	76	1266	1927313	84379	2011692	-1276152		$3,287,844	
	Q0	55	22	69107	120061	189168	-19491		$208,659	
	Q1	30	2748	1052877	63200	1116077	-4221519		$5,337,596	
	Q5	92	195	584876	166256	751132	-629364		$1,380,496	
	R0	73	2289	1382998	68750	1451748	-2465468		$3,917,216	
	SU	80	5455	396969	118365	515334	-521460		$1,036,794	
					DAILY	B737-200->	$6,878	$749,702		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32776	$20,259,729	$4,948,657	$25,208,386	($26,817,050)	$892,230	$52,917,666	($1,427,521)

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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
C130A	LA	62	6881	317623	62343	379966	-74766		$454,732	
	M5	154	6729	6706818	1328212	8035030	-10138545		$18,173,575	
	M9	113	3504	2263542	281848	2545390	-1844070		$4,389,460	
	N4	208	2947	5017650	2567088	7584738	-5055514		$12,640,252	
	P1	137	719	527100	90663	617763	-566461		$1,184,224	
	P2	76	1292	1944278	84740	2029018	-1273129		$3,302,147	
	Q0	55	22	69109	120093	189202	-19491		$208,693	
	Q1	30	2383	914686	62450	977136	-3252321		$4,229,457	
	Q5	92	195	585138	166236	751374	-629364		$1,380,738	
	R0	73	2283	1378716	68647	1447363	-2461336		$3,908,699	
	SU	80	5453	395183	119475	514658	-521310		$1,035,968	
					DAILY	C130A->	$3,681	$401,229		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	32408	$20,119,843	$4,951,795	$25,071,638	($25,836,307)	$543,757	$51,451,702	$38,443
S2T	LA	62	8925	382367	62300	444667	-85695		$530,362	
	M5	154	6734	6724380	1331801	8056181	-10144010		$18,200,191	
	M9	113	4764	3460103	340337	3800440	-2301575		$6,102,015	
	N4	208	2951	5036938	2555643	7592581	-5062213		$12,654,794	
	P1	137	720	528373	90371	618744	-568215		$1,186,959	
	P2	76	1332	2047137	82079	2129216	-1300982		$3,430,198	
	Q0	55	22	69099	119924	189023	-19491		$208,514	
	Q1	30	2843	1133709	64625	1198334	-4522696		$5,721,030	
	Q5	92	275	678844	165671	844515	-1044153		$1,888,668	
	R0	73	2293	1395030	64621	1459651	-2467172		$3,926,823	
	SU	80	5454	399411	117506	516917	-521405		$1,038,322	
					DAILY	S2T->	$5,092	$555,028		
					AVAILABILITY	R2000->	$2,096	$142,528		
ROW TOTALS		1080	36313	$21,855,391	$4,994,878	$26,850,269	($28,037,607)	$697,556	$55,585,432	($4,095,287)

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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
R2450	A4	121	147	656486	608934	1265420	-97717		$1,363,137	
	A5	92	303	669840	196944	866784	-53592		$920,376	
	B0	57	276	719138	68783	787921	-74889		$862,810	
	B6	131	131	236084	145995	382079	-46248		$428,327	
	B7	135	603	562626	259789	822415	-21183		$843,598	
	K3	109	8837	4581628	441064	5022692	-259255		$5,281,947	
					DAILY	R2450->	$2,475	$136,125		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	10297	$7,425,802	$1,721,509	$9,147,311	($552,884)	$136,125	$9,836,320	$0
P2T	A4	121	120	606281	603541	1209822	-79378		$1,289,200	
	A5	92	302	669623	197153	866776	-53467		$920,243	
	B0	57	276	718911	68850	787761	-74814		$862,575	
	B6	131	113	218908	146226	365134	-42329		$407,463	
	B7	135	603	562630	260705	823335	-21183		$844,518	
	K3	109	8263	4380481	429586	4810067	-253783		$5,063,850	
					DAILY	P2T->	$4,636	$254,980		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9677	$7,156,834	$1,706,061	$8,862,895	($524,954)	$254,980	$9,642,829	$193,491
E2C	A4	121	147	660219	606633	1266852	-98611		$1,365,463	
	A5	92	300	663996	197697	861693	-52617		$914,310	
	B0	57	276	718236	68784	787020	-74526		$861,546	
	B6	131	174	285671	138798	424469	-56798		$481,267	
	B7	135	603	562620	258052	820672	-21183		$841,855	
	K3	109	8709	4533863	436558	4970421	-259764		$5,230,185	
					DAILY	E2C->	$3,131	$172,205		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	10209	$7,424,605	$1,706,522	$9,131,127	($563,499)	$172,205	$9,866,831	($30,511)
S3	A4	121	147	656023	605643	1261666	-97616		$1,359,282	
	A5	92	303	669733	197143	866876	-53591		$920,467	
	B0	57	276	719138	68775	787913	-74889		$862,802	
	B6	131	102	218623	143254	361877	-43912		$405,789	
	B7	135	603	562677	261764	824441	-21183		$845,624	
	K3	109	8157	4341144	428716	4769860	-254201		$5,024,061	
					DAILY	S3->	$3,131	$172,205		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9588	$7,167,338	$1,705,295	$8,872,633	($545,392)	$172,205	$9,590,230	$246,090
A10	A4	121	147	660399	612492	1272891	-98744		$1,371,635	
	A5	92	300	664440	198154	862594	-52723		$915,317	
	B0	57	276	718236	68934	787170	-74526		$861,696	
	B6	131	183	296739	147178	443917	-59306		$503,223	
	B7	135	603	562632	263173	825805	-21183		$846,988	
	K3	109	8709	4533214	439493	4972707	-259764		$5,232,471	
					DAILY	A10->	$2,581	$141,955		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	10218	$7,435,660	$1,729,424	$9,165,084	($566,246)	$141,955	$9,873,285	($36,965)
L188	A4	121	120	597986	608352	1206338	-77878		$1,284,216	
Civilian	A5	92	301	666931	196740	863671	-53075		$916,746	
Purchase	B0	57	276	718684	69012	787696	-74738		$862,434	
	B6	131	106	187199	153206	340405	-39527		$379,932	
	B7	135	603	562643	268622	831265	-21183		$852,448	
	K3	109	7752	4198137	427770	4625907	-253157		$4,879,064	
					DAILY	L188->	$4,160	$228,800		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9158	$6,931,580	$1,723,702	$8,655,282	($519,558)	$228,800	$9,403,640	$432,680

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ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
P3A	A4	121	120	598168	608802	1206970	-77918		$1,284,888	
Military	A5	92	301	666951	196774	863725	-53076		$916,801	
Purchase	B0	57	276	718684	69007	787691	-74738		$862,429	
	B6	131	106	187279	152572	339851	-39586		$379,437	
	B7	135	603	562643	268781	831424	-21183		$852,607	
	K3	109	7958	4271146	429553	4700699	-254942		$4,955,641	
					DAILY	P3A->	$3,131	$172,205		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9364	$7,004,871	$1,725,489	$8,730,360	($521,443)	$172,205	$9,424,008	$412,312
C130E	A4	121	119	596828	612838	1209666	-78309		$1,287,975	
Military	A5	92	296	656694	196661	853355	-51203		$904,558	
Purchase	B0	57	276	719082	69429	788511	-74501		$863,012	
	B6	131	91	167582	174484	342066	-32496		$374,562	
	B7	135	603	562665	279053	841718	-21183		$862,901	
	K3	109	6722	3836290	422450	4258740	-252620		$4,511,360	
					DAILY	C130,E,K->	$3,681	$202,455		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	8107	$6,539,141	$1,754,915	$8,294,056	($510,312)	$202,455	$9,006,823	$829,497
C130E	A4	121	119	596828	612838	1209666	-78309		$1,287,975	
Civilian	A5	92	296	656694	196661	853355	-51203		$904,558	
Purchase	B0	57	276	719082	69429	788511	-74501		$863,012	
	B6	131	91	167582	174484	342066	-32496		$374,562	
	B7	135	603	562665	279053	841718	-21183		$862,901	
	K3	109	6722	3836290	422450	4258740	-252620		$4,511,360	
					DAILY	C130,E,K->	$5,852	$321,860		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	8107	$6,539,141	$1,754,915	$8,294,056	($510,312)	$321,860	$9,126,228	$710,092
L382G	A4	121	119	596828	612838	1209666	-78309		$1,287,975	
	A5	92	296	656694	196661	853355	-51203		$904,558	
	B0	57	276	719082	69429	788511	-74501		$863,012	
	B6	131	91	167582	174484	342066	-32496		$374,562	
	B7	135	603	562665	279053	841718	-21183		$862,901	
	K3	109	6722	3836290	422450	4258740	-252620		$4,511,360	
					DAILY	C130,E,K->	$11,967	$658,185		
					AVAILABILITY					
ROW TOTALS		645	8107	$6,539,141	$1,754,915	$8,294,056	($510,312)	$658,185	$9,462,553	$373,767
CV580	A4	121	150	666084	608315	1274399	-100313		$1,374,712	
	A5	92	287	647116	199833	846949	-45070		$892,019	
	B0	57	276	718359	68725	787084	-74557		$861,641	
	B6	131	100	197638	144453	342091	-36035		$378,126	
	B7	135	603	562624	257016	819640	-21183		$840,823	
	K3	109	10125	5029793	448149	5477942	-298822		$5,776,764	
					DAILY	CV580->	$3,902	$214,610		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	11541	$7,821,614	$1,726,491	$9,548,105	($575,980)	$214,610	$10,338,695	($502,375)

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B737	A4	121	120	602719	607164	1209883	-78802		$1,288,685	
	A5	92	302	667696	196824	864520	-53214		$917,734	
	B0	57	276	718911	68957	787868	-74814		$862,682	
	B6	131	114	217956	152558	370514	-42312		$412,826	
	B7	135	603	562640	267385	830025	-21183		$851,208	
	K3	109	7958	4270564	428922	4699486	-254940		$4,954,426	
					DAILY	B737-200->	$6,878	$378,290		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9373	$7,040,486	$1,721,810	$8,762,296	($525,265)	$378,290	$9,665,851	$170,469
C130A	A4	121	120	598147	609712	1207859	-77918		$1,285,777	
	A5	92	301	666952	196848	863800	-53076		$916,876	
	B0	57	276	718684	69030	787714	-74738		$862,452	
	B6	131	107	187541	154579	342120	-39662		$381,782	
	B7	135	603	562645	269570	832215	-21183		$853,398	
	K3	109	7958	4271116	429983	4701099	-254942		$4,956,041	
					DAILY	C130A->	$3,681	$202,455		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	9365	$7,005,085	$1,729,722	$8,734,807	($521,519)	$202,455	$9,458,781	$377,539
S2T	A4	121	149	665727	602773	1268500	-99784		$1,368,284	
	A5	92	300	664700	198762	863462	-52411		$915,873	
	B0	57	276	718584	68588	787172	-74612		$861,784	
	B6	131	118	213662	139447	353109	-37640		$390,749	
	B7	135	603	562632	253188	815820	-21183		$837,003	
	K3	109	10403	5160182	475047	5635229	-306425		$5,941,654	
					DAILY	S2T->	$5,092	$280,060		
					AVAILABILITY		$0	$0		
ROW TOTALS		645	11849	$7,985,487	$1,737,805	$9,723,292	($592,055)	$280,060	$10,595,407	($759,087)

PHOENIX SERVICE AREA - NF (APACHE-SITGRAVES, COCONINO, CORONADO, GOLA, PRESCOTT, TONTO), BLM (PHEONIX)
26-Oct-96 91 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:05 AM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
T3000	G1	265	2206	1720159	218678	1938837	-1138096		$3,076,933	
	G4	489	1160	1333576	40030	1373606	-699295		$2,072,901	
	G5	128	3458	1547226	94185	1641411	-238318		$1,879,729	
	G6	278	9864	6475539	1403137	7878676	-849633		$8,728,309	
	G9	100	2245	1025640	133622	1159262	15230		$1,144,032	
	H2	325	12227	4474411	964020	5438431	-331087		$5,769,518	
	PH	56	700	27486	92347	119833	-10892		$130,725	
					DAILY	T3000->	$2,887	$262,717		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31860	$16,604,037	$2,946,019	$19,550,056	($3,252,091)	$262,717	$23,064,864	$0
P2T	G1	265	2206	1720050	218787	1938837	-1138096		$3,076,933	
	G4	489	1160	1333656	39918	1373574	-699295		$2,072,869	
	G5	128	3458	1548082	92835	1640917	-238353		$1,879,270	
	G6	278	9864	6475539	1403137	7878676	-849633		$8,728,309	
	G9	100	2245	1025646	132578	1158224	15230		$1,142,994	
	H2	325	12295	4514366	904822	5419188	-330529		$5,749,717	
	PH	56	700	27740	91926	119666	-10895		$130,561	
					DAILY	P2T->	$4,636	$421,876		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31928	$16,645,079	$2,884,003	$19,529,082	($3,251,571)	$421,876	$23,202,529	($137,665)
E2C	G1	265	2206	1721594	217243	1938837	-1138096		$3,076,933	
	G4	489	1160	1334166	39868	1374034	-699338		$2,073,372	
	G5	128	3636	1584985	95689	1680674	-265411		$1,946,085	
	G6	278	9864	6478716	1399960	7878676	-849633		$8,728,309	
	G9	100	2247	1028226	131115	1159341	15231		$1,144,110	
	H2	325	13330	5085391	868379	5953770	-330000		$6,283,770	
	PH	56	712	29181	88198	117379	-11111		$128,490	
					DAILY	E2C->	$3,131	$284,921		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	33155	$17,262,259	$2,840,452	$20,102,711	($3,278,358)	$284,921	$23,665,990	($601,126)
S3	G1	265	2206	1720003	218834	1938837	-1138096		$3,076,933	
	G4	489	1160	1334444	39638	1374082	-699342		$2,073,424	
	G5	128	3801	1675740	91634	1767374	-292127		$2,059,501	
	G6	278	9864	6477718	1400958	7878676	-849633		$8,728,309	
	G9	100	2247	1027147	132440	1159587	15229		$1,144,358	
	H2	325	12502	4649505	886987	5536492	-332719		$5,869,211	
	PH	56	700	27740	89578	117318	-10892		$128,210	
					DAILY	S3->	$3,131	$284,921		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	32480	$16,912,297	$2,860,069	$19,772,366	($3,307,580)	$284,921	$23,364,867	($300,003)
A10	G1	265	2206	1718466	220371	1938837	-1138096		$3,076,933	
	G4	489	1160	1334157	39909	1374066	-699338		$2,073,404	
	G5	128	3637	1584449	98643	1683092	-265459		$1,948,551	
	G6	278	9864	6475952	1402724	7878676	-849633		$8,728,309	
	G9	100	2248	1027684	133026	1160710	15232		$1,145,478	
	H2	325	13351	5061465	971500	6032965	-330577		$6,363,542	
	PH	56	732	28913	91347	120260	-11321		$131,581	
					DAILY	A10->	$2,581	$234,871		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	33198	$17,231,086	$2,957,520	$20,188,606	($3,279,192)	$234,871	$23,702,669	($637,805)

PHOENIX SERVICE AREA - NF (APACHE-SITGRAVES, COCONINO, CORONADO, GOLA, PRESCOTT, TONTO), BLM (PHEONIX)
26-Oct-96 91 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:05 AM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
L188	G1	265	2206	1720055	218782	1938837	-1138096		$3,076,933	
Civilian	G4	489	1160	1333652	39939	1373591	-699295		$2,072,886	
Purchase	G5	128	3458	1547239	94152	1641391	-238309		$1,879,700	
	G6	278	9864	6475510	1403166	7878676	-849633		$8,728,309	
	G9	100	2245	1025551	133650	1159201	15229		$1,143,972	
	H2	325	12225	4475784	962591	5438375	-331075		$5,769,450	
	PH	56	700	27492	92369	119861	-10892		$130,753	
					DAILY	L188->	$4,160	$378,560		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31858	$16,605,283	$2,944,649	$19,549,932	($3,252,071)	$378,560	$23,180,563	($115,699)
P3A	G1	265	2206	1720150	218687	1938837	-1138096		$3,076,933	
Military	G4	489	1160	1333653	39937	1373590	-699295		$2,072,885	
Purchase	G5	128	3458	1547324	94038	1641362	-238318		$1,879,680	
	G6	278	9864	6475539	1403137	7878676	-849633		$8,728,309	
	G9	100	2245	1025637	133638	1159275	15230		$1,144,045	
	H2	325	12227	4474547	964702	5439249	-331087		$5,770,336	
	PH	56	700	27481	92373	119854	-10892		$130,746	
					DAILY	P3A->	$3,131	$284,921		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31860	$16,604,331	$2,946,512	$19,550,843	($3,252,091)	$284,921	$23,087,855	($22,991)
C130E	G1	265	2206	1727364	211473	1938837	-1138096		$3,076,933	
Military	G4	489	1164	1344644	37504	1382148	-699299		$2,081,447	
Purchase	G5	128	3094	1402249	94951	1497200	-183688		$1,680,888	
	G6	278	9864	6482084	1396592	7878676	-849633		$8,728,309	
	G9	100	2134	985418	132843	1118261	12476		$1,105,785	
	H2	325	12016	4394713	959144	5353857	-321667		$5,675,524	
	PH	56	315	18661	95159	113820	-3239		$117,059	
					DAILY	C130E->	$3,681	$334,971		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	30793	$16,355,133	$2,927,666	$19,282,799	($3,183,146)	$334,971	$22,800,916	$263,948
C130E	G1	265	2206	1727364	211473	1938837	-1138096		$3,076,933	
Civilian	G4	489	1164	1344644	37504	1382148	-699299		$2,081,447	
Purchase	G5	128	3094	1402249	94951	1497200	-183688		$1,680,888	
	G6	278	9864	6482084	1396592	7878676	-849633		$8,728,309	
	G9	100	2134	985418	132843	1118261	12476		$1,105,785	
	H2	325	12016	4394713	959144	5353857	-321667		$5,675,524	
	PH	56	315	18661	95159	113820	-3239		$117,059	
					DAILY	C130E->	$5,852	$532,532		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	30793	$16,355,133	$2,927,666	$19,282,799	($3,183,146)	$532,532	$22,998,477	$66,387
L382G	G1	265	2206	1727364	211473	1938837	-1138096		$3,076,933	
	G4	489	1164	1344644	37504	1382148	-699299		$2,081,447	
	G5	128	3094	1402249	94951	1497200	-183688		$1,680,888	
	G6	278	9864	6482084	1396592	7878676	-849633		$8,728,309	
	G9	100	2134	985418	132843	1118261	12476		$1,105,785	
	H2	325	12016	4394713	959144	5353857	-321667		$5,675,524	
	PH	56	315	18661	95159	113820	-3239		$117,059	
					DAILY	C130,E,K->	$11,967	$1,088,997		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	30793	$16,355,133	$2,927,666	$19,282,799	($3,183,146)	$1,088,997	$23,554,942	($490,078)

PHOENIX SERVICE AREA - NF (APACHE-SITGRAVES, COCONINO, CORONADO, GOLA, PRESCOTT, TONTO), BLM (PHEONIX)

26-Oct-96 91 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
07:05 AM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
CV580	G1	265	2206	1721327	217510	1938837	-1138096		$3,076,933	
	G4	489	1160	1334333	39863	1374196	-699352		$2,073,548	
	G5	128	3641	1587511	95998	1683509	-265787		$1,949,296	
	G6	278	9864	6478486	1400190	7878676	-849633		$8,728,309	
	G9	100	2254	1031616	131793	1163409	15268		$1,148,141	
	H2	325	13245	5207632	889970	6097602	-332041		$6,429,643	
	PH	56	653	30459	92146	122605	-12400		$135,005	
					DAILY	CV580->	$3,902	$355,082		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	33023	$17,391,364	$2,867,470	$20,258,834	($3,282,041)	$355,082	$23,895,957	($831,093)
B737	G1	265	2206	1720149	218688	1938837	-1138096		$3,076,933	
	G4	489	1160	1333796	39932	1373728	-699307		$2,073,035	
	G5	128	3464	1551921	93878	1645799	-238734		$1,884,533	
	G6	278	9864	6475543	1403133	7878676	-849633		$8,728,309	
	G9	100	2246	1026127	133393	1159520	15229		$1,144,291	
	H2	325	12227	4426293	967058	5393351	-327277		$5,720,628	
	PH	56	700	27569	91756	119325	-10892		$130,217	
					DAILY	B737-200->	$6,878	$625,898		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31867	$16,561,398	$2,947,838	$19,509,236	($3,248,710)	$625,898	$23,383,844	($318,980)
C130A	G1	265	2206	1720033	218804	1938837	-1138096		$3,076,933	
	G4	489	1160	1333651	39943	1373594	-699295		$2,072,889	
	G5	128	3458	1547203	94406	1641609	-238318		$1,879,927	
	G6	278	9864	6475539	1403137	7878676	-849633		$8,728,309	
	G9	100	2245	1025534	133862	1159396	15230		$1,144,166	
	H2	325	12227	4469370	980220	5449590	-331087		$5,780,677	
	PH	56	700	27434	92691	120125	-10892		$131,017	
					DAILY	C130A->	$3,681	$334,971		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	31860	$16,598,764	$2,963,063	$19,561,827	($3,252,091)	$334,971	$23,148,889	($84,025)
S2T	G1	265	2206	1720981	217856	1938837	-1138096		$3,076,933	
	G4	489	1160	1333656	39918	1373574	-699295		$2,072,869	
	G5	128	3642	1589833	94344	1684177	-265665		$1,949,842	
	G6	278	9864	6475539	1403137	7878676	-849633		$8,728,309	
	G9	100	2255	1032800	130940	1163740	15269		$1,148,471	
	H2	325	13015	5017800	862990	5880790	-329564		$6,210,354	
	PH	56	850	36968	94343	131311	-17753		$149,064	
					DAILY	S2T->	$5,092	$463,372		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		1641	32992	$17,207,577	$2,843,528	$20,051,105	($3,284,737)	$463,372	$23,799,214	($734,350)

REDDING SERVICE AREA - (KLAMATH, LASSEN, MENDOCINO, MODOC, SIX RIVERS, PLUMUS, SHASTA-TRINITY)
25-Oct-96 108 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
06:47 PM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
T3000	M5	154	6729	6706006	1328050	8034056	-10138279		$18,172,335	
	M6	118	2167	1614812	456998	2071810	-1360016		$3,431,826	
	M8	54	1037	769987	202980	972967	-2371471		$3,344,438	
	M9	113	2922	2007215	278836	2286051	-1776248		$4,062,299	
	N0	59	1587	5079535	174989	5254524	-2965370		$8,219,894	
	N1	203	720	1467814	1124326	2592140	-4377770		$6,969,910	
	N4	208	1892	3865342	2539047	6404389	-3187005		$9,591,394	
					DAILY	T3000->	$2,887	$311,796		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17054	$21,510,711	$6,105,226	$27,615,937	($26,176,159)	$311,796	$54,103,892	$0
P2T	M5	154	6729	6706286	1328255	8034541	-10138317		$18,172,858	
	M6	118	2167	1616436	455119	2071555	-1360285		$3,431,840	
	M8	54	1037	763225	198270	961495	-2371238		$3,332,733	
	M9	113	2922	2007753	278510	2286263	-1776300		$4,062,563	
	N0	59	1587	5079749	174775	5254524	-2965370		$8,219,894	
	N1	203	720	1467807	1125083	2592890	-4377770		$6,970,660	
	N4	208	1892	3877115	2477154	6354269	-3188292		$9,542,561	
					DAILY	P2T->	$4,636	$500,688		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17054	$21,518,371	$6,037,166	$27,555,537	($26,177,572)	$500,688	$54,233,797	($129,905)
E2C	M5	154	9488	8974652	1331689	10306341	-13703820		$24,010,161	
	M6	118	2167	1613931	453661	2067592	-1359630		$3,427,222	
	M8	54	1084	787793	196714	984507	-2373008		$3,357,515	
	M9	113	2918	2005841	277072	2282913	-1773605		$4,056,518	
	N0	59	1587	5079623	174901	5254524	-2965370		$8,219,894	
	N1	203	720	1466060	1124331	2590391	-4377903		$6,968,294	
	N4	208	2902	4836542	2571068	7407610	-4986609		$12,394,219	
					DAILY	E2C->	$3,131	$338,148		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	20866	$24,764,442	$6,129,436	$30,893,878	($31,539,945)	$338,148	$62,771,971	($8,668,079)
S3	M5	154	9485	8965511	1328155	10293666	-13700774		$23,994,440	
	M6	118	2167	1613668	455034	2068702	-1359570		$3,428,272	
	M8	54	1040	777600	200218	977818	-2370825		$3,348,643	
	M9	113	2913	1992537	276991	2269528	-1768814		$4,038,342	
	N0	59	1587	5080051	174473	5254524	-2965370		$8,219,894	
	N1	203	719	1465698	1124427	2590125	-4377507		$6,967,632	
	N4	208	2818	4608736	2533957	7142693	-4854103		$11,996,796	
					DAILY	S3->	$3,131	$338,148		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	20729	$24,503,801	$6,093,255	$30,597,056	($31,396,963)	$338,148	$62,332,167	($8,228,275)
A10	M5	154	9488	8974219	1333650	10307869	-13703820		$24,011,689	
	M6	118	2167	1612529	456694	2069223	-1359630		$3,428,853	
	M8	54	1084	787519	201599	989118	-2373293		$3,362,411	
	M9	113	2926	2016279	278212	2294491	-1780562		$4,075,053	
	N0	59	1587	5079337	175187	5254524	-2965370		$8,219,894	
	N1	203	720	1466298	1124419	2590717	-4378237		$6,968,954	
	N4	208	2843	4659984	2663545	7323529	-4895307		$12,218,836	
					DAILY	A10->	$2,581	$278,748		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	20815	$24,596,165	$6,233,306	$30,829,471	($31,456,219)	$278,748	$62,564,438	($8,460,546)

REDDING SERVICE AREA - (KLAMATH, LASSEN, MENDOCINO, MODOC, SIX RIVERS, PLUMUS, SHASTA-TRINITY)

25-Oct-96 108 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
06:47 PM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
L188	M5	154	6729	6704510	1327778	8032288	-10138026		$18,170,314	
CIVILIAN	M6	118	2167	1613529	456686	2070215	-1359630		$3,429,845	
PURCHASE	M8	54	1038	768064	201841	969905	-2371806		$3,341,711	
	M9	113	2913	1993859	278254	2272113	-1768973		$4,041,086	
	N0	59	1587	5079575	174949	5254524	-2965370		$8,219,894	
	N1	203	719	1465576	1124471	2590047	-4372207		$6,962,254	
	N4	208	1891	3857271	2507253	6364524	-3184847		$9,549,371	
					DAILY	L188->	$4,160	$449,280		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17044	$21,482,384	$6,071,232	$27,553,616	($26,160,859)	$449,280	$54,163,755	($59,863)
P3A	M5	154	6729	6705078	1327812	8032890	-10138117		$18,171,007	
MILITARY	M6	118	2167	1613764	456724	2070488	-1359690		$3,430,178	
PURCHASE	M8	54	1038	769668	201859	971527	-2372148		$3,343,675	
	M9	113	2921	2004403	278241	2282644	-1775930		$4,058,574	
	N0	59	1587	5079569	174955	5254524	-2965370		$8,219,894	
	N1	203	719	1465576	1124473	2590049	-4372207		$6,962,256	
	N4	208	1891	3858944	2512024	6370968	-3185065		$9,556,033	
					DAILY	P3A->	$3,131	$338,148		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17052	$21,497,002	$6,076,088	$27,573,090	($26,168,527)	$338,148	$54,079,765	$24,127
C130E,K	M5	154	6732	6710184	1330808	8040992	-10139433		$18,180,425	
MILITARY	M6	118	2167	1614772	458634	2073406	-1359630		$3,433,036	
PURCHASE	M8	54	1030	750751	203230	953981	-2358950		$3,312,931	
	M9	113	2428	1627121	277691	1904812	-1343888		$3,248,700	
	N0	59	1526	4881125	172489	5053614	-2839599		$7,893,213	
	N1	203	716	1456793	1123986	2580779	-4354982		$6,935,761	
	N4	208	1848	3651604	2373341	6024945	-3106539		$9,131,484	
					DAILY	C130E->	$3,681	$397,548		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	16447	$20,692,350	$5,940,179	$26,632,529	($25,503,021)	$397,548	$52,533,098	$1,570,794
C130E,K	M5	154	6732	6710184	1330808	8040992	-10139433		$18,180,425	
CIVILIAN	M6	118	2167	1614772	458634	2073406	-1359630		$3,433,036	
PURCHASE	M8	54	1030	750751	203230	953981	-2358950		$3,312,931	
	M9	113	2428	1627121	277691	1904812	-1343888		$3,248,700	
	N0	59	1526	4881125	172489	5053614	-2839599		$7,893,213	
	N1	203	716	1456793	1123986	2580779	-4354982		$6,935,761	
	N4	208	1848	3651604	2373341	6024945	-3106539		$9,131,484	
					DAILY	C130E->	$5,852	$632,016		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	16447	$20,692,350	$5,940,179	$26,632,529	($25,503,021)	$632,016	$52,767,566	$1,336,326
L382G	M5	154	6732	6710184	1330808	8040992	-10139433		$18,180,425	
	M6	118	2167	1614772	458634	2073406	-1359630		$3,433,036	
	M8	54	1030	750751	203230	953981	-2358950		$3,312,931	
	M9	113	2428	1627121	277691	1904812	-1343888		$3,248,700	
	N0	59	1526	4881125	172489	5053614	-2839599		$7,893,213	
	N1	203	716	1456793	1123986	2580779	-4354982		$6,935,761	
	N4	208	1848	3651604	2373341	6024945	-3106539		$9,131,484	
					DAILY	C130,E,K->	$11,967	$1,292,436		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	16447	$20,692,350	$5,940,179	$26,632,529	($25,503,021)	$1,292,436	$53,427,986	$675,906

REDDING SERVICE AREA - (KLAMATH, LASSEN, MENDOCINO, MODOC, SIX RIVERS, PLUMUS, SHASTA-TRINITY)
25-Oct-96 108 = DAYS OF AVAILABILITY FOR 1ST AIRTANKER
06:47 PM 0 = DAYS OF AVAILABILITY FOR 2ND AIRTANKER
$0 = DAILY AVAILABILITY FOR 2ND AIRTANKER
0 = TYPE OF 2ND AIRTANKER

ALTERNATIVE	UN	FREQ	ACRES BURNED	AVERAGE ACRE FFF	UNIT MISSION COST	TOTAL FFF	NET VALUE CHANGE	AIRTANKER DAILY AVAILABILITY	COLUMN TOTAL	CHANGE FROM CURRENT
CV580	M5	154	9488	8973822	1334200	10308022	-13703576		$24,011,598	
	M6	118	2167	1612672	454446	2067118	-1359630		$3,426,748	
	M8	54	1085	790777	197179	987956	-2374525		$3,362,481	
	M9	113	2926	2016319	277010	2293329	-1780562		$4,073,891	
	N0	59	1587	5079214	175310	5254524	-2965370		$8,219,894	
	N1	203	719	1468955	1124559	2593514	-4373885		$6,967,399	
	N4	208	2911	4879037	2614823	7493860	-5002331		$12,496,191	
					DAILY	CV580->	$3,902	$421,416		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	20883	$24,820,796	$6,177,527	$30,998,323	($31,559,879)	$421,416	$62,979,618	($8,875,726)
B737	M5	154	6730	6707731	1327518	8035249	-10139300		$18,174,549	
	M6	118	2167	1613822	455972	2069794	-1359630		$3,429,424	
	M8	54	1037	767231	201152	968383	-2370842		$3,339,225	
	M9	113	2913	1993814	278125	2271939	-1768973		$4,040,912	
	N0	59	1587	5079644	174880	5254524	-2965370		$8,219,894	
	N1	203	719	1465398	1124453	2589851	-4376708		$6,966,559	
	N4	208	2808	4563310	2582830	7146140	-4842538		$11,988,678	
					DAILY	B737-200->	$6,878	$742,824		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17961	$22,190,950	$6,144,930	$28,335,880	($27,823,361)	$742,824	$56,902,065	($2,798,173)
C130A	M5	154	6729	6705038	1328109	8033147	-10138117		$18,171,264	
	M6	118	2167	1613572	457141	2070713	-1359690		$3,430,403	
	M8	54	1037	768437	202303	970740	-2370869		$3,341,609	
	M9	113	2922	2005329	278901	2284230	-1776035		$4,060,265	
	N0	59	1587	5079518	175006	5254524	-2965370		$8,219,894	
	N1	203	719	1465582	1124484	2590066	-4372207		$6,962,273	
	N4	208	1891	3857930	2527582	6385512	-3185315		$9,570,827	
					DAILY	C130A->	$3,681	$397,548		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	17052	$21,495,406	$6,093,526	$27,588,932	($26,167,603)	$397,548	$54,154,083	($50,191)
S2T	M5	154	9482	8958333	1333586	10291919	-13698018		$23,989,937	
	M6	118	2167	1614909	451949	2066858	-1359948		$3,426,806	
	M8	54	1087	808268	199149	1007417	-2378027		$3,385,444	
	M9	113	3437	2239588	281324	2520912	-1837891		$4,358,803	
	N0	59	1587	5079555	174969	5254524	-2965370		$8,219,894	
	N1	203	719	1466599	1124426	2591025	-4375237		$6,966,262	
	N4	208	2936	4977271	2663378	7640649	-5038427		$12,679,076	
					DAILY	S2T->	$5,092	$549,936		
					AVAILABILITY	R2000->	$0	$0		
ROW TOTALS		909	21415	$25,144,523	$6,228,781	$31,373,304	($31,652,918)	$549,936	$63,576,158	($9,472,266)

Night Operations

APPENDIX F.

Required Avionics Equipment for Night Retardant Operations

The installation of the equipment cannot only be in the airtanker alone. Ground forces will involved in fighting the fire. Therefore a lead plane or Air Tactical Group Supervisor (ATGS) will be required to assure that the drop zone is clear. (Reference FAA waiver to low level flying which requires a lead plane to assure the approach, drop and egress is clear in congested areas.) Hence, lead planes will be required to have equipment installed. Also, since this is a national effort and large fire support should be considered, ATGS will be involved in multiple division fires. To achieve the benefits of night operations, the ATGS aircraft must also be upgraded with equipment.

The basic capability for each of these aircraft will be the same. However, the installed equipment does not. Below are the type of equipment which are required for each type of aircraft.

Lead Plane	ATGS	Airtanker
FLIR on gimbals	FLIR on gimbals	FLIR
Helmet Display	Helmet Display	HUD
Moving Map Display & GPS targeting Sys	Moving Map Display & GPS targeting Sys	Moving Map Display & GPS Targeting Sys
INS/Attitude Sensor	Strobe Lights	INS/Attitude Sensor
Strobe Lights	TCAS	Strobe Lights
TCAS		TCAS
Radar Altimeter		Radar Altimeter

For the detection system, forward Looking Infrared (FLIR) is the best solution for sensing the environment over a fire at night. Infrared energy is in a wave length just beyond the visible light spectrum. It is not susceptible to refraction caused by water vapor, smoke or haze suspended in the atmosphere. Or in other words, it "looks right through" fog, clouds, smoke and haze. By contrast, light amplification systems (night vision systems) only amplify the existing visible light at night. The existing light may be caused by the moon, refracted light from nearby city lights, etc. These sources are unreliable in that the moon cycles from full to new, cities may not be nearby, etc. Therefore, reliance on this technology for night operations is inferior to infrared. Additionally, infrared may still be used during the day and enhance operations. Whereas, light amplification systems are only operable at night. The lead plane and ATGS require gimbal mounted FLIR because of the role they perform over the fire. These aircraft remain on station and constantly survey the fire. Gimbal mounting allows the FLIR to slew in all directions regardless of the aircraft heading. The airtankers would not require a gimbal mount FLIR. Airtankers are only over the fire for a short time in comparison to the lead plane or ATGS. They would be shown the approach and drop by being lead. Therefore, the FLIR would be fixed forward to view what was in front of the aircraft.

The display provided to the pilot is different among the aircraft in the same way as the FLIR. The lead plane and ATGS would use a helmet mounted display which would project the FLIR image onto the face shield of the helmet. This provides a view of the fire scene where ever the pilot or ATGS looks. The helmet would be instrumented to detect the head movements of the person wearing it and slew the gimbal mounted FLIR to look in that direction. Because the FLIR detector is mounted on the belly of the aircraft, the person whe aircraft and see the fire seen under the aircraft. The airtanker would use a Heads Up Display (HUD). The HUD is a stationary display device which acts similar to a TelePrompTer. It can be looked through, but images are combined in the glass and focused at infinity such that the images can be seen or looked through. The helmet system works the same way.

A moving map display and GPS targeting system is required to be installed in each aircraft. The FLIR will provide a view of the environment over the fire in a monochrome display. In this regard, some objects will look the same on the display. For example, large flat rock will be indistinguishable from a grass area, or small pond, etc. This is not to say that objects cannot be discerned with FLIR imaging. The system displays thermal images and the resolution does not display texture well, as does a camera using visible light. So the ability to describe ground features will not be as precise as during the day. Hence an alternate means is required to identify the target. Because the lead plane or ATGS has been orbiting the fire constantly, they will be able to record the retardant drops with latitude and longitude coordinates. These can then be used to identify the next drop starting point. Commercial systems already exist in the aerial agriculture market that automatically control the spraying of chemicals base on the ground track of the aircraft using GPS. These systems may only require slight modification for aerial retardant application.

The intent of the helmet and HUD display systems is to keep the pilot's eyes out side the cockpit at all times during critical low level flying, because every time the pilot looks down at instruments, the pilot is not looking at where the plane is going. During low level flight, airspeed, aircraft attitude (nose up/down, wings level or in a bank) are critical bits of information to maintain safe flying. Displaying this information on the HUD or in the helmet allow the pilos without lookinnel instruments. Therefore a means to measure these parameters is necessary to provide as input to the display systems. An Inertial Navigation System (INS) or attitude sensing system would provide the necessary inputs to the display systems. The ATGS is not seen as needing this since they orbit several thousand feet over the fire and direct the air attack. Whereas the lead plane and airtanker operate at 150 feet over the terrain during drops.

Each aircraft will be equipped with high intensity strobe lights. This will aid the ground in seeing the approaching aircraft, as well as air to air visibility.

Fires attract spectators, both on the ground and in the air. All aircraft are built with transponders. Transponders were originally intended for use in heavy air traffic control areas. It was a means of identifying each aircraft to ground controllers. The same concept has been applied to the cockpit in the form of TCAS (Traffic alert and Collision Avoidance System). The system interrogates

signals from all aircraft within a twenty mile radius of the aircraft in which it (TCAS) is installed, and displays their location, bearing and distance on a screen. Hence, the pilot is now aware of all of the air traffic in his vicinity. If another aircraft gets to close, the system displays it as red and provides a tone to the pilot as a warning. The pilot can then take appropriate evasive action.

Due to the low level flying necessary during the retardant drops, the lead plane and airtanker will have a radar altimeter. This provides a continuous readout of the height above the ground. The equipment is required as a secondary indication to the FLIR display of clearance above the ground during low level flight. Additionally, this will aid in retardant drop effectiveness because having the altitude above the ground displayed in digital format is more accurate than a visual approximation by looking out the window during the night or day.

Details of Process to Determine Investments Needed at Airtanker Bases

APPENDIX G.

Details of Process to Determine Investments Needed at Airtanker Bases

CHARTER FOR AIRTANKER BASE STUDY GROUP

The Airtanker Base Study Group will provide detailed information to the National Airtanker Study Committee about the condition of and any capital improvement needs for each federal airtanker base to meet the Standards in the Interagency Retardant Base Planning Guide, Fixed and Rotor Wing (1995). The detailed dollar estimates of capital improvement needs will assist the Committee with the optimization of reasonable airtanker base and airtanker fleet possibilities.

To provide for consistency in the condition survey nation-wide, the Airtanker Base Study Group has prepared a Condition Survey Checklist based on the standards set in the Guide. This checklist will assist with the condition survey at each base by further defining the standards. The degree of accuracy of these estimates is expected to be within plus or minus 10%.

The condition survey is designed to address the condition of the airtanker base. In many cases nation-wide the airtanker base is just a part of an aerial firefighting facility. In these instances it is important to identify only those costs associated with the airtanker base.

GUIDING PRINCIPLES and ASSUMPTIONS

The most probable improvements needed at each base, will be those structures and facilities that will assure that wastes generated at the base are contained and disposed of in a manner that guarantees the environment surrounding the base (within the control of the agency) will not be adversely impacted.

Each base has a design capacity expressed in gallons per day or gallons per hour of retardant output based on the calculated daily peak demand. This design capacity is used to determine number of loading pits, gallons of storage of mixed and or bulk product and overall size of the base.

The stated design capacity will have concurrence from all organizational levels.

All improvements estimated to be needed are in accordance with the designed capacity of the base, and are the most cost efficient and cost effective solutions possible.

In respect to many of the standards in te Interagency Retardant Base Planning Guide, Fixed and Rotor Wing (1995), there is no appreciable difference between a Primary Base and a Reload Base.

Each base will receive as an objective and impartial condition survey as possible based on the current status of the base.

The estimated costs to allow for changes in chemical product will be identified.

An estimate of the size and cost to clean-up of the area currently used to dispose of liquid wastes from the airtanker base will be made.

ORIGINAL CONDITION SURVEY AND INSTRUCTIONS:

COVER PAGE

Airtanker Base: ________________ Region: ______________ Date: ____________

Summary of Information for Airtanker Base Prepared By

Team Members	Expertise
	Regional Airtanker Base Specialist
	Regional Facilities Engineer Rep.
	Local Airtanker Base Manager
	Forest Fire Management Officer
	Local Facilities Engineer Rep.

Narrative Report on the Current Condition Survey for Airtanker Base Prepared By

Team Members	Expertise
	Regional Airtanker Base Specialist
	Regional Facilities Engineer Rep.
	Local Airtanker Base Manager
	Forest Fire Management Officer
	Local Facilities Engineer Rep.

This Information and Current Condition Survey Reviewed By

	Forest Fire Management Officer
	Regional Airtanker Base Specialist
	Regional Aviation Safety Officer
	Regional Aviation Officer

This Information and Current Condition Survey Approved By

	Regional Director, Engineering
	Regional Director, Fire & Aviation

Summary of Information for Airtanker Base

Base Name: ____________________ Base Location: ________________________

Base Managed by: ____
(agency or agencies)

Mission: ____________________
(primary/reload)

Planned Gallons per Day: ________________ Planned Gallons per Hour: ______________

See next page for details to complete the next two items
Calculated Daily peak Demand (Liquid Product): ______________
Calculated Daily peak Demand (Dry Product): ______________

Average Gallons per Year: ________________ (last 10 year Average)

Average Gallons per Year for each Agency Served Based on Last _____ Years:

AGENCY	AVERAGE GALLONS PER YEAR

Largest Airtanker in terms of wheel loading and wingspan being

operated at the base: ____________________ ____________________________
(wheel loading) (wing span)

Current type(s) of Retardant base is designed for and can accommodate:

Tank Inventory:

Purpose	Size	Purpose	Size

How to Calculate the Calculated Daily Peak Demand

Liquid and Fluid Concentrate

Average Gallons Per Hour- Determine the average time it will take to load a 2,450 gallon airtanker. Use this number to compute a logical number of airtankers that can be loaded per hour, considering aircraft movement in and out of the loading pits. This will give you an average gallons per hour production rate. If there are several loading pumps multiply this number by the number of pumps.

Daily Peak Demand- Based on historical production at the base, determine the logical number of hours the base would be in peak production (peak production is when the base is loading the logical number of airtankers calculated above). "Average Gallons Per Hour" multiplied by the number of hours of peak production will give you the "Daily Peak Demand" expressed in gallons.

Mix Ratio- Determine the mix ratio for the product used at the base. Consider the possibility of changes in product from a smaller mix ratio to a larger mix ratio. They currently range from 3.6:1 to 5:1. Dividing the number of gallons required for the "Daily Peak Demand" by the preferred product mix ratio will give you the number of gallons of concentrate you need in storage to meet the "Daily Peak Demand"

Delivery Time- Another factor in determining the amount of concentrate storage is the time required to transport the product to the base after the order has been placed. Consider the historical transportation time into the storage requirements. Another factor to consider is the cost of expedited delivery. These costs should be weighed against the cost to provide storage.

Dry Product

Eductor or Batch Mixer- Use the manufacturer's computed data for production rates. Based on this production rate and the "Daily Peak Demand" calculate the amount of wet storage needed and the size of the storage area for the dry product.

INSTRUCTIONS

A Narrative Report on the Current Condition Survey for Airtanker Base

The narrative report will follow the format below.

I. Cost Summary Sheet
Display costs in this section in summary fashion in the order listed below.

II. Chemical Mixing Facility
- A. Receiving Pad/Dock
- B. Product Storage
- C. Water Supply
- D. Mixing Equipment
- E. Sampling and Testing
- F. Recirculation
- G. Distribution and Loading System
- H. Measurement Systems
- I. Other

III. Aircraft Handling Facilities
- A. Airport Master Plan
- B. Airport Capabilities
- C. Airport Improvements
- D. Runway(s)
- E. Taxiway(s)
- F. Apron(s), Taxilane(s)
- G. Pad(s), Loading Pit(s)
- H. Pad(s), Fueling/Maintenance, Standby and Parking
- I. Other

IV. Base Structures and Facilities
- A. Base Operations Office
- B. Pilot/Contractor Ready Room
- C. Workshop and Equipment Storage Area
- D. Security Fencing and Barriers
- E. Sanitary Facilities
- F. Lighting
- G. Ramp Wash-down Cleanup Facilities
- H. Contractor Work/Storage Area
- I. Signing and Marking
- J. Utilities and Services
- K. Access Road and Parking Areas
- L. Sanitation System
- M. Laundry
- N. Trash Disposal
- O. Backup Systems
- P. Safety
- Q. Landscaping and Layout
- R. Other

INSTRUCTIONS

A Narrative Report on the Current Condition Survey for Airtanker Base

V. Wash-Down Residues Treatment

A. Collection
B. Treatment
C. Disposal
D. Other

VI. Current Waste Disposal

A. Description of Current Method
B. Adequacy of Current Method
C. Estimated Size and Cost to Clean Up Current Site
D. Other

VII. Photographic Record

Provide color prints of overall facility and detailed photos of items needing to be upgraded. Make references to these photos in your narrative.

The findings of the Condition Survey should be reported to the National Airtanker Study Committee in a narrative format using the outline above. Condition Survey Narrative Report Due to National Airtanker Study Committee by October 16, 1995.

Each subject area will describe the current condition of the base. For each item requiring upgrading for each subject area, identify the following:

Item which requires upgrade
The reason for the upgrade
The proposed upgrade solution
The estimated cost of the upgrade
The basis of the estimated cost of the upgrade.

An example of how to complete an item of this survey follows

H. Measurement Systems

Measurements are made using the sight gages on the aircraft tanks. The base requires an upgrade to provide a more accurate measurement of retardant loaded on the aircraft. The upgrade will provide actual pounds of retardant pumped by the retardant contractor, and the actual weight of the retardant load. We propose the purchase of a Micromotion type flow meter. The cost of the upgrade is estimated at $xxxx.xx. This cost is based on the procurement of the meter at $yyyy.yy and miscellaneous plumbing changes valued at $zzz.zz.

INSTRUCTIONS

A Narrative Report on the Current Condition survey for Airtanker Base

Also provide a summary cost page showing the individual costs of upgrade and the final total. The individual costs will be at the same level of detail as the individual subject items.

An example of how to complete an item of this survey follows

H. Measurement Systems.

Flow Meter $xxxx.xx

The following standards and criteria by item have been extracted from the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995) and/or defined by the Airtanker Base Study Group of the National Airtanker Study Team. Each item is referenced by a page number from the Guide. The team conducting the Condition Survey should become familiar with all text within the Guide concerning the item being surveyed. Each Geographic Area representative currently has a copy of the Guide. As they become available, (3-4 weeks) a published copy of the Guide will be furnished to each airtanker base through the National Airtanker Study Committee.

If at all possible, the Condition Survey should be conducted while the base is in operation. Any problems, questions and/or concerns arising during the Condition Survey should be referred to Ward Monroe. The resolution of the problems or concerns will be distributed to all members of the Airtanker Study Group to maintain consistency.

Address questions to:

Ward Monroe
Office Phone: 503/883-6855
DG Address: W.Monroe:R06F20a
FAX: 503/883-6709
Home Phone: 503/882-3511
Winema National Forest Dispatch: 503/883-6850

Bernie Lionberger:
Office Phone: 208/772-3283
DG Address: R01F04a
FAX: 208/765-7443

CHECKLIST FOR
A Narrative Report on the Current Condition Survey for Airtanker Base

CHEMICAL MIXING FACILITY

RECEIVING PAD/DOCK (page 6)

Dimensions For Transport Equipment - The Receiving Pad/Dock is large enough to accommodate the largest flatbed trailer, air-slide unit or tanker trailer used to transport retardant concentrate or dry powder to the base. Access to the Pad/Dock is unconfined and adequate for tractor trailer vehicles.

Surface Condition - The surface of the Receiving Pad/Dock is in a condition that will facilitate cleanup of spilled product, and will not adversely affect unloading operations.

Drainage For Waste/Spill Management - There is adequate drainage to contain and collect the most probable amount of liquid spilled during unloading or transfer operations.

STORAGE OF PRODUCT (page 10 and Appendix F)

Capacity Meets Gallons Per Hour/Day Requirements - There is sufficient storage capacity to meet the gallons per hour and gallons per day requirements for the airtanker base. This includes the time required from dispatch of a product from the manufacture's supply point to receipt at the base.

Tank Condition - All tanks needed for the operation are in a condition that will not adversely affect the operation.

Tank Stability - All tanks needed for the operation are satisfactorily mounted on secure bases.

Tank Location - All tanks needed for the operation are located at the facility to maximize the space available and the efficiency of the operation.

Dry Powder/Containerized Storage Space - There is sufficient storage space for Dry Powder and Containerized products to meet the gallons per hour, gallons per day requirements of the base.

Dry Powder/Container Protection - There is adequate protection from the elements for Dry Powder and Containerized products being stored at the base. Considering operational use and over winter storage.

Flexibility To Store All Types Of Retardants - The base has the flexibility to store all types of retardants planned to be used at the base.

Containment For Waste/Spill Management - There is an adequate containment and recovery system in place for the most probable amount of product likely to be spilled in the storage area.

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WATER SUPPLY (page 19)

Storage To Meet Capacity - There is adequate water storage to meet the gallons per hour and gallons per day requirements of the base.

Delivery Flow and Volume - There is adequate delivery flow and volume to maintain the water supply needed for the gallons per hour and gallons per day requirements of the base.

Purity Requirements - The purity of the water supply is sufficient to mix with retardant. Back flow prevention valves are in place where water supply is directly connected to municipal or other domestic water systems.

MIXING EQUIPMENT (page 17)

Proportioning Equipment - Proportioning equipment and valves are in good condition, a system is in place to assure the fluid concentrate and water tank levels are maintained at a relative level.

Blending/Mixing Equipment - Blending equipment is in good condition and located to maximize the efficiency of the operation.

SAMPLING AND TESTING (page 8)

Quality Assurance - Facilities and equipment are available and in-place to insure that procedures required by the National Retardant Contract are being followed.

Quality Control - Facilities, equipment and procedures are available and in-place to insure quality control is being maintained in accordance with applicable requirements.

RECIRCULATION (page 15)

Recirculation System - The recirculation system is installed and operating in accordance with current guidelines for the product(s) being furnished from the base.

Condition of Recirculation System - The condition of the recirculation system does not adversely affect the operation or the quality of the product being furnished from the base.

DISTRIBUTION AND LOADING SYSTEMS (page 21)

Piping, Condition, Location - All pipe used in the distribution system is of adequate size and condition and is in a location so as to not adversely affect the operation.

Pumps, Condition, Location -All pumps used in the distribution system are of adequate size and condition and are in a location so as to not adversely affect the operation.

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DISTRIBUTION AND LOADING SYSTEMS (page 21) Continued

Valves, Condition, Location -All valves used in the distribution system are of adequate size and condition and are in a location so as to not adversely affect the operation.
Hoses, Condition, Location -All hoses used in the distribution system are of adequate size and condition and are in a location so as to not adversely affect the operation.

Engineering Analysis of Complete System - An engineering analysis of the complete system has been accomplished to maximize the efficiency of the distribution and loading system.

Containment For Waste/Spill Management - There is adequate containment for the most probable amount of liquid likely to be spilled during distribution and loading operations.

MEASUREMENT SYSTEMS (page 25)

Accuracy, - The measurement system in-place is regularly maintained and calibrated with an error of less that two percent.

Adequate Number To Meet Design Capacity - There are an adequate number of measurement devices to meet the gallons per hour and gallons per day requirements of the base.

Included In Engineering Analysis Of Complete System - The measurement devices have been included in the engineering analysis of the complete distribution and loading system.

AIRCRAFT HANDLING FACILITIES

AIRPORT (page 26)

Airport Master Plan - Consultation with the Airport Manager has confirmed there are no problems or conflicts with the Airtanker Base and the Airport Master Plan.

Airport Expansion/Improvements - Describe any proposed airport expansion and/or improvements planned in the near future that will affect airtanker and/or airtanker base operations.

Air traffic - There are no major conflicts with air traffic at the airport with Airtanker Operations and none in the foreseeable future.

Noise - Noise from Airtanker Operations is not a major issue at the airport, and not projected to be in the foreseeable future.

Approach/Departure - The approach and departure to the primary runway is not a safety issue with any of the aircraft currently in the Airtanker fleet. There is no indications that the approach and departure routes to the primary runway will be a problem within the foreseeable future.

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In the following sections (runways, taxiways, aprons, pits) the term planned means that which these currently built surfaces are capable of handling in terms of wheel loading, turn radius, etc. This may not be the same as the loading of the currently used airtankers identified in the Airtanker Base Information Sheet. The Airport Authority or airtanker base designer should maintain records of this information. Also, you should note if the Airport Authority has current plans approved and expects to receive funding to upgrade these surfaces.

RUNWAY(S) (page 28)

The Primary Runway and the combination of Elevation, Prevailing Wind, Ambient Air Temperature, Runway Length and aircraft landing/take-off gross weight has no adverse affect on the Airtankers planned to be operated from the airport.

TAXIWAY(S) (page 28)

Aircraft Maximum Take-off Weight - Taxiway(s) used by Airtankers to access the primary runway and loading pits are capable of accommodating the maximum gross weight of the largest airtanker planned to operate from the base. If not, waivers and over-gross permits have been issued by the airport authority.

Width - The Taxiway(s) used by airtankers to access the primary runway and loading pits are of sufficient width to accommodate the largest airtanker planned to operate from the base. Propeller wash does not create a problem with dust and/or loose debris along the edges of the Taxiway.

Surface Condition - The surface of the Taxiway(s) are in a condition that will not adversely affect airtanker operations.

Wingspan Clearance - There is sufficient clearance for the wingspan of the largest airtanker planned to be operated from the base.

APRON(S), TAXILANE(S) (page 29)

Aircraft Maximum Take-off Weight - The Apron(s)and Taxilane(s) are constructed and maintained for the maximum gross weight of the heaviest airtanker planned to operate from the base.

Dimensions - The dimensions of the Apron(s) and Taxilane(s) are large enough for the largest airtanker planned to operate from the base.

Surface Condition - The surface condition of the Apron(s) and Taxilane(s) are in a condition that will facilitate cleanup of spilled product and will not adversely affect airtanker operations.

Wingspan Clearance - There is sufficient clearance for the wingspan of the largest airtanker planned to operate from the base.

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PAD(S), LOADING PIT(S) (page 29-33)

Aircraft Maximum Take-off Weight - The Pad(s) and Loading Pit(s) are constructed and maintained for the maximum gross weight of the heaviest airtanker planned to operate from the base.

Dimensions - The dimensions of the Pad(s) and Loading Pit(s) are large enough for the largest airtanker planned to operate from the base.

Surface Condition - The surface condition of the Pad(s) and Loading Pit(s) are in a condition that will facilitate cleanup of spilled product and will not adversely affect airtanker operations. The surface of the Pad(s) and Loading Pit(s) are not adversely affected by aircraft fuel and/or retardant.

Wingspan Clearance - There is sufficient clearance for the wingspan of the largest airtanker planned to operate from the base.

Drainage For Waste Management - There is adequate drainage to contain and collect the most probable amount of liquid spilled and/or generated by airtanker operations on the Pad(s) and Loading Pit(s). Consider aircraft washdown, fueling, maintenance.

PAD(S), FUELING/MAINTENANCE, STANDBY AND PARKING (page 29)

Due to the size and complexity of airtanker operations at a particular base, is there a need to designate and develop pad(s) specifically for Fueling/Maintenance, Standby and Parking?

Aircraft Maximum Take-off Weight - The Fueling/Maintenance Pad(s) are designed and maintained for the maximum gross weight of the heaviest airtanker planned to operate from the base.

Dimensions - The dimensions of the Fueling/Maintenance Pad(s) are large enough for the largest airtanker planned to operate from the base.

Surface Condition - The surface condition of the Fueling/Maintenance Pad(s) are in a condition that will facilitate the cleanup of spilled liquids and will not adversely affect airtanker operations. The surface of the Pad(s) is not adversely affected by aircraft fuels, solvents, oils, or retardant.

Wingspan Clearance - There is sufficient clearance for the wingspan of the largest airtanker planned to operate from the base.

Drainage For Waste Management - There is adequate drainage to contain and collect the most probable amount of liquid spilled and/or generated by airtanker Fueling and Maintenance.

Meets Grounding Requirements - Grounding rods are installed and available to meet grounding requirements for the safe refueling of all aircraft planned to operate from the base.

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BASE STRUCTURES AND FACILITIES

All base structures and facilities meets applicable local, State and Federal Building Codes.

BASE OPERATIONS OFFICE (page 35)

Visibility OF Entire Mixing Plant and Ramp - There is adequate visibility of the entire ramp and mixing plant from the operations office.

Space For Expected Size Of Operations - There is adequate space for the number of people needed during maximum operating conditions.

Cooling, Heating, and Ventilation - Environmental conditions within the office are adequate for the climate of the area where the base is located.

Lighting - Lighting within the office are adequate.

Electrical Supply - The electrical supply for the office is adequate and in compliance with local codes.

Sound Proofing and Acoustics - There is adequate soundproofing and acoustics are such that the safety and efficiency of the people working in the office are not adversely affected during airtanker operations.

Communication and Office Equipment - There is adequate telephone and radio communications and office equipment available to meet the needs and requirements of the operation.

Ramp Communications - There is an adequate outside P.A., alert horn, and radio communications for ramp operations. Headsets are available for use during aircraft operations including hot loading operations.

PILOT/CONTRACTOR READY ROOM (page 36)

Space For Expected Size Of Operation - Adequate size to accommodate flight crews stationed at the base with additional space to handle crews on standby during extended operations.

Cooling, Heating, and Ventilation - Environmental conditions within the ready room are adequate for the climate of the area where base is located.

Toilet and Shower Facilities - Adequate toilet and shower facilities for both men and women. Capacity is adequate for the number of people routinely working at the base.

Food Preparation and Storage Facilities - Light food preparation and storage facilities are in-place such as a micro-wave oven, refrigerator and sink with hot and cold water.

Furniture For Comfort - Furniture in kinds and amounts to provide comfort during periods of standby.

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PILOT/CONTRACTOR READY ROOM (page 36) continued

Television/VCR For Training and Entertainment - Television with VCR for training and entertainment during long periods of standby.

WORKSHOP AND EQUIPMENT STORAGE AREA (page 37)

Space For Equipment Storage Needs - Workshop with adequate space to store tools and equipment needed for maintenance of base.

Tools And Equipment For Maintenance Of Equipment - Tools and equipment adequate to maintain base equipment.

SECURITY FENCING AND BARRIERS (page 38)

Height and Length - Security fence is a minimum of 6 feet in height and of sufficient length to provide full security to base.

Gates And Locks - Gates are located for convenience access with adequate locks for security.

SANITARY FACILITIES (page 38)

Meets Expected Capacity - Sewer system is adequate for size of facility and meets applicable codes and regulations.

LIGHTING (page 38)

Adequate For Expected Nighttime Operations - Exterior lighting system is adequate for any expected nighttime operations, and provides for security.

RAMP WASH-DOWN CLEANUP FACILITIES (page 39)

Equipment - Pumps and small diameter hoses to aid in cleaning ramp and mixing facilities. Pressure washer(s) available where needed to reduce overall amount of water used in cleanup and washdown.

Containment For Waste/Spill Management (Appendix F) - Waste water generated during ramp cleanup is contained and collected to be properly disposed of.

CONTRACTOR WORK AREA STORAGE (page 40)

Expected Capacity - Mixing and Loading contractor storage space for equipment and tools. Adequate for size of contractors expected operation.

Space For Contractor Personnel - Adequate space for contractors personnel during standby periods. May be included in Pilots/Contractor's Ready room space.

SIGNING AND MARKING (page 41)

For Safety Of Aircraft, Vehicles, Personnel - Adequate signing to provide information and safety for expected size of the operation.

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UTILITIES AND SERVICES (page 43)

Water Supply
Electrical Power Meets Code For Expected Capacity
Natural or Liquefied Gas, Heating Oil
Communications

ACCESS ROAD AND PARKING AREAS (page 45)

Adequate Size For Expected Capacity
Condition Of Road and Parking Surface

SANITATION SYSTEM (page 45)

Stormwater Discharge Meets EPA requirements
Domestic waste water and sewage system in-place and adequate

LAUNDRY (page 46)

Laundry system or service in place and adequate

TRASH DISPOSAL (page 46)

On-site trash disposal in-place and adequate
Commercial service available and adequate.
Hazardous material containers are available and not mixed with regular trash.

BACKUP SYSTEMS (page 47)

WATER

Water supply adequate and reliable

PUMPING

Reliable backup gas, diesel, or propane powered pumps.

NATURAL or LIQUIFIED GAS

Storage capacity large enough to insure availability

COMMUNICATIONS

Backup system available

SAFETY (page 47)

ADMINISTRATIVE CONTROLS

Safety plan
OSHA Requirements

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DECKS (PLATFORMS), WALKWAYS, STEPS, AND LADDERS (page 48)

Safe access, egress
Non-skid surfaces
Rails, cages

PROTECTIVE COVERS (page 49)

Grates/Protective covers over drains, pits, trenches
Protective covers over shafts, belts, gears

SUN PROTECTION (page 49)

Shaded rest areas in place and adequate

EMERGENCY EQUIPMENT (page 49)

Fire Extinguisher
Fire Protection
Emergency Showers and Eye Wash Facilities

CHEMICAL DUST (page 50)

Personal Protective Equipment Required by MSDS Available

SLIPPERY SURFACES (page 50)

Washdown Facilities Available
Non-skid Surfaces Where Needed.

WATER DAMAGE (page 50)

Electrical System Water Proof, Water Resistant (UL Approved)

FUEL SPILLS (page 50)

Fuel Spill Precautions and Plan in place

LANDSCAPING AND LAYOUT (page 51 and page 52)

STRESS REDUCTION

NOISE REDUCTION)

DIRT AND DUST

VISITOR CONTROL/SEPARATION

FUNCTIONAL SEPARATION