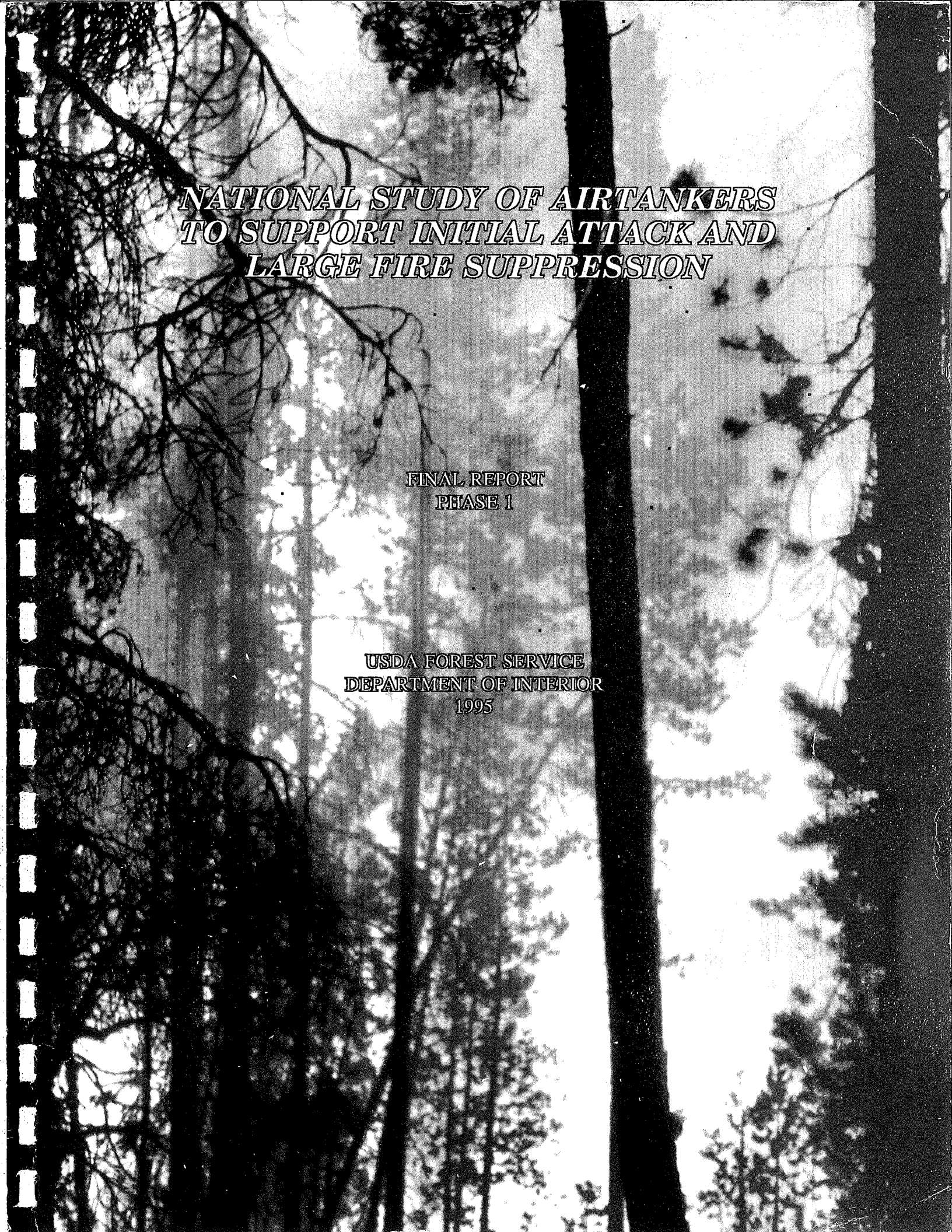

NATIONAL STUDY OF AIRTANKERS TO SUPPORT INITIAL ATTACK AND LARGE FIRE SUPPRESSION

FINAL REPORT
PHASE 1

USDA FOREST SERVICE
DEPARTMENT OF INTERIOR
1995

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FINAL REPORT
PHASE 1
REPORT WITH COMPLETE APPENDICES

USDA FOREST SERVICE
DEPARTMENT OF INTERIOR
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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 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, Wini Sorensen, Dan Winner, and Elizibeth Wright at the Area analysis level, the initial attack analysis could not have been completed. Many dedicated fire planners at the local level spent significant amounts of time supporting Area initial attack analysis. All work accomplished by individuals was done following a challenging a difficult fire season and during the November through January period of time. 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.

The photo on the cover was taken by Don Carlton on the Paulina Fire which occurred on the Deschutes National Forest in 1988.

EXECUTIVE SUMMARY
Phase 1 Report

BACKGROUND

In 1991, the National Shared Forces Task Force Report was completed by a team composed of Forest Service managers. This Report recommended a schedule for completion of studies to determine the most efficient level to staff and procure National Shared Forces. This study is the third chartered by this Report. 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 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 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. Alternatives will be examined and displayed for numbers and base locations

The Timeline This National Airtanker Study will be conducted in two phases. Phase 1 will provide the basis determining agency needs in the short term and become the basis for the 1996-1998 Forest Service and Department of Interior large airtanker contract solicitations. Phase 1 will be completed by March 1, 1995. Phase 2 will provide the basis for determining agency needs in the long term and become the basis for the Forest Service and Department of Interior large airtanker contract solicitations from 1999 into the future and until revised. Phase 2 will be completed by March 1, 1996.

GOALS/OBJECTIVES FOR PHASE 1

The goal for Phase 1 is to optimize the currently available airtanker fleet and find the best base locations. Realistic opportunities for change and interagency coordination will be considered.

Recommendations will be made on:

1. The number and size of airtankers by location.

2. If additional performance criteria should be part of contract specification at some airtanker base locations.

3. On the indication of need for airtankers with capacity of between 1000 and 2000 gallons.

4. On an indication of need to develop night time capability.

THE STUDY PROCESS FOR PHASE 1

Step 1. Examine historic uses and trends as well as airtanker base information on an interagency basis.
Initial attack data from local NFMAS analysis together with data on use of airtankers to support large fire suppression was identified as needed to be collected to support analysis.

Step 2. Develop alternatives to address scenarios for staffing and airtanker base locations.
The primary end product of this analysis was: 1) the number and size of airtankers by location; 2) if additional performance criteria should be part of contract specification at some airtanker base locations; and 3) on the indication of need for airtankers with capacity of between 1000 and 2000 gallons. To address these questions, the following scenarios where built within which alternatives addressed the theme of the scenario.

Scenario 1 - Current Program Based on 1995 Fire Season Staffing of Large Airtankers for Federal and State Agencies (30 Forest Service, 6 Department of Interior, and 5 State for 41 total)

Scenario 2 - No Federal Staffing of Large Airtankers

Scenario 3 - Current Program of Airtankers (Scenario 1) Used to Resolve Geographic Area Airtanker Base Location Issues

Scenario 4 - Current Number of Federal Airtankers Used to Determine Marginal Value of Turbine Capability by Airtanker Base

Scenario 5 - Reduced Forest Service Large Airtanker Program (25 airtankers)

Scenario 6 - Addition of Airtanker Capability Above Current Program Based on Geographic Area Discretion

Scenario 7 - Analysis of Airtanker in 1000-2000 Gallon Size Class Based on Geographic Area Discretion

Information was be gathered from all airtankers bases used to service large airtankers to determine the "state of health" of the airtanker base program.

Step 3. Use the NFMAS initial attack assessment (IAA) model to compare staffing and airtanker base alternatives as it relates to initial attack.
Forces used for initial attack of wildland fires are analyzed and justified using the National Fire Management Analysis System (NFMAS) and the BLM/BIA Fire Management Activity Plan.

Step 4. Examine historic retardant use on wildfires which have escaped initial attack to predicted airtanker needs to support extended attack and escaped wildfire needs.
Agency data bases were queried to gather information needed to develop estimates of airtanker use on fires. The focus was on wildfires greater than 100 acres in size. This information included the number

of large wildfires, the episodic nature with which they occurred and the average expected airtanker demand to service these escaped wildfires.

Step 5. Gather and analyze information on the physical status of airtanker bases.
A questionnaire was developed for completion by personnel at each federal airtanker base in the United States. The questionnaire focused on the gathering of information on the physical status of each base. The results were used to develop a collective list of needed capital improvements.

Step 6. Display procurement, staffing and base and dispatch flow options based on analysis results. Display advantages and disadvantages and costs through analysis.

Step 7. Develop recommendations to address goals/objectives for phase 1.

Step 8. Concerns and opportunities generated by phase 1 of this study and comments for future analysis in phase 2.

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 over the past eight years. 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.

PERFORM INITIAL ATTACK ANALYSIS BY DEVELOPING ALTERNATIVES TO ADDRESS SCENARIOS BY GEOGRAPHIC AREA

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 considers

initial attack support and was be used to analyze the effect of the alternatives. The local initial attack forces remained constant as airtanker staffing and locations were changed. Where use of the IAA model was not current or not used on an area, a equivalent process was allowed as long as consistency was maintained.

Airtanker Categories

Airtankers types are divided into five categories for the purpose of analysis. These five categories are as follows:

Engine Type	Tank Size	Category	Aircraft in Category
Turbine	1500 Gal.	T1500	To Be defined
Turbine	3000 Gal.	T3000	C-130A, P3A
Reciprocating	2200 Gal.	R2200	P2V, DC-4, P4Y2, SP2H, DC-6
Reciprocating	3000 Gal.	R3000	DC-7, KC-97
Cooperator	Misc.	Coop	Misc.

The total Annual Airtanker Program Cost was calculated as the sum of the airtanker availability for the season, the annual operation and maintenance costs of the airtanker base, and the annualized value of one time capital costs at the airtanker base.

The term Fire Suppression (FFF) Costs was 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 $0.758 per gallon. Average acre costs include all other fire suppression costs expressed on a per acre basis.

The term Net Value Change (NVC) Costs was 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.

The term Agency Alternative Cost was used to refer to sum of **one agency's** fire suppression costs, net value change costs, and airtanker program costs.

The term Alternative Cost was used to refer to the of **all agency's** fire suppression costs, net value change costs, and airtanker program costs.

Scenario 1 - Current Program Based on 1995 Fire Season Staffing of Large Airtankers for Federal and State Agencies (30 Forest Service, 6 Department of Interior, and 5 State for 41 total)

The goal of this scenario was for all geographic areas to "benchmark" their IAA Most Efficient Level (MEL) analysis so the airtanker information was based on what will be staffed in the 1995 fire season. There is only one alternative in this scenario. Airtanker staffing is described in box on page 13. Total annual fire frequency was 10,850 fires per year resulting in 474,575 acres burned. The expected FFF and NVC were $168,665,418 and -$132,419,059 respectively. The Annual Airtanker Program Cost for 1995 is $11,192,024 hence the sum of Total Alternative Cost for the one Alternative in this Scenario was $312,276,501.

Scenario 2 - No Federal Staffing of Large Airtankers

The goal for Scenario 2 was to determine a baseline value(s) to measure the benefit of an alternative and to define the value of the airtanker program as measured against any other alternative. All large airtankers including cooperator airtankers were not used. With the same total annual fire frequency of 10,850 fires per year, the resulting in 560,575 acres burned. The expected FFF and NVC were $223,682,074 and -$185,486,375 respectively. The Annual Airtanker Program Cost for 1995 is of course $0 hence the sum for the Total Alternative Cost for the one Alternative in this Scenario was $409,168,449.

The difference in values between Scenario 1 (IAA MEL Budget Level benchmarked to 1995 large airtanker staffing) and Scenario 2 (no large airtanker staffing) is as follows:

ACRES BURNED	(FFF) FIRE SUPPRESSION COST	(NVC) NET VALUE CHANGE	(ATPC) AIRTANKER PROGRAM COST	DIFFERENCE IN FFF + NVC ONLY BETWEEN SCENARIO 1 AND SCENARIO 2	BENEFIT / ATPC COST
85,990	$55,016,656	$53,067,316	$11,192,024	$ 96,891,948	8.7/1

The benefit to airtanker program cost ratio of this 1995 large airtanker program is ($96,891,948/$11,192,024) or 8.7 to 1. This benefit cost is to the initial attack program. Additional benefits can be attained in the support of large fire suppression.

Scenarios 3-7

The results of these Scenarios is embodied in the Recommendations.

HISTORIC RETARDANT USE on WILDFIRES THAT HAVE ESCAPED INITIAL ATTACK

Size class D-G fire occurrence increases in March mainly from the Eastern and Southern Area. The Alaska fire season can be seen in the peak in BLM occurrence in late June. The traditional western fire season starts in June and peaks on August. The late fire season due to East and Santa Ana in the western coastal areas and dry cold frontal winds in the intermountain areas is seen in late October and November.

Without regard for agency, the average number of gallons delivered per fire for fires from 100-5000 acres was 30,392 gallons. For fires 5000 acres and larger in size, the average gallons dropped was 202,205 gallons. The fires sampled were from all agencies and occurred within the last two years. Forest Service fire occurrence for fires greater than 100 acres (D-G) for the years 1970-1993 was displayed on a half-month basis (first two weeks of the month versus the last two weeks of the month). This same type of data was displayed for the BLM for the period 1980-1993.

Together, this information allowed for calculation of the expected number of airtanker plane-days (based on the 1980-1993 time period) that would be needed to support these large fires. An airtanker plane-day is one airtanker flying for 8 hours for one day. Staffing an additional number of airtankers to meet this demand would provide a benefit to large fire support as well as include a reduced compromise to initial attack by the drawing away of airtankers which support initial attack.

INFORMATION on the PHYSICAL STATUS of AIRTANKER BASES

Airtanker bases have evolved through the years as products and aircraft have changed. These changes have responded to short term needs rather than long range planning. Maintenance of facilities and equipment has been less than what is needed to meet acceptable standards of safety, health and sanitation. These issues and concerns have been recognized by government employees and the airtanker industry. Information was requested from each airtanker base to determine the physical status and associated capital improvements needed. An estimate of the total cost of capital improvements needed at airtanker bases is $58,363,174.

Staffing issues raised indicate a need for some type of career appointment for the Air Tanker Base Manager. Responses show 30% of the bases are staffed with Permanent Full Time employees, and 19% are staffed with Permanent Part Time employees. There are bases with a temporary employee as the Air Tanker Base Manager. There is a shortage of trained personnel available for extended operations and in some cases for seven day coverage.

DISPATCH FLOW CONTROLLING AIRTANKERS

Mobility of critical firefighting resources is the key to providing successful initial attack of ignitions during the episodal ignition events. Airtankers are a unique resource that can fly significant distances within logical mobilization times to provide relatively high fireline production rates on fires. A key to this mobility is maintaining an adequate dispatch flow managed at an organization level that maximizes flexibility and utilizes broadscale analysis in decision-making. Verification of priorities is best achieved from a perspective which maximizes effective utilization of these national shared resources.

There is a high correlation between the number of fires in the size class D-G and the episodal way fires start, mainly from lightning storms. Analysis from the Forest Service's Northern, Intermountain (Great Basin) and the Pacific Northwest Regions, indicates the percent fires greater than 100 acres that result for episodal ignition events is 70-80%.

Throughout the study effort, it became apparent that in some areas, dispatch of airtankers is automatic during some times of fire danger rating. In other areas, airtankers are not dispatched until someone is observing the fire and orders the airtanker. Both of these situations indicate a need for adequate information to determine if dispatch of airtanker resources is the reasonable action to employ. Issues of safety and economic efficiency arise immediately. The value of information to aid in the dispatch of firefighting resources can be high particularly when the consequences of an inadequate dispatch can result in an escaped fire. In addition, a resource dispatched will be delayed in responding to higher priority alarms until released hence an opportunity cost may also be appropriate in some situations. Phase 2 of this study has the opportunity to explore these issues and provide possible recommended solutions.

RECOMMENDATIONS

The Number and Size of Airtankers by Location for the 1996-1998 Contract Period

A table on page 43 contains the committee recommendations for staffing of large airtankers for the 1996-1998 contract period. This recommendation includes staffing airtankers at Hill AFB and West Yellowstone based on initial attack efficiency. The study committee recommends staffing one airtanker in the South to support the large fires in the Southern and Eastern Areas. This also has a benefit as the fire season is during a time of year that other resources from the west are several days travel away. The study committee recommends staffing two large airtankers in the Southwest Area for large fire support during the southwestern fire season and three airtankers in the Western United States for large fire support during the western fire season. The committee estimates the cost to procure and staff these additional airtankers to be $900,000-$1,000,000 annually.

Study Committee Recommendations on Airtanker Bases

California Area

Pursue development of airtanker base a Mather AFB and relocation of airtanker base at Hemet-Ryan to San Bernardino County Airport. Committee recommends that the Area analyze Ramona airtanker base as safety issues are of concern.

Pacific Northwest Area

Pursue relocation of new airtanker base at Wenatchee.

Rocky Mountain Area

Pursue necessary capital improvements at Jeffco. Pursue necessary maintenance at Rapid City so base can function as a reload airtanker base.

Southwest Area

Pursue consolidation of airtanker bases within the area with the closing of the airtanker base at Grand Canyon.

A subcommittee of area and agency airtanker base specialists and a project engineer from San Dimas will be tasked to evaluate and determine actual needs and detailed costs to upgrade bases to standards set in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995). This task will be accomplished during Phase 2 of the National Airtanker Study with findings and recommendations due by November of 1995.

The Forest Service and Department of Interior Washington Office's should work with EPA to address environmental issues.

The expectation from the National level is that the hosting unit will support airtanker base staffing and the physical plant in accordance with the standards in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995).

Indication of Need for Airtanker in the 1000-2000 Gallon Size Class

Two Areas analyzed T1500's in Scenario 7. Most areas were not able to analyze this alternative given the time to do Phase 1. The committee recommends further study in Phase 2.

Indication of Need for Nighttime Capability

The focus of the committee on accomplishing the data analysis to support the earlier questions, analysis was not performed on this topic. The committee recommends further study in Phase 2.

Airtankers Versus Airtanker Bases

A key to efficient utilization of airtankers is having fully functional airtanker bases. Without the physical plant in place, airtankers must fly from further distances to provide service to fires. On the other hand, airtankers need to be mobile which reinforces a need to manage airtanker flow at the highest practical coordination level.

Resolution Of Issues Identified In Phase 1 and To Be Resolved In Phase 2

The following issues were identified in Phase 1. Due to time and analytical constraints, it was not possible to resolve the issue in Phase 1. The study committee recommends that the issue(s) be resolved during Phase 2.

Alaska Area

The Committee recommends updating the BLM analysis in Alaska using more current data obtained and developed during Phase 1. The Alaska Division of Forestry should be included in this update. Pursue upgrading McGrath, Galena and Ft. Yukon airtanker bases to the standards in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995).

California Area

The Committee recommends that the Area analyze Ramona airtanker base. Safety issues are of concern. The runway is too short for all but two types of existing heavy airtankers, the requirement to land and sit loaded means that aircraft are not loaded to contract specifications and there is a great deal of encroachment to the runway area. Resolve the issue in the initial attack analysis where ground-based forces where being allowed to substitute for the airtankers.

Great Basin Area

The Committee endorses the desire of the BLM to explore the best airtanker base location in western Nevada. The Committee recommends gathering of data to define the proportionate use of Minden, Stead and Pocatello airtankers by agencies receiving retardant from these airtanker bases.

Northern Area

The Committee recommends that the Montana BLM and Northern Region conduct analysis not possible in Phase 1 on the capital investment value of Billings given initial attack benefits and the need to support large fires. Addition of an airtanker at West Yellowstone may provide influence on this analysis.

Pacific Northwest Area

The Committee recommends pursuing construction of new airtanker base at Wenatchee. Continue to pursue working with all agencies to allow for inclusion of all agency initial attack and large fire support data in Phase 2 analysis.

Rocky Mountain Area

The Committee recommends pursuing necessary capital improvements at Jeffco. Pursue necessary maintenance at Rapid City so base can function as a reload airtanker base. The Committee recommends gathering of data to define the proportionate use of Jeffco and Grand Junction airtankers by agencies receiving retardant from these airtanker bases. The Area should resolve the value of maintaining a reload base at Greybull.

Southwest Area

Pursue consolidation of airtanker bases within the area with the closing of the airtanker base at Grand Canyon.

Southern Area

The Committee endorses updating of NFMAS analysis. As a high priority, airtanker use at calibration must be at historic level. Analyze appropriate alternatives to display tradeoffs to other methods of initial attack. Continue to pursue working with all agencies to allow for inclusion of all agency initial attack and large fire support data in Phase 2 analysis.

The Committee Further Recommends

1. Establishment of and adherence to minimum training and performance standards for airtanker base personnel.

2. Adequate airtanker base facilities promotes efficient and safe use of airtankers. If the hosting unit is unwilling to support minimum base standards (as defined by the "guide"), then relocation of airtanker should be pursued.

3. Reaffirmation 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.

4. The airtanker base cost and airtanker availability should be funded on an interagency basis.

5. 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.

6. Phase 2 of this study should provide focus to the finding that significant benefits from using airtankers with larger capacity can be attained in certain defined situations. In addition, this phase should define the roles and interrelationships of all platforms that can deliver fire retardant.

CONCERNS and OPPORTUNITIES

1. Some areas have a concern with the assumptions used in the IAA as they apply to airtankers. Specificly, the assumption that the fireline production rate drops linearly from a maximum at zero rate-of-spread to zero fireline produced at a rate-of-spread of forty chains hour.

2. 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.

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

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

Phase 1 Report

BACKGROUND

In 1991, the National Shared Forces Task Force Report was completed by a team composed of Forest Service managers. This Report recommended a schedule for completion of studies to determine the most efficient level to staff and procure National Shared Forces. This study is the third chartered by this Report. 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 National Shared Forces Task Force Report 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.

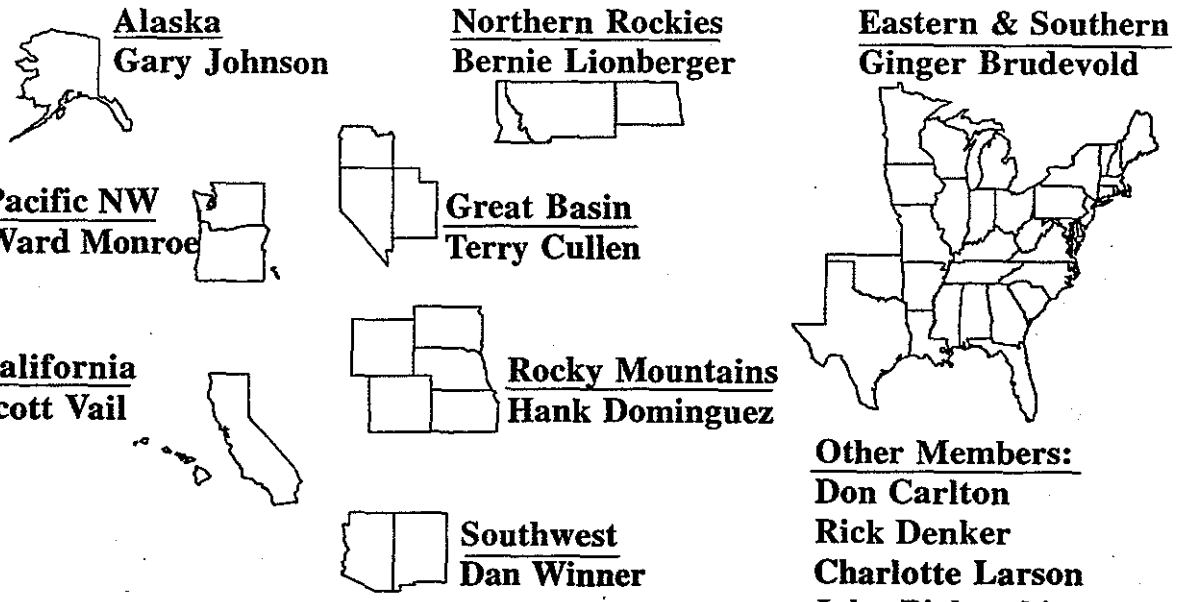
The first study completed under the umbrella of the National Shared Forces Task Force Report was the National study of Type I and II Helicopters To Support Large Fire Suppression (January 1993). The second study chartered by the NSFTFR Steering Committee is the National Aerial Delivered Firefighter Study which is currently in progress. The third study chartered is the National Airtanker Study.

THE STUDY TEAM

The NSFTFR Steering Committee has requested the USDA Forest Service's PNW Region provide the coordination and leadership for a National Airtanker Study (NATS). A Study Team has been established to conduct this effort. The committee has 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 is through the Bureau of Land Management. Coordination with Regional and State Levels as well as State agencies is through team members representing geographic areas. The committee members have been selected to represent agencies, technical specialty and geographic areas and are listed in Appendix A. Figure 1 on the next page defines the geographic areas and the person on the study team representing the area.

Figure 1.

National Airtanker Study
Geographic Area Representatives



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 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. Alternatives will be examined and displayed for numbers and base locations

The Timeline This National Airtanker Study will be conducted in two phases. Phase 1 will provide the basis determining agency needs in the short term and become the basis for the 1996-1998 Forest Service and Department of Interior large airtanker contract solicitations. Phase 1 will be completed by March 1, 1995. Phase 2 will provide the basis for determining agency needs in the long term and become the basis for the Forest Service and Department of Interior large airtanker contract solicitations from 1999 into the future and until revised. Phase 2 will be completed by March 1, 1996.

GOALS/OBJECTIVES FOR PHASE 1

The goal for Phase 1 was to optimize the currently available airtanker fleet and find the best base locations. Realistic opportunities for change and interagency coordination will be considered.

Recommendations will be made on:

1. The number and size of airtankers by location.

2. If additional performance criteria should be part of contract specification at some airtanker base locations.

3. On the indication of need for airtankers with capacity of between 1000 and 2000 gallons.

4. On an indication of need to develop night time capability.

GUIDING PRINCIPLES (ASSUMPTIONS) TO BE 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 included 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 1 are:

1. For the Forest Service and Bureau of Land Management, forces used for initial attack of wildland fires are analyzed and justified using the National Fire Management Analysis System (NFMAS). Some states also use NFMAS while other agencies use similar systems which are appropriate to each agencies 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 Phase 1, use of the Initial Attack Assessment (IAA) model and existing local National Fire Management Analysis System (NFMAS) analysis was assumed. Past history of demand, unavailability and current dispatch philosophy in initial attack analysis (NFMAS) was assumed.

2. Generally the overall information currently available was assumed to 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 1 did not critique airtanker operational effectiveness and efficiency at the incident.

GOALS/OBJECTIVES (GENERAL) FOR PHASE 2

The **initial goals** for Phase 2 follow. **These will be revisited and revised based on agency, cooperator and industry input at the beginning of Phase 2.** The initial goals are to optimize all reasonable airtanker base and airtanker fleet possibilities and is not constrained by the current fleet. A recommendation will be made defining the optimum airtanker numbers, size, and performance criteria by location. 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 2000 gallon size class, night use, the role of MAFFS and the role of Type I and II helicopters in the application retardant.

Phase 2 will utilize the best available technology. Relationships will be developed between historic and optimal demand. Consider use of a National flow model to reflect move-up and the conductivity to the system. Past history of demand and current dispatch philosophy in initial attack analysis (NFMAS) will be used. Airtankers including all helicopter types and multi-engine fixed wing platforms will be considered in Phase 2.

THE STUDY PLAN FOR PHASE 1

1. Examine historic uses and trends as well as airtanker base information on an interagency basis.

2. Develop alternatives to address scenarios for staffing and airtanker base locations.

3. Use the NFMAS initial attack assessment (IAA) model to compare staffing and airtanker base alternatives as it related to initial attack.

4. Examine historic retardant use on wildfires which have escaped initial attack to predicted airtanker needs to support extended attack and escaped wildfire needs.

5. Gather and analyze information on the physical status of airtanker bases.

6. Display procurement, staffing and base and dispatch flow options based on analysis results. Display advantages and disadvantages and costs through analysis.

7. Develop recommendations to address goals/objectives for phase 1.

8. Concerns and opportunities generated by the phase 1 of this study and comments for future analysis in phase 2.

THE STUDY PROCESS FOR PHASE 1

The diagram on page 7 helps one to understand the flow which guided the study process. The scope of this study was to determine the most efficient number of airtankers to support initial attack and large fire suppression. The use of the military (MAFFS) and 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 these resources are needed when private vendor sources for large airtankers are exhausted. MAFFS is an integral part of the total airtanker support during these events.

```
|<---IA--->|<-----Large Fire Suppression------>|<----Other---->|
|<------- Scope of this Airtanker Study------->|<---Military-->|
|<----- Private Sector Airtanker Supply ------>|     (MAFFS)
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Step 1. Examine historic uses and trends as well as airtanker base information on an interagency basis.

Initial attack data from local NFMAS analysis together with data on use of airtankers to support large fire suppression was identified as needed to be collected to support analysis. For each area, the purpose, data needed, data sources, and responsible person was identified. The historic period for gathering initial attack analysis varied based on local NFMAS analysis but in general included the time period 1980 - 1993. Data on airtanker use to support large wildfires varied but in general covers the 1980-1993 period of time.

Step 2. Develop alternatives to address scenarios for staffing and airtanker base locations.

The primary end product of this analysis is: 1) the number and size of airtankers by location; 2) if additional performance criteria should be part of contract specification at some airtanker base locations; and 3) on the indication of need for airtankers with capacity of between 1000 and 2000 gallons. To address these questions, the following scenarios where built within which alternatives addressed the theme of the scenario.

Scenario 1 -	Current Program Based on 1995 Fire Season Staffing of Large Airtankers for Federal and State Agencies (30 Forest Service, 6 Department of Interior, and 5 State for 41 total)
Scenario 2 -	No Federal Staffing of Large Airtankers
Scenario 3 -	Current Program of Airtankers (Scenario 1) Used to Resolve Geographic Area Airtanker Base Location Issues
Scenario 4 -	Current Number of Federal Airtankers Used to Determine Marginal Value of Turbine Capability by Airtanker Base
Scenario 5 -	Reduced Forest Service Large Airtanker Program (25 airtankers)

Scenario 6 - Addition of Airtanker Capability Above Current Program Based on Geographic Area Discretion

Scenario 7 - Analysis of Airtanker in 1000-2000 Gallon Size Class Based on Geographic Area Discretion

Detailed information on scenarios and alternatives analyzed by geographic region starts on page 12. Information will be gathered from all airtankers bases used to service large airtankers to determine the "state of health" of the airtanker base program.

Step 3. Use the NFMAS initial attack assessment (IAA) model to compare staffing and airtanker base alternatives as it relates to initial attack.

Forces used for initial attack of wildland fires are analyzed and justified using the National Fire Management Analysis System (NFMAS) and the BLM/BIA Fire Management Activity Plan. NFMAS initial attack assessment (IAA) model considers initial attack support and was used to analyze the effect of the alternatives. The local initial attack forces remained constant as airtanker staffing and locations are changed. Detailed information on initial attack analysis by Geographic Area is contained in Appendices C-K.

Step 4. Examine historic retardant use on wildfires which have escaped initial attack to predicted airtanker needs to support extended attack and escaped wildfire needs.

Agency data bases were queried to gather information needed to develop estimates of airtanker use on fires. The focus was on wildfires greater than 100 acres in size. This information included the number of large wildfires, the episodic nature with which they may occur and the average expected airtanker demand to service these escaped wildfires. Details of information gathered is contained in Appendices L and M.

Step 5. Gather and analyze information on the physical status of airtanker bases.

A questionnaire was developed for completion by personnel at each federal airtanker base in the United States. The questionnaire focused on the gathering of information on the physical status of each base. The results were used to develop a collective list of needed capital improvements. Detailing results from the questionnaire are in Appendix N.

Step 6. Display procurement, staffing and base and dispatch flow options based on analysis results. Display advantages and disadvantages and costs through analysis.

This is displayed in analysis section.

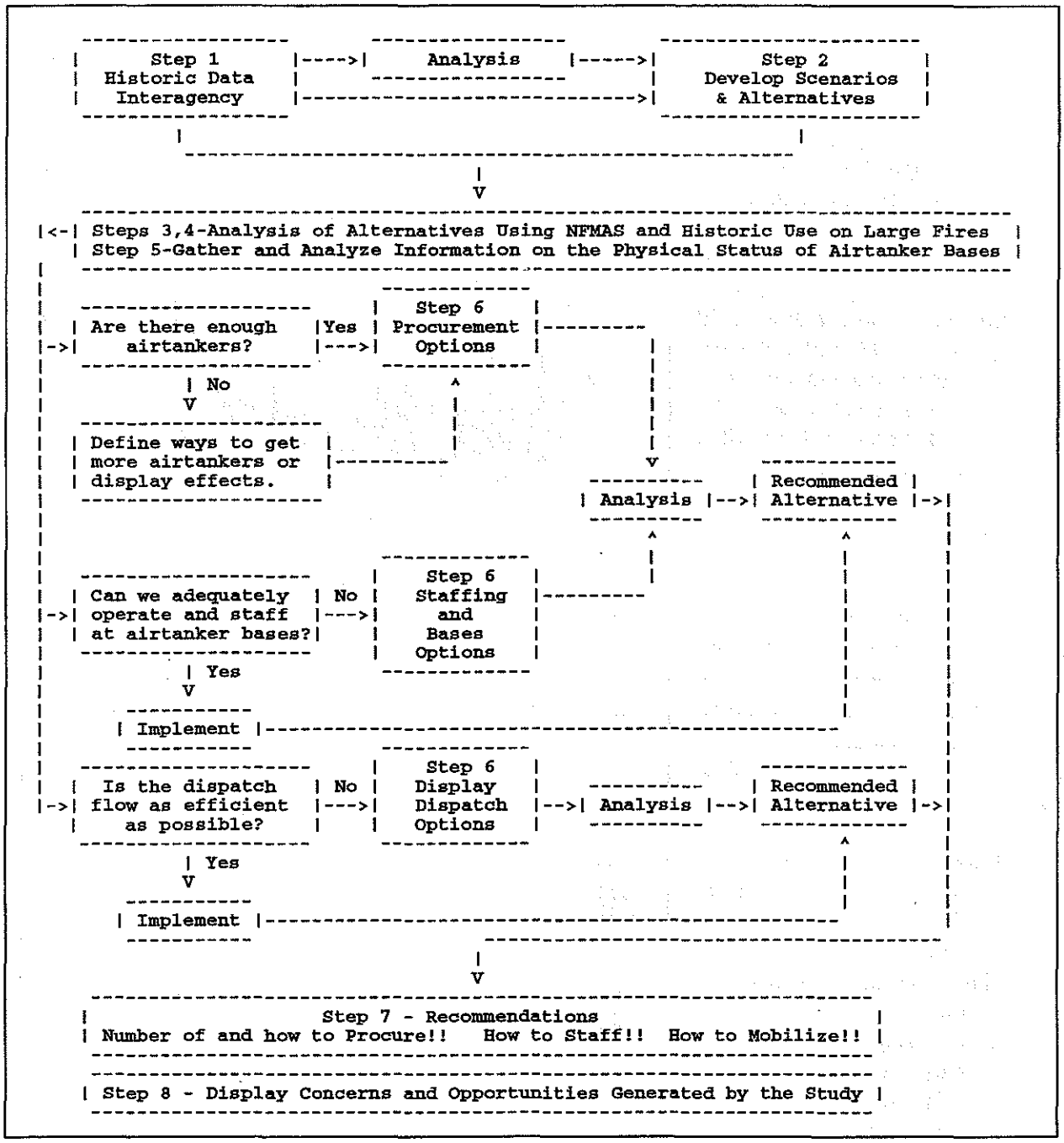
Step 7. Develop recommendations to address goals/objectives for phase 1.

These is covered in the recommendations section.

Step 8. Concerns and opportunities generated by phase 1 of this study and comments for future analysis in phase 2.

These is covered in the recommendations section.

STUDY PROCESS AND FLOW



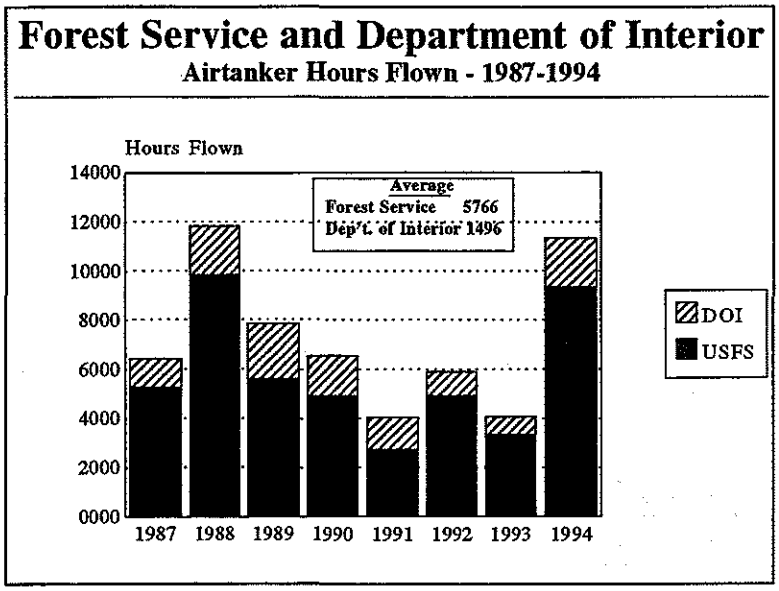
STEP 1: HISTORIC USE, DEMAND AND TRENDS FOR LARGE AIRTANKERS

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 chart in Figure 2 shows the number of flight hours flown by large airtankers contracted for by the Forest Service and the Department of Interior over the past eight years. 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 past three years with adjustments for State and MAFFS gallons dropped, 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 will be of value in Step 4, Historic Retardant Use on Wildfires That Have Escaped Initial Attack.

Figure 2 - Hours Flown



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.

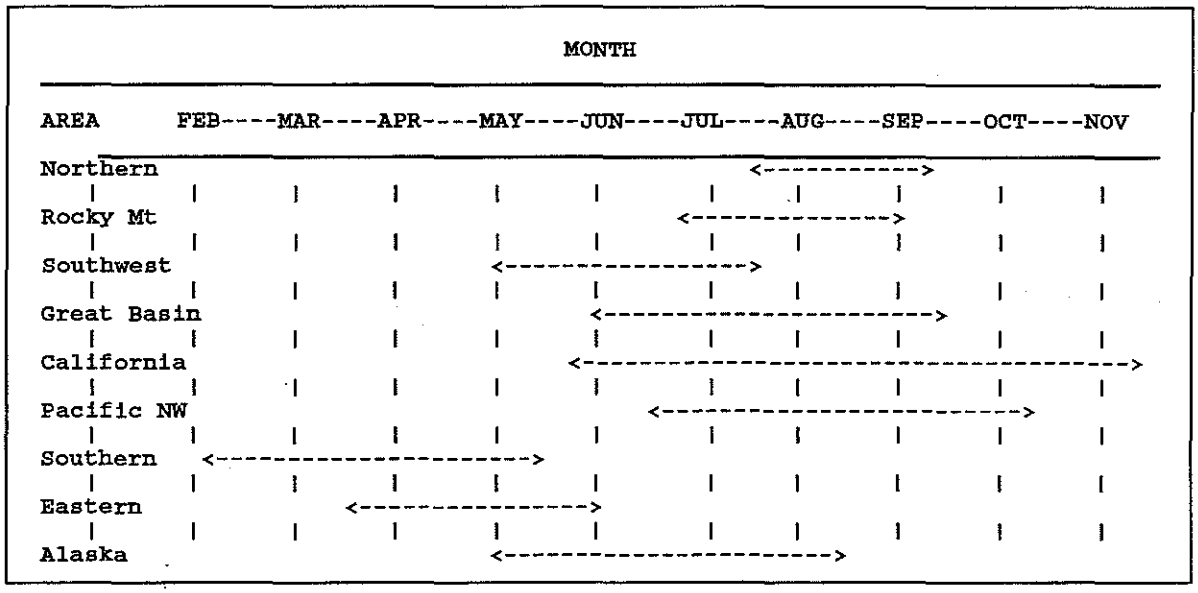
Additional Airtanker Capability Requested

Year	<------ MAFFS------> Number of Missions	Gallons Dropped	Additional Days Airtankers Were 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

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. The box above contains information on when additional airtanker capability was requested and used by year. This information is given to provide understanding that events do occur which tax the large airtanker fleet during past years.

The following diagram 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.

CRITICAL TIME PERIOD TO STAFF LARGE AIRTANKERS



STEPS 2 and 3: PERFORM INITIAL ATTACK ANALYSIS BY DEVELOPING ALTERNATIVES TO ADDRESS SCENARIOS BY GEOGRAPHIC AREA

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 considers initial attack support and was used to analyze the effect of the alternatives. The local initial attack forces remained constant as airtankers staffing and locations is changed. Where use of the IAA model was not current or not used on an area, a 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 B.

Key Assumptions

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. The formula used is:

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

where the production factor is 1.0 for NFDRS fuel models A, L and T, is 0.6 for NFDRS fuel models C, N, S, and U and is 0.4 for all the rest of the NFDRS fuel models. The following chart gives the chains of fireline built per drop.

Gallons Dropped	Fuel Models A, L, T	Fuel Models C, N, S, U	Fuel Models Others
3000 Gallons	30 chains	18 chains	12 chains
2200 Gallons	22 chains	13 chains	9 chains
1500 Gallons	15 chains	9 chains	6 chains

To model 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 rates 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.

To insure that fire retardant drops are used in conjunction with other firefighting forces such as engine crews, helitack crews, hand crews, and dozers, these forces must arrive within 60 minutes of a fire retardant drop when the flame length on the modelled fire is less than two feet or the IAA will assume the fire retardant drop was ineffective. If the flame length on the modeled fire is greater than two feet, this time limit is reduced to 30 minutes.

Airtanker Categories

Airtankers types are divided into five categories for the purpose of analysis. These five categories are as follows:

Engine Type	Tank Size	Category	Aircraft in Category
Turbine	1500 Gal.	T1500	To Be defined
Turbine	3000 Gal.	T3000	C-130A, P3A
Reciprocating	2200 Gal.	R2200	P2V, DC-4, P4Y2, SP2H, DC-6
Reciprocating	3000 Gal.	R3000	DC-7, KC-97
Cooperator	Misc.	Coop	Misc.

In addition, flight rate, cruise speed and climb rate were defined as follows for each category. The flight rate by airtanker category used is based on a weighted average from the Forest Service 1995 Airtanker Contract.

Aircraft Type	Base Flight Rate	(Knots) Speed	Number of Minutes To Climb <-----To Given Altitude (Ft. AGL)-----> 1000	2000	3000	4000	5000
T1500	$1,740	250	0.70	1.30	2.00	2.70	3.30
T3000	$2,801	238	0.70	1.30	2.00	2.70	3.30
R2200	$1,467	189	1.05	2.10	3.20	4.30	5.30
R3000	$2,145	235	1.30	2.60	3.90	5.20	6.50

Airtanker Program Cost Assumptions

The following table shows the daily availability rate by airtanker category used based on a weighted average from the Forest Service 1995 Airtanker Contract.

Aircraft Type	Daily Availability
T1500	$2,381
T3000	$2,486
R2200	$1,987
R3000	$2,420

Total availability cost for an airtanker at a base was calculated as the product of the number of days by base from the 1995 contract and the daily availability.

For airtanker base annual operation and maintenance costs, the 1995 cost to staff and run the airtanker base was used.

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 might be 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 periods (years),
where Pv is the present value of the investment.

The discount rate used was set at 4% unless otherwise noted.

The total Annual Airtanker Program Cost was calculated as the sum of the airtanker availability for the season, the annual operation and maintenance costs of the airtanker base, and the annualized value of one time capital costs at the airtanker base.

Other Costs

All dollars are to be expressed in 1995 dollars. The factor used to move dollars to 1995 is listed below.

Year	Index	CPI Factor	Year	Index	CPI Factor
1984	224.8	1.4564	1990	276.6	1.1837
1985	233.3	1.4033	1991	282.1	1.1606
1986	240.3	1.3625	1992	295.1	1.1095
1987	247.5	1.3228	1993	304.8	1.0741
1988	257.1	1.2734	1994	314.2	1.0420
1989	266.1	1.2304	1995	327.4	1.0000

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 $0.758 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.

The term Agency Alternative Cost is used to refer to sum of **one agency's** fire suppression costs, net value change costs, and airtanker program costs.

The term Alternative Cost is used to refer to the of **all agency's** fire suppression costs, net value change costs, and airtanker program costs.

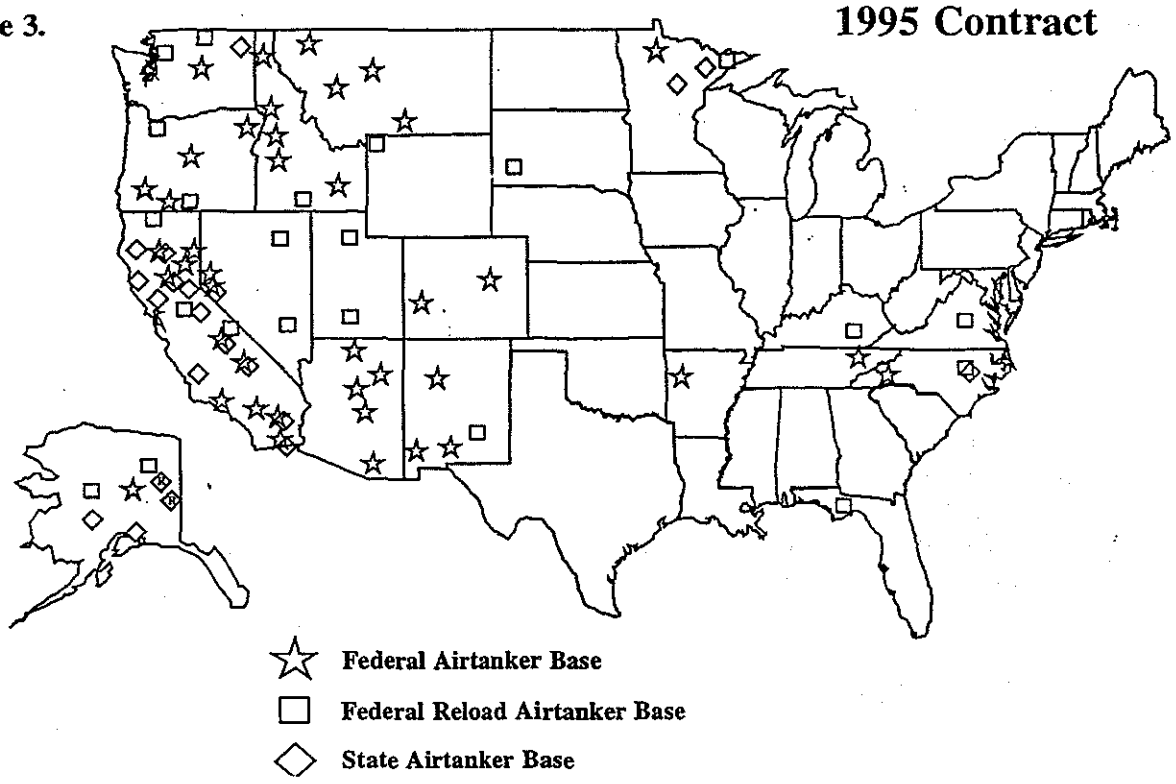
Cooperators

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.

Scenario 1 - Current Program Based on 1995 Fire Season Staffing of Large Airtankers for Federal and State Agencies (30 Forest Service, 6 Department of Interior, and 5 State for 41 total)

The goal of this scenario was for all geographic areas to "benchmark" their IAA Most Efficient Level (MEL) analysis so the airtanker information was based on what will be staffed in the 1995 fire season. There is only one alternative in this scenario. Airtanker staffing is described in box on page 13.

Figure 3.



1995 Large Airtanker Staffing

Geo. Area	Base	Season	No. Days	Aircraft Model	Study Category
AK-BLM	Ft. Wainwright	5/20-8/17	90	PB4Y2	R2200
AK-BLM	Ft. Wainwright	6/01-8/29	90	PB4Y2	R2200
AL-AK	Palmer	5/01-7/29	90	DC-4	R2200
AK-AK	Ft. Wainwright	5/22-8/19	90	KC-97	R3000
C-FS	Chester	6/15-10/16	106	SP2H	R2200
C-FS	Chico	7/03-10/16	91	DC4	R2200
C-FS	Fresno	5/23-10/31	139	C130	T3000
C-FS	Hemet	5/18-11/17	158	DC4	R2200
C-FS	Hemet	6/15-11/17	134	DC4	R2200
C-FS	Lancaster	6/03-12/01	156	SDC4	R2200
C-FS	Lancaster	7/02-11/15	118	P2V	R2200
C-CA	Paso Robles	6/01-10/31	153	SP2H	R2200
C-FS	Porterville	6/02-10/24	125	SP2H	R2200
C-BLM	Porterville	6/20-8/17	50	DC4	R2200
C-FS	Ramona	4/30-11/30	184	DC4	R2200
C-FS	Redding	6/11-10/14	108	P3A	T3000
C-CA	Redding	7/01-10/15	107	SP2H	R2200
C-FS	Santa Barbara	6/02-11/02	132	P3A	T3000
C-CA	Santa Rosa	7/01-10/15	107	C130	T3000
E-MN	Hibbing	4/15-5/29	45	PB4Y2	R2200
E-MN	Bemidji	4/15-5/29	45	PB4Y2	R2200
E-BIA	Brainerd	4/05-5/19	45	DC4	R2200
GB-FS	Boise	7/13-9/29	67	P2V	R2200
GB-FS	McCall	7/17-9/21	58	P3A	T3000
GB-BLM	Minden	6/16-9/13	90	DC7	R3000
GB-BLM	Pocatello	6/23-9/30	100	PB4Y2	R2200
GB-BLM	Stead	6/01-9/08	100	DC4	R2200
N-BLM	Billings	7/1-9/28	93	P2V	R2200
N-FS	Coeur'd Alene	7/15-9/29	66	P2V	R2200
N-FS	Grangeville	7/16-9/16	54	PB4Y	R2200
N-FS	Helena	7/29-9/18	45	P3A	T3000
N-FS	Kalispell	7/14-9/17	56	P2V	R2200
N-FS	Missoula	7/13-9/14	55	P2V	R2200
PNW-WDNR	Deer Park	6/25-9/29	90	PBY	R2200
PNW-FS	Klamath Falls	7/13-9/29	67	P2V	R2200
PNW-FS	Klamath Falls	5/27-9/30	109	C130	T3000
PNW-FS	LaGrande	6/26-10/15	96	C130	T3000
PNW-FS	Medford	6/15-10/19	109	DC7	R3000
PNW-FS	Redmond	6/08-9/26	95	C130	T3000
PNW-FS	Redmond	7/01-10/23	99	DC7	R3000
PNW-FS	Wenatchee	6/11-10/03	99	P2V	R2200
PNW-FS	Wenatchee	6/10-10/25	119	C130	T3000
RM-FS	Jeffco	6/16-9/30	92	PB4Y	R2200
RM-BLM	Grand Junction	6/09-9/16	100	PB4Y2	R2200
S-FS	Ashville	2/27-5/13	65	DC4	R2200
S-FS	Ft. Smith	2/23-5/09	61	P3A	T3000
S-FS	Knoxville	3/01-5/20	70	PB4Y	R2200
S-FS	Knoxville	2/24-5/09	64	DC6	R2200
SW-FS	Alamagordo	4/01-7/11	87	P2V	R2200
SW-FS	Albuquerque	5/22-7/14	46	PB4Y	R2200
SW-FS	Albuquerque	4/29-6/12	39	P2V	R2200
SW-FS	Ft. Huachuca	5/15-6/18	30	DC4	R2200
SW-FS	Ft. Huachuca	6/14-7/12	25	P2V	R2200
SW-FS	Grand Cyn	5/11-8/11	80	DC6	R2200
SW-FS	Phoenix	5/06-8/17	89	P3A	T3000
SW-FS	Prescott	5/04-7/15	62	P3A	T3000
SW-FS	Silver City	5/06-7/26	70	P3A	T3000
SW-FS	Silver City	4/19-7/11	72	P2V	R2200
SW-FS	Winslow	5/10-7/11	54	P2V	R2200
SW-FS	Winslow	5/03-7/12	61	P2V	R2200

Table 1 gives the results for Scenario 1 by Geographic Area. The totals in the table are based on initial attack analysis. **In comparing these values with the values in any other alternative (within a later scenario), be alert that they only reflect the value of large airtankers in support of initial attack.** Uses of large airtankers to support extended attack and large fire support will be covered in a later section. All values will be considered when recommendations are made.

Table 1 - Scenario 1 Results

GEO AREA	FIRE FREQ	ACRES BURNED	(FFF) FIRE SUPPRESSION COSTS	(NVC) NET VALUE CHANGE	(ATPC) AIRTANKER PROGRAM COST	FFF + NVC + ATPC = ALTERNATIVE COST	TOTAL D-F FIRES	TOTAL G FIRES	TOTAL AT DISP
Calif.	2349	74731	$71,284,544	-$64,469,415	$4,146,588	$139,900,547	37.00	3.80	843
Gt. Basin	2220	285756	$35,331,486	-$27,619,150	$1,307,744	$64,258,380	137.79	14.33	595
Northern	563	4497	$6,267,434	- $831,355	$680,867	$7,779,656	4.75	0.08	39
Pacific NW	2412	46639	$25,909,872	-$31,941,624	$2,267,166	$60,118,662	30.13	1.18	465
Rocky Mt.	438	7543	$3,868,944	- $1,925,015	$171,600	$5,965,559	4.23	0.20	11
Southwest	2051	46000	$20,673,902	- $4,095,120	$1,929,000	$26,698,022	36.14	1.82	350
Southern	817	9419	$5,329,236	- $1,537,380	$689,059	$7,555,675	14.44	0.05	152
TOTAL	10850	474585	$168,665,418	-$132,419,059	$11,192,024	$312,276,501	264.48	21.46	2455

All numbers in the table represent average annual expect values based on approximately the last 10 year of actual data. In any one year, actual results may be more or less than the annual average.

GEO Area refers to the geographic area which is defined on page 2 of this document.

The **Fire Freq** column is contains the annual number of fires.

Acres Burned is the annual expected acres burn and included acres from fires contained on initial attack as well as acres from fires which escape initial attack.

As mentioned before, **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 $0.758 per gallon. Average acre costs include all other fire suppression costs expressed on a per acre basis.

As mentioned before, **Net Value Change (NVC) Costs** are used to describe the algebraic sum of the effects of a fire on the resource (timber, recreation, etc.) keeping in mind that some effect are negative and some positive. In general, the algebraic sum is a negative number.

As defined before, **Annual Airtanker Program Cost** was calculated as the sum of the airtanker availability for the season, the annual operation and maintenance costs of the airtanker base, and the annualized value of one time capital costs at the airtanker base.

As mentioned before, **Alternative Cost** is used to refer to **one agency's** fire suppression costs, net value change costs, and airtanker program costs. In this case since there is only one alternative in Scenario 1, the Scenario Cost and Alternative Cost are the same.

The **Total D-F Fires** is the annual expected number of fires between 100 and 5000 acres in size.

The **Total G Fires** is the annual expected number of fires 5000 acres and larger in size.

The **Total AT Disp** (Airtanker Dispatches) is the annual expected number of initial attack dispatches for large airtankers.

For the Great Basin, the Forest Service data is for the Intermountain Region and the BLM data for 16 Districts in southern Idaho, Nevada and Utah.

In the Great Basin Area and the Rocky Mountain Areas, the airtanker program costs are reflect the proportion of the total annual budgeted airtanker program costs based on the proportionate benefit to each area from the airtanker bases and airtankers with each Geographic Area. Details of the calculations are contained in Appendices F and I respectively.

In the Pacific Northwest, the following agencies fund the annual airtanker availability costs using a proportionate share based on the past ten years retardant dropped. For 1995, the approximate proportionate shares are: Forest Service, 63%; Oregon State Department of Forestry, 19%; Bureau of Indian Affairs, 6%; Washington Department of Natural Resources, 6%; Bureau of Land Management, 4%; and National Park Service, 2%. The Area was able to utilize initial attack analysis for the Forest Service lands, Oregon Department of Forestry lands and on the Colville Indian Agency. Collectively, this accounts for about 85% of the gallons dropped. For simplicity, the entire airtanker program cost was used.

In all other Areas, the initial attack analysis (IAA) was based solely on Forest Service lands with other agency information integrated subjectively. One-hundred percent of the budgeted airtanker program costs were used in the analysis.

Scenario 2 - No Federal Staffing of Large Airtankers

The goal for Scenario 2 was to determine a baseline value(s) to measure the benefit of an alternative and to define the value of the airtanker program as measured against any other alternative. All large airtankers including cooperator airtankers were not used. There was only one alternative in this Scenario.

Table 2 gives the results for Scenario 2 by Geographic Area. The totals in the table are based on initial attack analysis. **In comparing these values with the values in any other alternative (within a later scenario), be alert that they only reflect the value of large airtankers in support on initial attack.** Uses of large airtankers to support extended attack and large fire support will be covered in a latter section.

The results for all geographic areas are below with a line comparing the total with Scenario 1.

Table 2 - Scenario 2 Results and Comparison With Scenario 1

GEO Area	FIRE FREQ	ACRES BURNED	(FFF) FIRE SUPPRESSION COSTS	(NVC) NET VALUE CHANGE	(ATPC) AIRTANKER PROGRAM COST	FFF + NVC + ATPC = ALTERNATIVE COST	DIFFERENCE BETWEEN SCENARIO 1 AND 2 ALTERNATIVE COST	DIFFERENCE BETWEEN SCENARIO 1 AND 2 ACRES BURNED	TOTAL D-F FIRES	TOTAL G FIRES	TOTAL AT DISP
Calif.	2349	99135	$97,692,254	-$99,859,198	$0	$197,551,452	($57,650,905)	-24404	34.12	5.76	0
Gt. Basin	2220	302477	$42,419,827	-$30,311,922	$0	$72,731,749	($8,473,369)	-16721	147.44	14.93	0
Northern	563	6270	$7,203,234	- $1,065,276	$0	$8,268,510	($488,854)	-1773	7.34	0.08	0
Pacific NW	2412	62765	$39,223,034	-$45,075,661	$0	$84,298,695	($24,180,033)	-16126	42.92	1.65	0
Rocky Mt.	438	7791	$3,940,424	- $2,010,792	$0	$5,951,216	$14,343	-248	4.36	0.21	0
Southwest	2051	72052	$28,395,320	- $5,516,536	$0	$33,911,856	($7,213,834)	-26052	73.07	2.35	0
Southern	817	10085	$4,807,981	- $1,646,990	$0	$6,454,971	$1,100,704	-666	14.65	0.05	0
TOTAL	10850	560575	$223,682,074	-$185,486,375	$0	$409,168,449	($96,891,948)	-85990	323.90	25.03	0

The difference in values between Scenario 1 (IAA MEL Budget Level benchmarked to 1995 large airtanker staffing) and Scenario 2 (no large airtanker staffing) is as follows:

ACRES BURNED	(FFF) FIRE SUPPRESSION COST	(NVC) NET VALUE CHANGE	(ATPC) AIRTANKER PROGRAM COST	DIFFERENCE IN FFF + NVC ONLY BETWEEN SCENARIO 1 AND SCENARIO 2	BENEFIT / ATP COST
85,990	$55,016,656	$53,067,316	$11,192,024	$ 96,891,948	8.7/1

The benefit to airtanker program cost ratio of this 1995 large airtanker program is ($96,891,948/$11,192,024) or 8.7 to 1. This benefit cost is to the initial attack program. Additional benefits can be attained in the support of large fire suppression. Specific information for several Geographic Area follow.

Great Basin Geographic Area

In the Great Basin Area for the BLM analysis only, the difference between Scenario 1 and 2 is $11,866.

Study Committee Recommendation:

The study committee concurs with that the current airtanker program in support of initial attack is justified.

Study Committee Rationale:

When compared with the total annual alternative cost of $29,405,217, the airtanker program is at the break even point.

Rocky Mountain Geographic Area

In the Rocky Mountain Area, the difference between Scenario 1 and 2 is $14,343.

Study Committee Recommendation:

The study committee concurs with that the current airtanker program in support of initial attack is justified.

Study Committee Rationale:

When compared with the total annual alternative cost of $5,951,216, the airtanker program is at the break even point.

Southern Geographic Area

In the Southern Area, the difference between Scenario 1 and 2 is $1,100,704.

Geographic Area Recommendation:

The Geographic Area recommends that the airtanker program remain as it currently is staffed with four airtankers. The verification of airtanker use in initial attack analysis needs to occur. The maintenance of initial attack capability until appropriate tradeoffs or substitutions can be made is critical as well as the maintenance of firefighter safety. The Geographic Area will be updating their NFMAS analysis for the entire region on an interagency basis in June 1995. At this time, the airtanker issue will be analyzed in conjunction with a mix of airtankers and helicopters.

Geographic Area Rationale:

Using strictly Forest Service fires on Forest Service land, the initial attack (IAA) portion of this analysis indicates airtankers play a small role in fire suppression in the Southern Region and it would be most efficient to not have airtankers. It does not take into account cooperators' fires or their use of airtankers in mutual aid and offset protection areas which certainly does occur. Fires and/or acres burned in the wildland urban interface areas are increasing and continue to demand rapid initial attack which cannot be supplied without aerial delivery. Airtankers also play a role in the support of large fires for Forest Service and cooperators. The use of airtankers to support large fire will be examined in Step 4.

Study Committee Recommendation:

The study committee concurs with the Geographic Area recommendation with one exception. The committee recommends on the basis of analysis for the Southern Geographic Area in Scenario 5 and the need to support large suppression (Step 4), that one of the airtankers at Knoxville be staffed not based on initial attack but for large fire support. The committee endorses updating of the NFMAS analysis including a through analysis of cooperator use and need for airtanker support. This update is of critical importance as it relates to this study. As a high priority, airtanker use at calibration must be at the historic level. Analyze appropriate alternatives to display tradeoffs to other methods of initial attack. Complete within the timeframes of Phase 2.

Study Committee Rationale:

Making changes in the airtanker program without full information and understanding of the relationships would be hazardous. A commitment in Phase 2 to look at alternatives is the most viable approach.

Scenario 3 - Current Program of Airtankers (Scenario 1) Used to Resolve Geographic Area Airtanker Base Location Issues

The goal of this Scenario is for geographic areas to solve airtanker base issues. The number of large airtankers remained the same as in Scenario 1 (1995 fire season) but alternate base locations were tested to allow for comparison. Alternatives were constructed based on issues currently active in each geographic area. Following are issues and the results of analysis by geographic area.

Alaska Geographic Area

No alternatives were developed.

California Geographic Area

Issues:

The area analyzed two alternatives. Alternative 33 would move the existing BLM airtanker at Porterville to Mather Field (MHR) outside Sacramento. Alternative 37 would move the existing airtankers at Hemet-Ryan to San Bernardino Co. Airport (Norton AFB) and existing airtanker at Chico (CIC) to Mather Field. Hemet-Ryan and Chico would remain California Department of Forestry (CDF) airtanker bases.

Key Assumptions:

San Bernardino County Airport and Mather Field are available for move-in during the 1996-1998 contract period. Hemet-Ryan has significant safety problems including a short runway, congested area, no adequate area to abort loads, noise abatement issues, no control tower, increased glider usage, limited parking for transit aircraft, and general encroachment of facilities to the airport. No large airtankers currently exist between Chico and Fresno. Forest health issues and recent large fire occurrence in the Central Sierras have occurred in the vicinity of Sacramento. The nature of the military airfields offer opportunities for safe efficient bases and for interagency participation. BLM has an airtanker which contributes to the overall airtanker availability in California. BLM acres and occurrence were not available but input will be requested on all alternatives. CDF maintains an extensive and effective airtanker fleet and the use of CDF funded large airtankers will be included in the initial analysis.

Results:

Alternative 31: Moving from Chico to Mather would reduce acres burned by 20 and reduce annual total costs by $120,018. An additional advantage of this alternative is that the reload base at Stockton could be closed.

Alternative 32: Moving from Hemet to San Bernardino County Airport would reduce acres burned by 5 but increase annual total costs by $143,075 due to the cost of relocating.

Alternative 33: Moving the BLM airtanker at Porterville to Mather would reduce acres 600 and reduce annual total costs by $311,892. BLM is assumed to pay 50% of the costs to build the airtanker base at Mather.

Geographic Area Recommendation:

Move from Chico to Mather and move the BLM airtanker at Porterville to Mather. Move from Hemet to San Bernardino County Airport based mainly on operational and safety concerns.

Geographic Area Rationale:

Forest Service airtankers must be moved from Hemet because of safety considerations. Moving Chico airtanker to Mather will better serve the Central Sierras and give better state-wide coverage. Alternative 61 indicates a significant contribution in cost and acreage burned by adding an T3000 category airtanker at Mather which reinforces the result from Alternative 33. Implementing Alternative 33 is the most cost efficient way to get these benefits.

Study Committee Recommendation:

Support decision to move airtankers and build airtanker bases. The Area examine the status of the reload base at Stockton following move to Mather AFB.

Study Committee Rationale:

Committee recommends that the Region analyze Ramona airtanker base. Safety issues are of concern. The runway is too short for all but two types of existing heavy airtankers, the requirement to land and sit loaded means that aircraft are not loaded to contract specifications and there is a great deal of encroachment to the runway area.

Eastern Geographic Area

No alternatives were developed.

Great Basin Geographic Area

Issues:

Alternative 48 addresses the staffing of a reload base at Battle Mountain with the existing R2200 category airtanker at Stead. There is a concern that the entire State of Nevada does not have complete initial attack airtanker coverage.

Alternative 60 moved the existing T3000 category at McCall to Boise to join a R2200 category airtanker. McCall is maintained as a reload base. The area wanted to see the effect of this change.

Key Assumptions:

There are none.

Results:

Alternative 48: The marginal difference between this Alternative and Alternative 10 (which has a R2200 category airtanker at Stead) is -$116,578 with additional 160 acres burned. These acres burn in the higher fire occurrence areas serviced by Stead.

Alternative 60: The marginal difference between this Alternative and Alternative 10 (which has a T3000 category airtanker at McCall) is -$2,067,813 with additional 2775 acres burned. These acres burn in the higher fire occurrence areas serviced by McCall.

Geographic Area Recommendation:

From the BLM, a recommendation was made to add an airtanker at Battle Mountain. This issue will be addressed in Scenario 6. The BLM did not make a recommendation on moving the airtanker at Stead to Battle Mountain. From the Forest Service, it was recommended to not move the airtanker from McCall.

Geographic Area Rationale:

For the Forest Service, it is not economic and efficient to move the airtanker from McCall.

Study Committee Recommendation:

The committee recommends to maintain the reload base at Battle Mountain and to not move the airtanker from Stead to Battle Mountain. The committee concurs with the Forest Service recommendation to maintain the airtanker base and airtanker at McCall. The committee endorses the desire of the BLM to explore the best airtanker base location in western Nevada.

Study Committee Rationale:

Cost efficiency.

Northern Geographic Area

Issues:

The area wanted to examine airtanker bases at Grangeville and Kalispell versus closing these bases and moving the airtankers to Coeur 'd Alene and Missoula.

The Billings airtanker base is in need of extensive maintenance with safety of operation a key issue. The physical location of the base on the airport is not near fixed base operator facilities and operating space requirements. Facilities and equipment appear to be below standards set in the Interagency Airtanker Base Planning Guide.

Key Assumptions:

When airtankers were moved from Grangeville and Kalispell, the bases were not maintained as reload bases.

Results:

Alternative 31: The marginal difference between this Alternative (move airtanker at Grangeville to Coeur 'd Alene) and Alternative 01 (which has an R2200 category airtanker and base at Grangeville) is -$347,922 with additional 403 acres burned.

Alternative 32: The marginal difference between this Alternative (move airtanker at Kalispell to Missoula) and Alternative 01 (which has an R2200 category airtanker and base at Kalispell) is a savings of $21,101 with additional 18 acres burned.

Alternative 33: The marginal difference between this Alternative (move airtanker at Grangeville to Coeur 'd Alene and airtanker at Kalispell to Missoula) and Alternative 01 (which has an R2200 category airtankers and bases at Grangeville and Kalispell) is -$121,525 with additional 60 acres burned.

Billings: Initial attack analysis by the BLM was not possible given data and time available. Forest Service analysis in the Northern Area was also not available. The Rocky Mountain Area did examine the value to an airtanker at Billings to the Area and the marginal difference without an airtanker was an additional acres burned of 4 and annual total cost of $2,649. Historic use to support large fires is common at Billings.

Geographic Area Recommendation:

Maintain the Grangeville, Kalispell and Billings airtanker bases. Staff all three bases with an airtanker.

Geographic Area Rationale:

Keeping Grangeville is the most cost efficient alternative. At Kalispell, the base is needed for large fire support even though the marginal benefit is quite close to zero. At Billings, the State BLM Director for Montana in a memo (2-17-95) to the BLM Director, Office of Fire and Aviation, has indicated support to maintain the base. The BLM Director, Office of Fire and Aviation, in a memo (2-9-95) to the study committee has expressed support to retain the airtanker and base at Billings.

Study Committee Recommendation:

Concur with reservations for further analysis at Billings.

Study Committee Rationale:

In Phase 2, the Montana BLM and Northern Region should conduct analysis not possible in Phase 1 on the capital investment value at Billings given initial attack benefits and the need to support large fires. Addition of an airtanker at West Yellowstone may provide influence on this analysis.

Pacific Northwest Geographic Area

Issues:

The Wenatchee airtanker base location is inadequate due to conflicts with other uses at the airport. The airtanker base is also in close proximity to the regional fire cache which creates serious problems for both operations during large fire and extended initial attack operations. In addition the airport has recently constructed a taxiway that has effectively eliminated the use of pit number 3. Currently the proposal to remedy the deficiencies at the current location provides at best a short term fix at an annualized cost of $8,330.

Key Assumptions:

A short term fix is not acceptable. Use the opportunity provided by the National Airtanker Study to analyze the consequences of relocating the base at the Yakima, WA or Moses Lake, WA airports, or at a different location on the Wenatchee airport. The cost to build at all three locations is equal. The current base location is not used as a reload base.

Results:

Alternative 03: The marginal difference between this alternative, which moves the base to Moses Lake, and Alternative 01 is an additional $1,644,506 in C+NVC and 990 acres burned annually.

Alternative 04: The marginal difference between this alternative, which moves the base to Yakima, and Alternative 01 is an additional $1,380,391 in C+NVC and 889 acres burned annually.

Geographic Area Recommendation:

Explore building a new airtanker base at Wenatchee airport at a site across the runway from the current location. This is called Alternative 24 for further reference.

Geographic Area Rationale:

Cost efficiency.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur

Rocky Mountain Geographic Area

No Alternatives were analyzed.

Southwest Geographic Area

Issues:

The main issue to be resolved in this Scenario was to determine if the Forest Service should continue to maintain eight airtanker bases. The Grand Canyon airtanker base does not have the capability to function as a large fire support facility due to limited water supply. The Grand Canyon airtanker base also does not appear to meet standards for facilities and investments are an issue.

Key Assumptions:

When a base is closed, it is not available as a reload. Alternatives were constructed with three, four, five, seven and eight airtankers bases (Current Situation-Alternative 01). A detailed description of the number of airtankers and base location is located in Appendix J.

Results:

Below is a listing of the results.

	ALT	DESCRIPTION	FREQ	ACRES	$$$ FFF	$$$ NVC	$$$ AT PG CT	$$$ TOTAL	$$$ $$ DIFF	AC DIFF
1	01	1995 Contract	2051	46000	20673902	-4095120	1929000	26698022	------	------
3	03	3 BASES, 11 AT	2051	45125	20233924	-4656418	1679000	26569342	128680	875
3	04	3 BASES, 11 AT	2051	55037	23370053	-4233452	1679000	29282505	-2584483	-9037
3	05	3 BASES, 11 AT	2051	44859	20532414	-4183829	1679000	26395243	302779	1141
3	06	4 BASES, 11 AT	2051	47132	21634226	-4460790	1729000	27824016	-1125994	-1132
3	07	4 BASES, 11 AT	2051	40522	18924813	-3803752	1729000	24457565	2240457	5478
3	08	4 BASES, 11 AT	2051	54922	23195121	-4872106	1729000	29796227	-3098205	-8922
3	09	4 BASES, 11 AT	2051	47407	21065747	-4150102	1729000	26944849	-246827	-1407
3	10	5 BASES, 11 AT	2051	46757	20446261	-4419275	1779000	26644536	53486	-757
3	11	5 BASES, 11 AT	2051	49276	21176181	-4042191	1779000	26997372	-299350	-3276
3	12	5 BASES, 11 AT	2051	42455	19474036	-4402731	1779000	25655767	1042255	3545
3	13	5 BASES, 11 AT	2051	46364	21002256	-4107029	1779000	26888285	-190263	-364
3	14	7 BASES, 11 AT	2051	40085	18571174	-4125010	1879000	24575184	2122838	5915
3	15	7 BASES, 11 AT	2051	39328	18308125	-4010909	1879000	24198034	2499988	6672
3	16	7 BASES, 11 AT	2051	40986	18820004	-4342557	1879000	25041561	1656461	5014
3	17	7 BASES, 11 AT	2051	43670	19923446	-4546604	1879000	26349050	348972	2330
3	18	7 BASES, 11 AT	2051	44184	20048271	-4341455	1879000	26268726	429296	1816
3	19	7 BASES, 11 AT	2051	42373	19299570	-4526855	1879000	25705425	992597	3627
3	20	7 BASES, 11 AT	2051	43409	19414758	-4263356	1879000	25557114	1140908	2591

In general, the "super base" alternatives 03-13 were not as cost efficient as alternatives 14 and 15. Alternative 07 does appear to be slightly more cost effective than alternative 14 but additional analysis is needed in Phase 2 to verify the results. Alternative 07 does not provide for base operations to support large fire operations with in the Area.

Geographic Area Recommendation:

Close the base at Grand Canyon and move the airtanker to Prescott.

Geographic Area Rationale:

Cost efficiency. Pursue the value of Ft. Huachucha (Libby) airtanker base in Phase 2 as well as verification of Alternative 07.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur with Area.

Southern Geographic Area

No Alternatives were analyzed.

Scenario 4 - Current Number of Federal Airtankers Used to Determine Marginal Value of Turbine Capability by Airtanker Base

The goal of this Scenario is to determine the marginal benefit of T3000 over a R2200 at each base. This Scenario is constructed to aid in the answering if "additional performance criteria should be part of contract specification at some airtanker base locations." **In several geographic areas, an analysis was done which indicates that R3000 aircraft give very similar results as T3000 category aircraft for initial attack effectiveness. The major difference is rate of climb capability. Based on the data defining the R3000 and T3000 categories on page 10, this result was expected. Hence, in this Scenario where a T3000 is referenced, an R3000 is also viable.**

Presently, there are a limited number of 3000 gallon capacity airtankers available to staff requests for this category of aircraft. Based on current aircraft inventory that could be on contract for the 1996-1998 period, it appears the logical alternative to a category T3000 airtanker at a base would be a R2200 category airtanker.

The process used involved developing an alternative where all airtankers staffed in Scenario 1 were from the R2200 category. Then, an alternative was built where at each airtanker base a T3000 category airtanker was staffed rather than a R2200. If two airtankers were staffed at an airtanker base, then the first airtanker sent to a fire was the T3000. **Modelling rotation of airtankers upon dispatch was not practical.** Alternatives were only built at airtanker bases where geographic area's proposed to staff the base with a T3000. Following are the results of analysis by geographic area.

The results for all geographic areas are below with a line comparing the national total with Scenario 1.

Table 3.

GEO AREA	FIRE FREQ	ACRES BURNED	(FFF) FIRE SUPPRESSION COSTS	(NVC) NET VALUE CHANGE	(ATPC) AIRTANKER PROGRAM COST	FFF + NVC + ATPC = ALTERNATIVE COST	DIFFERENCE BETWEEN SCENARIO 1 AND 4 ALTERNATIVE COST	DIFFERENCE BETWEEN SCENARIO 1 AND 4 ACRES BURNED	TOTAL D-F FIRES	TOTAL G FIRES	TOTAL AT DISP
Calif.	2349	76505	$73,159,043	-$64,998,789	$3,957,467	$142,115,299	- $2,214,752	-1774	27.40	3.97	808
Gt. Basin	2220	288171	$35,869,595	-$27,973,107	$1,278,802	$65,121,504	- $863,124	-2415	137.79	14.33	595
Northern	563	4536	$6,294,083	- $833,330	$658,412	$7,785,825	- $6,169	-39	4.83	0.08	38
Pacific NW	2412	51594	$30,013,527	-$38,102,349	$2,047,331	$70,163,207	-$10,044,545	-4955	32.25	1.33	450
Rocky Mt.	438	7543	$3,868,944	- $1,925,015	$171,600	$5,965,559	$0	0	4.23	0.20	11
Southwest	2051	49378	$21,919,645	- $4,706,519	$1,929,000	$28,555,164	- $1,857,142	-3378	43.53	1.82	262
Southern	817	9437	$5,279,113	- $1,543,348	$667,620	$7,490,081	$65,594	-18	14.44	0.05	153
TOTAL	10850	487164	$176,403,950	-$140,082,457	$10,710,232	$327,196,639					

The benefit to airtanker program cost ratio of having the 800 gallons of retardant plus cruise speed advantage is ($20,431,670/$481,792) or 31 to 1. This benefit cost is to the initial attack program only. Additional benefits can be attained in the support of large fire suppression.

ACRES BURNED	FFF	NVC	(ATPC) AIRTANKER PROGRAM COST	DIFFERENCE FFF+NVC BETWEEN SCENARIO 1 AND ALL R2200	BENEFIT / ATPC COST
-12,579	-$7,738,532	$7,663,398	$481,792	-$14,920,138	31/1

Below is a table that shows the difference in values between Scenario 1 (Current Situation with 1995 Staffing of Airtankers) and program staffed only with R2200 category aircraft. Results are based on an expected average higher cruise speed of about 46 knots for a T3000 or R3000 over a R2200 and an additional 800 gallons of deliverable retardant. The following list ranks the bases with the marginal difference between staffing the base with a T3000 or a R2200 category airtanker being the criteria. Airtanker bases not listed either were not analyzed or the marginal difference was negative.

Table 4.

Geo. Area	Airtanker Base	Priority Ranking	Current Airtanker-1	Current Airtanker-2	Committee Recommend Airtanker-1	Committee Recommend Airtanker-2
NW	La Grande	1	T-3000		3000	2200
NW	Redmond	2	T-3000	R-3000	3000	2200
NW	Wenatchee	3	T-3000	R-2200	3000	3000
SW	Winslow	4	R-2200	R-2200	3000	2200
N	Coeur 'd Alene	5	R-2200		3000	
CA	Redding	6	T-3000		3000	2200
GB	McCall	7	T-3000		3000	
NW	Medford	8	R-3000		3000	
CA	Fresno	9	T-3000		3000	
NW	Klamath Falls	10	T-3000	R-2200	3000	2200
GB	Pocatello	11	R-2200		2200	
SW	Prescott	12	T-3000		3000	2200
SW	Libby	13	R-2200	R-2200	3000	2200
GB	Hill AFB	14			3000	
N	West Yellowstone	15			3000	
SW	Phoenix	16	T-3000		3000	
SW	Alamogordo	17	R-2200		2200	2200
SW	Silver City	18	T-3000	R-2200	3000	2200
SO	Ashville	19	R-2200		3000	
GB	Boise	20	R-2200		3000	2200
SW	Grand Canyon	21	R-2200			
SW	Abuquerque	22	R-2200	R-2200	2200	2200
CA	Santa Barbara	23	T-3000		3000	

Scenario 5 - Reduced Forest Service Large Airtanker Program (25 airtankers)

The goal of this scenario is to determine the effect of a large airtanker program with 5 less airtankers contracted nationally by the Forest Service. It was assumed that the Forest Service contracted number of airtankers was 25 (rather than 30 in Scenario 1) with all other agency staffing remaining unchanged. Since in many cases, one airtanker may service more than one airtanker base during the yearly fire season, more than 5 airtankers at airtankers bases needed to be reduced. Due the small number of airtankers staffed by the Forest Service in the Alaska, Eastern, Great Basin, and Rocky Mountains Areas, these Areas were not asked to analyze reductions.

Reductions by geographic area were assigned as follows:

Table 5.

Geographic Area	Airtanker --Current Staffing-- FS	OAS	State	Forest Service Airtanker Staffing In Scenario 4
Alaska	0	2	2	0
California	11	1	3	9
Eastern	0	1	2	0
Great Basin	2	3	0	2
Northern	5	1	0	4
Pacific NW	8	0	0	6
Rocky Mountain	1	1	0	1
Southwest	12	1	0	9
Southern	4	0	0	3
Total	43	10	7	50

Following are the results of analysis by geographic area.

Alaska Geographic Area

No alternatives were developed as no reductions were assigned to this Geographic Area.

California Geographic Area

Issues:

The Area was asked to display the effect of reducing two airtankers within the Area to support the National reduction of five airtankers.

Key Assumptions:

None.

Results:

Alternative 51 was developed as the Area chose to examine the effect of reducing from two airtankers staffed each at Lancaster and Hemet (or San Bernardino County Airport) each to one at each location. The acres burned in Alternative 51 was 629 less than the acres burned in Alternative 01 (Current Situation with 1995 Staffing of Airtankers) when it was expected that more acres would burn with fewer airtankers. Examination of the construction of the initial attack analysis indicated that ground based forces where being allowed to substitute for the airtankers. In addition, the fireline production rates where competitive, particularly at rates of spread higher than 20 chains per hour where the initial attack model resources airtanker production rates (see page 10).

Geographic Area Recommendation:

Retain the airtankers for now while examining the underlying causes of the current analysis results. Resolve the issue in Phase 2.

Geographic Area Rationale:

Changes in airtanker staffing must be based on analysis results that management adopts and supports. At this time, more study is needed.

Study Committee Recommendation:

Keep both airtankers for now and examine more closely how the dispatch philosophy and fireline production rates for ground based resources is applied in Phase 2.

Study Committee Rationale:

Engines were catching fires when airtankers were not dispatched. This was possible given the dispatch philosophy and fireline production rates. The committee supports a current analysis of how airtankers are being dispatched and modelled.

Eastern Geographic Area

No alternatives were developed as no reductions were assigned to this Geographic Area.

Great Basin Geographic Area

No alternatives were developed as no reductions were assigned to this Geographic Area.

Northern Geographic Area

Issues:

The Area was asked to display the effect of reducing one airtanker within the Area to support the National reduction of five airtankers. Analyze cutting one airtanker at a time at Grangeville, Missoula, Kalispell and Helena.

Key Assumptions:

Cut airtanker and base at the same time.

Results:

For cutting of the airtanker and closing the base at Grangeville, the marginal difference between this Alternative and Alternative 01 (which has a R2200 category airtanker at Grangeville) is -$219,171 with an additional 470 acres burned.

For cutting of the airtanker and closing the base at Missoula, the marginal difference between this Alternative and Alternative 01 (which has a R2200 category airtanker at Missoula) is negative (-)$172,739 with an additional 409 acres burned.

For cutting of the airtanker and closing the base at Helena, the marginal difference between this Alternative and Alternative 01 (which has a R2200 category airtanker at Helena) is a negative (-) $114,222 with an additional 381 acres burned.

For cutting of the airtanker and closing the base at Kalispell, the marginal difference between this Alternative and Alternative 01 (which has a R2200 category airtanker at Kalispell) is negative (-) $88,282 with an additional 361 acres burned.

Geographic Area Recommendation:

Do not reduce one airtanker.

Geographic Area Rationale:

Cost efficiency.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur.

Pacific Northwest Geographic Area

Issues:

The Area was asked to display the effect of reducing two airtankers within the Area to support the National reduction of five airtankers.

Key Assumptions:

As two airtankers were reduced, the airtanker base was left open as a reload base. The Area analyzed three Alternatives. These Alternatives were; Alternative 10: cut a R2200 category airtanker at Klamath Falls and a R3000 category airtanker at Redmond; Alternative 11: cut a R2200 category airtanker at Klamath Falls and a R2200 category airtanker at Wenatchee; Alternative 12: cut a T3000 category airtanker at LaGrande and a R3000 category airtanker at Medford.

Results:

For cutting of one airtanker at Klamath Falls and one airtanker at Redmond (Alternative 10), the marginal difference between this Alternative and Alternative 01 is -$6,436,686 with an additional 3,581 acres burned.

For cutting of one airtanker at Klamath Falls and one airtanker at Wenatchee (Alternative 11), the marginal difference between this Alternative and Alternative 01 is -$6,488,541 with an additional 3,619 acres burned.

For cutting of one airtanker at LaGrande and one airtanker at Medford (Alternative 12), the marginal difference between this Alternative and Alternative 01 is -$9,343,538 with an additional 4,749 acres burned.

Geographic Area Recommendation:

Do not reduce two airtankers.

Geographic Area Rationale:

Cost efficiency.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur.

Rocky Mountain Geographic Area

No alternatives were developed as no reductions were assigned to this Geographic Area.

Southwest Geographic Area

Issues:

The Area was asked to display the effect of reducing three airtankers within the Area to support the National reduction of five airtankers.

Key Assumptions:

As airtankers were reduced, the airtanker base was left open as a reload base. The Area analyzed nine alternatives, six with a reduction of two airtankers and three with a reduction of one airtanker based on Forest Service staffing. It was not discovered until late in the analysis that the Area was to cut three Forest Service funded airtankers (but it appears this is not a problem).

Results:

Alternatives 21-26 all have a reduction of two airtankers within the Area and Alternatives 27-29 all have a reduction of one airtanker within the Area. The reader is referred to Appendix J for details of staffing by Alternative. Alternative 01 (Current Staffing Based on 1995 Contract) has a alternative cost of $26,698,022. Alternatives 14 which has the Grand Canyon airtanker base closed (recommended in Scenario 3) has a alternative cost of $24,575,184. Alternatives 21-29 have a alternative cost that ranges from $27,331,421 to $30,639,890 which are all higher that the current situation or proposed situation. It is expected that given these results, that analyzing alternatives with a reduction of three airtankers within the area would have produced alternative costs higher the Alternatives discussed already.

Geographic Area Recommendation:

Do not reduce airtankers below eleven.

Geographic Area Rationale:

Cost efficiency.

Study Committee Recommendation:
Concur.

Study Committee Rationale:
Concur.

Southern Geographic Area

Issues:
The Area was asked to display the effect of reducing one airtanker within the Area to support the National reduction of five airtankers.

Key Assumptions:
Alternative 5 was developed which reduced the number of airtankers at Knoxville from two to one. Staffing at other airtanker bases remains as defined in Alternative 1 (Current Staffing Based on 1995 Contract).

Results:
For cutting of one airtanker at Knoxville (Alternative 5), the marginal difference between this Alternative and Alternative 01 is $286,971 with additional 226 acres burned. The positive marginal benefit indicates that the additional fire suppression cost and the net value change resulting from the 226 additional acres burned does not offset the airtanker program cost for this airtanker. The fire suppression cost is the sum of two types of costs; 1) the costs based on per acre calculations and 2) costs based on trip expenses, such as airtankers. These latter cost are called "unit mission costs." In this case, the additional per acre costs increase $59,786 with the additional 226 acres burned but the unit mission costs are $233,960 less indicating that the initial attack model is able to substitute resources which are less expensive than an airtanker with only a small (226) increase in acres burned.

Geographic Area Recommendation:
Analysis shows that airtankers may not be being used to their optimum advantage in initial attack analysis. Verification of the cost efficiency of airtankers versus other type of resources such as helicopters will occur in Phase 2.

Geographic Area Rationale:
Further analysis is needed in Phase 2 before significant changes are made.

Study Committee Recommendation:
The committee recommends that the Knoxville airtanker is not justified based on initial attack given results of this analysis and the results of Scenario 1. Moving the 3000 gallon category airtanker at Ft. Smith to Ashville assists in the support of this recommendation. This recommendation will be re-visited following analysis of the needs to support fires greater than 100 acres in size in Step 4.

Study Committee Rationale:
Cost efficiency.

In summary, the net effect of cutting five Forest Service funded airtankers as documented in Table 5 is an increase in total annual alternative costs of about $7,000,000 at the lowest assuming least impacting cuts were made.

Scenario 6 - Addition of Airtanker Capability Above Current Program Based on Geographic Area Discretion

The goal of this Scenario was to determine the marginal value of adding (as a minimum) one airtanker to a geographic area if personnel in the geographic area felt there might be value in the proposed addition. This was an optional Scenario.

The process was to develop alternatives which added an additional airtanker(s), either T3000, R3000 or R2200 category as desired, and determine the best location to add an airtanker to the geographic area. If an area wanted to recommend adding one airtanker, then the marginal value of adding a second airtanker in addition to the previous recommendation required an analysis which assumed that the first recommended addition was in place. Following are the results of analysis by geographic area.

Alaska Geographic Area

No Alternatives were analyzed.

California Geographic Area

Issues:

Add an additional airtanker within the Area. Alternative 61 was developed adding an airtanker at Mather AFB beyond staffing in Alternative 10 (Current Staffing Based on 1995 Contract).

Key Assumptions:

None.

Results:

For addition of one airtanker at Mather AFB (Alternative 61), the marginal difference between this Alternative and Alternative 01 is $395,921 was 629 fewer acres burned. It is also of value to note that the Area ran Alternative 33 which moves the BLM R2200 category airtanker at Porterville to Mather. The marginal difference between Alternative 33 and Alternative 01 is $311,892 with 600 fewer acres burned.

Geographic Area Recommendation:

Both the Forest Service and the BLM recommend moving the airtanker at Porterville to Mather AFB.

Geographic Area Rationale:

The value of adding an airtanker at Mather can be obtained at less cost by moving the BLM airtanker at Porterville to Mather.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur.

Eastern Geographic Area

No alternatives were analyzed.

Northern Geographic Area

No Alternatives were analyzed.

Great Basin Area

Issues:

Add an additional airtanker within the Area. Alternatives 41 and 42 were developed adding a T3000 and a R2200 category airtanker respectively at Hill AFB, (Ogden) Utah. Alternatives 43 and 44 were developed adding a T3000 and a R2200 category airtanker respectively at Ceder City, Utah. Alternatives 45 and 46 were developed adding a T3000 and a R2200 category airtanker respectively at West Yellowstone. Alternative 49 was developed adding a R2200 category airtanker at Battle Mountain. Alternative 61 was developed adding a T3000 category airtanker at Boise.

Given the results of the Alternatives mentioned above as well as the +$447,116 benefit to having a T3000 category airtanker at Pocatello (versus a R2200 category airtanker), the Forest Service developed the following alternatives. Time constraints did not allow for analysis by the BLM.

Alternative 70 was developed adding T3000 category airtankers at West Yellowstone and Hill AFB and staffing a T3000 category airtanker at Pocatello. Alternative 71 was developed adding T3000 category airtankers at West Yellowstone and Hill AFB and staffing a R2200 category airtanker at Pocatello. Alternative 72 was developed adding a T3000 category airtanker at West Yellowstone and staffing a T3000 category airtanker at Pocatello. Alternative 73 was developed adding a T3000 category airtanker at Hill AFB and staffing a T3000 category airtanker at Pocatello.

Key Assumptions:

None.

Results:

For addition of one T3000 or one R2200 category airtanker at Hill AFB (Alternatives 41 and 42), the marginal difference between these Alternatives and Alternative 10 is $21,711 with 629 fewer acres burned and -$167,410 with 73 more acres burned respectively. The additional acres burned in Alternative 42 is due to the modelling assumption used in which the closest airtanker was sent in the IAA, not the quickest airtanker.

For addition of one T3000 or one R2200 category airtanker at Ceder City (Alternatives 43 and 44), the marginal difference between these Alternatives and Alternative 10 is -$179,602 with 1,263 fewer acres burned and -$105,468 with 81 fewer acres burned respectively.

For addition of one T3000 or one R2200 category airtanker at West Yellowstone (Alternatives 45 and 46), the marginal difference between these Alternatives and Alternative 10 is $99,194 with 1,220 fewer acres burned and -$170,432 with 28 fewer acres burned respectively.

For addition of one R2200 category airtanker at Battle Mountain (Alternative 48), the marginal difference between this Alternative and Alternative 10 is -$116,578 with 160 fewer acres burned.

For addition of one T3000 category airtanker at Boise (Alternative 61), the marginal difference between this Alternative and Alternative 10 is $30,850 with 1,315 fewer acres burned.

In analyzing all the alternatives above, it is observed that the marginal difference in all alternatives resulted from a positive marginal difference for the Forest Service and a negative marginal difference for the BLM. It appears that analyzed individually, it is justified to recommend adding a 3000 gallon category airtanker at Hill AFB and West Yellowstone as well as staffing Pocatello with a 3000 gallon category airtanker. This result lead to the development of the Alternatives that follow as the Area wanted to examine marginal benefit of adding two airtankers. In the results that follow for Alternatives 70-73, only Forest Service data is displayed as time constraints did not allow for analysis by the BLM.

For addition of one T3000 airtanker at West Yellowstone and one T3000 airtanker at Hill AFB with the staffing of a T3000 category airtanker at Pocatello (Alternative 70), the marginal difference between this Alternative and Alternative 10 is $649,061 with 3,191 fewer acres burned.

For addition of one T3000 airtanker at West Yellowstone and one T3000 airtanker at Hill AFB with the staffing of a T2200 category airtanker at Pocatello (Alternative 71), the marginal difference between this Alternative and Alternative 10 is $31,619 with 1,757 fewer acres burned.

For addition of one T3000 airtanker at West Yellowstone and the staffing of a T3000 category airtanker at Pocatello (Alternative 72), the marginal difference between this Alternative and Alternative 10 is $617,725 with 2,599 fewer acres burned.

For addition of one T3000 airtanker at Hill AFB and the staffing of a T3000 category airtanker at Pocatello (Alternative 73), the marginal difference between this Alternative and Alternative 10 is $684,464 with 2,942 fewer acres burned.

Geographic Area Recommendation:

Both the Forest Service and the BLM recommend adding 3000 gallon category airtankers at Hill AFB and West Yellowstone as well as staffing Pocatello with a 3000 gallon category airtanker.

Geographic Area Rationale:

Economic efficiency. The BLM affirmatively supports the recommendation since the collective benefit to the U.S. Government is positive.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

The Committee commends the teamwork that existed within the Great Basin Area and was needed to complete this analysis. Addition of airtankers at Hill AFB and West Yellowstone with a 3000 gallon category airtanker at Pocatello (Alternative 70) has a slight ($40,000) disadvantage to staffing only at Hill AFB and Pocatello with a 3000 gallon category airtanker (Alternative 73). Given this small difference compared to the total alternative cost and also based on the conservative staffing to support large fires which will be documented in Step 4, this appears to be a good recommendation. It is clear observing the unit mission cost differences between T3000 and R2200 category airtankers that care to dispatch the most cost efficient airtanker is of high value to BLM fires when a logical choice is available.

Pacific Northwest Geographic Area

Issues:

Add an additional airtanker within the Area. Alternatives 14-20 were developed adding an airtanker, one at a time, in addition to the staffing in Alternative 01 (Current Staffing Based on 1995 Contract). Alternatives developed were: Wenatchee (Alternative 14), Redmond (Alternative 15), Klamath Falls (Alternative 16), LaGrande (Alternative 17), Medford (Alternative 18), Troutdale (Alternative 19) and Omak (Alternative 20).

Key Assumptions:

At bases were more than two airtankers would exist with two of them 3000 gallon category airtankers, the 3000 gallon airtankers were dispatched first and second with the R2200 category airtanker third.

Results:

All alternatives had a negative marginal difference in alternative cost when compared with Alternative 01.

Redmond had the smallest negative marginal difference at -$43,069 with Klamath Falls the most negative, -$253,665. Wenatchee has a marginal difference of a -$113,800 which became positive when some initial data was included from effects on land protected by the Washington State Department of Natural Resources. Verification of this result will be left to Phase 2.

Geographic Area Recommendation:

Add no airtankers based on initial attack efficiency within the Area. Examine in Phase 2 inclusion of initial attack data from other agencies.

Geographic Area Rationale:

Economic efficiency.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur.

Rocky Mountain Geographic Area

Issues:

Add an additional airtanker within the Area. Alternative 6A (add R2200 category airtanker at Rapid City) and Alternative 6B (add T3000 category airtanker at Rapid City) were developed.

Key Assumptions:

None.

Results:

For addition of one R2200 category airtanker at Rapid City (Alternative 6A), the marginal difference between this Alternative and Alternative 01 is -$161,997 with 15 fewer acres burned.

For addition of one T3000 category airtanker at Rapid City (Alternative 6B), the marginal difference between this Alternative and Alternative 01 is -$133,917 with 85 fewer acres burned.

Geographic Area Recommendation:

Add an T3000 category airtanker at Rapid City.

Geographic Area Rationale:

A T3000 category airtanker can reduce the acres burned by 85 on the Black Hills and Nebraska National Forests. The service area for the Rapid City airtanker base contains high value timber resources as well as mixed ownership lands composed of urban and rural interfaces. Support (though not included in the analysis) is possible to initial attack in Wyoming and southeast Montana. The Black Hills National Forest has the highest fire frequency and acres burned within the Area analyzed.

Study Committee Recommendation:

The committee reaffirms the need for an airtanker base at Rapid City to support airtanker operations on fires and pre-positioning during areas of need. The committee does not recommend staffing an airtanker on a full time basis at Rapid City.

Study Committee Rationale:

The data does not support full time staffing based on initial attack economic efficiency. Large fire support and pre-positioning can occur from an airtanker base at Rapid City.

Southwest Geographic Area

Issues:

Add one R2200 category airtanker at Prescott (Alternative 30) with the keeping of an airtanker at Grand Canyon.

Key Assumptions:

None.

Results:

Alternative 01 (Current Staffing Based on 1995 Contract) has a alternative cost of $26,698,022. Alternatives 30 have a alternative cost of $27,353,486 which is higher that the current situation.

Geographic Area Recommendation:

Add no airtankers based on initial attack efficiency within the Area.

Geographic Area Rationale:

Economic efficiency.

Study Committee Recommendation:

Concur.

Study Committee Rationale:

Concur.

Southern Geographic Area

No alternatives were analyzed.

Scenario 7 - Analysis of Airtanker in 1000-2000 Gallon Size Class Based on Geographic Area Discretion

The goal of this Scenario was to determine if there appears to be a need for an airtanker in the 1000 to 2000 gallon size category. Geographic areas were to examine this Scenario on an optional basis.

The process was to develop alternatives at selected locations by modifying Scenario 1 by replacing or adding a T1500 category airtanker. If the selected location had two airtankers, the Area analyzed and reported the values for the following combinations: 1-T1500 (first out) and 1-R2200; 2-T1500 (first out) and 1-R2200; and 2-T1500. If the selected location had one airtanker, the Area analyzed and reported the values for a single T1500 with all other airtankers as staffed in the 1995 contract. Following are the results of analysis by geographic area.

Three Geographic Areas analyzed this optional Scenario. The following information summaries the results.

		Difference from R2200		Difference from T3000	
Geo. Area	Base	Acres Burned	Alternative Cost	Acres Burned	Alternative Cost
Rocky Mountain	Jeffco	-12	-$ 33,986	-49	-$11,891
	Grand Junction	1	-$ 37,091	- 6	+$11,066
	Grand Rapids	-11	-$ 32,824	- 6	-$176,034
Southern	Ashville	0	-$126,930	-150	-$310,919
	Knoxville	-11	-$108,137	-177	-$112,028
	Ft. Smith	-19	-$ 5,880	- 37	+$ 59,714

In all cases except for one in the Rocky Mountain and Southern Areas, the T1500 was less efficient in reducing acres burned from an R2200 or T3000 category airtanker. In two situations though, the marginal difference in Alternative Cost is favorable to the T1500 category airtanker. In several situations, the differences are small though indicating an almost equal tradeoff between the categories.

STEP 4. HISTORIC RETARDANT USE on WILDFIRES THAT HAVE ESCAPED INITIAL ATTACK

The graph in Figure 4 was developed for data in the Forest Service and Department of Interior data bases on retardant use on large fires. The data used to build the graph is in Appendix L. The data below is quite variable as one can see. The average number of gallons delivered per fire for fires from 100-5000 acres is 30,392 gallons. For fires 5000 acres and larger in size, the average gallons dropped is 202,205. The fires sampled are from all agencies and occurred within the last two years. Averages are also given for the Forest Service and the BLM large fire occurrence will be use for each agency separately in this analysis.

Table 7A (on page 38, top) contains a listing of the number of fires from the Forest Service fire occurrence data base that were greater than 100 acres (D-G) for the years 1970-1993. The data is displayed on a half-month basis (first two weeks of the month versus the last two weeks of the month). Table 7B (on page 38, middle) contains a listing of the number of fires from the BLM fire occurrence data base that were greater than 100 acres (D-G) for the years 1980-1993. There are totaled for 1980-1993 in Table 7C (on page 38, bottom). Details of this fire occurrence data are in Appendix M.

Together, this information can allow calculation of the expected number of airtanker plane-days that would be needed to support these large fires. An airtanker plane-day is one airtanker flying for 8 hours for one day. This information is contained in Tables 8A-8C. The details of how this is calculated follow.

In the section documenting Step 1, it was developed that on the average, 3001 gallons are dropped per hour flown by retardant planes. Using the coefficients documented in Figure 4 and the fire occurrence in Tables 7A-7C, the total retardant demand for a two week period can be determined. Current regulations allow a flight crew to fly no more than 8 hours per day, hence the average maximum of gallons that can be dropped in a day by a retardant plane is 3001*8 or 24,008 gallons per day. Dividing the total gallons needing to be dropped on D-G fires by 24,008, an estimate of the number of airtanker plane-days needed to support fires in the D-G size class is determined. The expected airtanker plane-days by half-month is contained in Table 8A for the Forest Service only, in Table 8B for the BLM only, and for both agencies together in Table 8C. These tables are on page 39.

Figure 4.

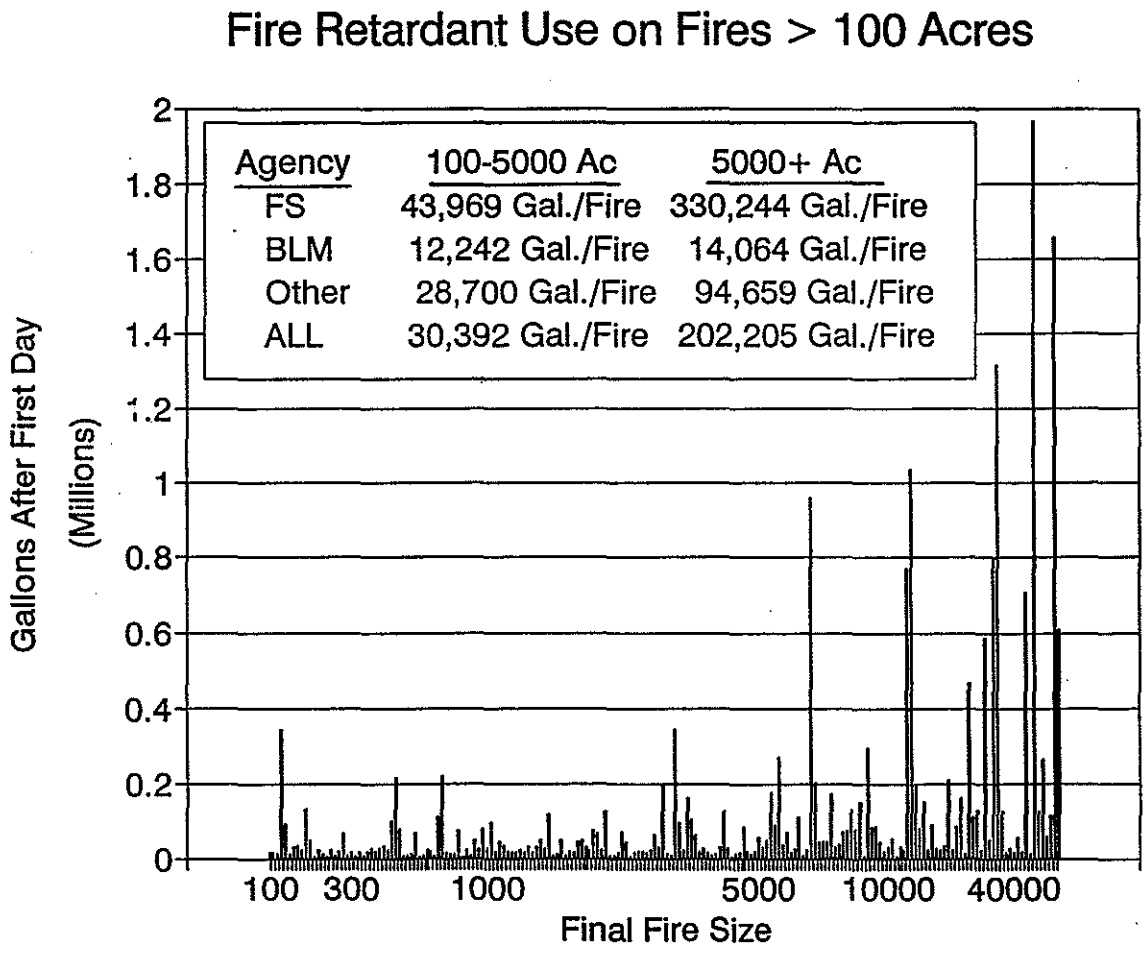


TABLE 7A - FOREST SERVICE - NUMBER OF D-G FIRES

FS FIRES		JAN 1	JAN 2	FEB 1	FEB 2	MAR 1	MAR 2	APR 1	APR 2	MAY 1	MAY 2	JUN 1	JUN 2	JUL 1	JUL 2	AUG 1	AUG 2	SEP 1	SEP 2	OCT 1	OCT 2	NOV 1	NOV 2	DEC 1	DEC 2	
	YEA	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM
ALL FS	1970	1	1	2	9	4	2	21	10	8	5	1	11	11	16	10	35	5	20	14	4	10	3	5	0	208
ALL FS	1971	0	4	1	1	9	9	18	13	6	8	4	25	12	3	7	16	5	17	4	2	2	2	0	0	168
ALL FS	1972	1	0	0	4	6	5	2	2	7	3	1	1	16	15	20	6	6	2	4	2	0	1	0	0	104
ALL FS	1973	0	0	0	0	1	1	1	1	2	3	2	12	15	10	33	16	5	0	3	3	3	3	0	0	114
ALL FS	1974	0	1	3	7	5	5	5	6	7	9	7	35	11	17	11	11	17	18	1	6	8	0	1	1	192
ALL FS	1975	0	0	0	2	3	5	3	5	7	1	7	3	7	6	21	4	6	13	4	2	1	3	2	1	106
ALL FS	1976	0	6	3	5	10	5	8	6	6	1	13	10	8	3	6	15	4	1	3	3	7	6	2	3	134
ALL FS	1977	0	0	2	18	5	12	9	10	2	5	15	8	6	12	37	5	1	0	1	1	4	3	2	1	159
ALL FS	1978	0	0	0	3	0	10	18	4	3	4	4	9	11	9	15	8	5	8	8	14	13	0	0	2	148
ALL FS	1979	0	0	2	0	3	4	2	4	6	3	16	27	32	18	19	9	28	15	14	4	1	5	3	1	216
ALL FS	1980	1	1	1	7	8	6	9	14	5	4	10	20	13	36	28	13	7	10	18	5	19	14	8	2	259
ALL FS	1981	2	8	0	10	13	32	19	7	2	4	2	19	4	23	17	46	2	16	0	3	6	6	5	1	247
ALL FS	1982	0	1	0	4	4	5	5	2	0	3	3	4	3	7	12	8	10	2	2	3	5	2	0	0	85
ALL FS	1983	1	0	0	4	5	7	1	6	4	11	4	6	24	13	6	4	4	4	0	2	2	1	0	0	109
ALL FS	1984	2	3	2	1	0	2	2	12	11	22	6	13	33	27	32	17	8	17	0	3	3	1	0	4	221
ALL FS	1985	0	1	1	4	6	10	20	10	6	7	11	33	68	34	7	16	4	4	4	3	1	0	0	2	252
ALL FS	1986	4	10	0	2	13	31	11	10	21	2	3	11	35	13	89	16	7	0	5	3	3	0	0	1	290
ALL FS	1987	0	2	5	0	8	12	16	18	14	0	34	20	25	13	15	66	112	25	19	4	49	4	7	0	468
ALL FS	1988	1	7	4	27	14	50	14	12	22	11	23	41	49	52	50	38	35	7	8	9	4	1	6	1	486
ALL FS	1989	1	1	4	5	10	18	10	17	7	12	15	15	45	89	8	4	16	1	5	5	14	7	6	2	317
ALL FS	1990	5	0	5	1	2	5	4	3	5	6	5	28	16	17	59	5	17	5	12	4	7	8	2	1	222
ALL FS	1991	0	6	3	2	8	18	7	3	5	4	1	7	11	9	16	22	7	8	22	29	12	8	1	3	212
ALL FS	1992	0	0	4	8	4	3	11	5	9	5	14	19	14	12	44	50	4	16	4	6	0	0	0	0	232
ALL FS	1993	0	0	1	0	1	1	2	3	9	17	14	13	11	5	10	11	4	6	6	7	4	2	2	0	129
1970-1993																										
AVERAGE =		1	2	2	5	6	11	9	8	7	6	9	16	20	19	24	18	13	9	7	5	7	3	2	1	212
MAXIMUM =		5	10	5	27	14	50	21	18	22	22	34	41	68	89	89	66	112	25	22	29	49	14	8	4	486
1980-1993																										
AVERAGE =		1	3	2	5	7	14	9	9	9	8	10	18	25	25	28	23	17	9	8	6	9	4	3	1	252
MAXIMUM =		5	10	5	27	14	50	20	18	22	22	34	41	68	89	89	66	112	25	22	29	49	14	8	4	486

TABLE 7B - BUREAU OF LAND MANAGEMENT - NUMBER OF D-G FIRES

BLM FIRES		JAN 1	JAN 2	FEB 1	FEB 2	MAR 1	MAR 2	APR 1	APR 2	MAY 1	MAY 2	JUN 1	JUN 2	JUL 1	JUL 2	AUG 1	AUG 2	SEP 1	SEP 2	OCT 1	OCT 2	NOV 1	NOV 2	DEC 1	DEC 2	
	YEA	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM
ALL-BLM	1980							1	3	2	12	4	28	22	83	36	23	16	4	10	2					246
ALL-BLM	1981							2	2	3	4	9	61	39	56	53	71	23	20	6	5					354
ALL-BLM	1982							0	2	0	1	3	18	24	23	19	43	14	1	2	3					153
ALL-BLM	1983							1	7	3	15	15	30	79	65	55	20	24	19	2	5					340
ALL-BLM	1984							1	1	8	18	26	31	73	36	90	48	15	15	6	1					369
ALL-BLM	1985							2	2	3	14	12	75	163	63	26	61	7	2	2	1					433
ALL-BLM	1986							2	2	0	5	14	45	46	25	112	30	21	2	4	1					309
ALL-BLM	1987							11	13	10	3	39	36	28	31	26	42	16	13	16	7					291
ALL-BLM	1988							10	6	5	17	32	64	58	58	46	31	18	8	8	11					372
ALL-BLM	1989							3	14	5	10	10	36	60	60	26	17	7	7	7	0					262
ALL-BLM	1990							4	2	4	20	5	25	100	38	58	14	18	4	5	2					299
ALL-BLM	1991							2	3	1	3	16	46	48	29	16	39	8	7	12	8					238
ALL-BLM	1992							8	1	12	17	37	30	18	32	55	38	8	12	12	1					281
ALL-BLM	1993							1	5	11	16	38	39	25	48	45	13	11	8	4	5					269
1980-1993																										
AVERAGE =								3	5	5	11	19	40	56	46	47	35	15	9	7	4					301
MAXIMUM =								11	14	12	20	39	75	163	83	112	71	24	20	16	11					433

TABLE 7C - FOREST SERVICE AND BUREAU OF LAND MANAGEMENT - NUMBER OF D-G FIRES

FS/BLM DATA		JAN 1	JAN 2	FEB 1	FEB 2	MAR 1	MAR 2	APR 1	APR 2	MAY 1	MAY 2	JUN 1	JUN 2	JUL 1	JUL 2	AUG 1	AUG 2	SEP 1	SEP 2	OCT 1	OCT 2	NOV 1	NOV 2	DEC 1	DEC 2	
		D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM D-G
FS+BLM	1980	1	1	1	7	8	6	10	17	7	16	14	48	35	119	64	36	23	14	28	7	19	14	8	2	505
FS+BLM	1981	2	8	0	10	13	32	21	9	5	8	11	80	43	79	70	117	25	36	6	8	6	6	5	1	601
FS+BLM	1982	0	1	0	4	4	5	5	4	0	4	6	22	27	30	31	51	24	3	4	6	5	2	0	0	238
FS+BLM	1983	1	0	0	4	5	7	2	13	7	26	19	36	103	78	61	24	28	23	2	7	2	1	0	0	449
FS+BLM	1984	2	3	2	1	0	2	3	13	19	40	32	44	106	63	122	65	23	32	6	4	3	1	0	4	590
FS+BLM	1985	0	1	1	4	6	10	22	12	9	21	23	108	231	97	33	77	11	6	6	4	1	0	0	2	685
FS+BLM	1986	4	10	0	2	13	31	13	12	21	7	17	56	81	38	201	46	28	2	9	4	3	0	0	1	599
FS+BLM	1987	0	2	5	0	8	12	27	31	24	3	73	56	53	44	41	108	128	38	35	11	49	4	7	0	759
FS+BLM	1988	1	7	4	27	14	50	24	18	27	28	55	105	107	110	96	69	53	15	16	20	4	1	6	1	858
FS+BLM	1989	1	1	4	5	10	18	13	31	12	22	25	51	105	149	34	21	23	8	12	5	14	7	6	2	579
FS+BLM	1990	5	0	5	1	2	5	8	5	9	26	10	53	116	55	117	19	35	9	17	6	7	8	2	1	521
FS+BLM	1991	0	6	3	2	8	18	9	6	6	7	17	53	59	38	32	61	15	15	34	37	12	8	1	3	450
FS+BLM	1992	0	0	4	8	4	3	19	6	21	22	51	49	32	44	99	88	12	28	16	7	0	0	0	0	513
FS+BLM	1993	0	0	1	0	1	1	3	8	20	33	52	52	36	53	55	24	15	14	10	12	4	2	2	0	398
1980-1993																										
AVERAGE =		1	3	2	5	7	14	13	13	13	19	29	58	81	71	75	58	32	17	14	10	9	4	3	1	553
MAXIMUM =		5	10	5	27	14	50	27	31	27	40	73	108	231	149	201	117	128	38	35	37	49	14	8	4	858

FOREST SERVICE - NUMBER OF AIRTANKER PLANE-DAYS

D-F = 43,969 GAL/FIRE G=330,244 GAL/FIRE ALL D-G FIRES ARE INCLUDED

FS DATA		JAN	JAN	FEB	FEB	MAR	MAR	APR	APR	MAY	MAY	JUN	JUN	JUL	JUL	AUG	AUG	SEP	SEP	OCT	OCT	NOV	NOV	DEC	DEC	
PLANE DAYS		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
AREA	YEAR	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM
ALL-FS	1970	2	2	4	16	7	4	38	18	15	9	2	20	32	53	18	100	9	120	26	7	30	5	9	0	548
ALL-FS	1971	0	7	2	2	16	16	33	24	11	15	7	93	22	5	13	41	9	31	19	4	4	4	0	0	379
ALL-FS	1972	2	0	0	7	23	9	4	4	13	5	2	2	29	27	37	23	11	4	7	4	0	2	0	0	214
ALL-FS	1973	0	0	0	0	2	2	2	2	4	5	4	46	27	30	156	41	9	0	17	17	17	5	0	0	388
ALL-FS	1974	0	2	5	13	9	9	21	11	13	16	13	112	20	31	20	32	31	45	14	11	15	0	2	2	447
ALL-FS	1975	0	0	0	4	5	9	5	9	13	2	13	5	13	11	62	19	11	36	7	4	2	29	4	2	266
ALL-FS	1976	0	11	5	9	18	9	15	11	11	2	48	42	27	17	11	27	7	2	17	5	13	11	4	5	329
ALL-FS	1977	0	0	4	33	9	22	16	18	4	21	51	15	11	34	163	9	2	0	2	2	7	5	4	2	434
ALL-FS	1978	0	0	0	5	0	18	33	7	5	7	7	16	20	16	39	15	9	15	15	26	24	0	0	4	283
ALL-FS	1979	0	0	4	0	5	7	4	7	11	5	41	73	71	57	35	28	99	27	26	7	2	9	5	2	527
ALL-FS	1980	2	2	2	13	15	11	16	26	21	7	18	60	36	90	51	36	13	18	33	9	35	109	15	4	641
ALL-FS	1981	4	15	0	18	24	59	35	13	4	7	4	47	7	78	43	227	4	65	0	5	11	11	9	2	691
ALL-FS	1982	0	2	0	7	7	9	9	4	0	5	5	7	5	13	22	15	18	4	4	17	9	4	0	0	168
ALL-FS	1983	2	0	0	7	9	13	2	11	7	20	7	11	44	24	11	7	7	7	0	4	4	2	0	0	200
ALL-FS	1984	4	5	4	2	0	4	4	22	20	52	11	24	72	49	59	43	15	31	0	5	5	2	0	7	441
ALL-FS	1985	0	2	2	7	11	18	37	18	11	13	32	108	315	62	13	29	7	7	7	17	2	0	0	4	724
ALL-FS	1986	7	18	0	4	24	57	20	18	38	4	5	20	76	24	330	29	61	0	9	5	5	0	0	2	758
ALL-FS	1987	0	4	9	0	15	22	29	33	26	0	74	49	58	36	51	192	599	93	47	7	102	7	13	0	1465
ALL-FS	1988	2	13	7	49	26	92	26	22	40	20	54	159	221	167	223	248	171	37	15	16	7	2	11	2	1629
ALL-FS	1989	2	2	7	9	18	45	18	43	13	22	39	51	130	378	15	7	29	2	9	9	26	13	11	4	903
ALL-FS	1990	9	0	9	2	4	9	7	5	9	11	9	75	29	31	275	9	43	9	22	7	25	27	4	2	633
ALL-FS	1991	0	11	5	4	15	33	13	17	9	7	2	13	32	16	41	52	13	15	64	65	22	15	2	5	472
ALL-FS	1992	0	0	7	15	7	5	20	9	16	9	38	59	26	22	140	223	19	53	7	11	0	0	0	0	687
ALL-FS	1993	0	0	2	0	2	2	4	5	16	79	38	24	20	9	18	20	7	23	11	49	7	4	4	0	344
1970-1993																										
AVERAGE =		1	4	3	9	11	20	17	15	14	14	22	47	56	53	77	61	50	27	16	13	16	11	4	2	565
MAXIMUM =		9	18	9	49	26	92	38	43	40	79	74	159	315	378	330	248	599	120	64	65	102	109	15	7	1629
1980-1993																										
AVERAGE =		2	5	4	10	13	27	17	18	17	18	24	50	77	71	92	81	72	26	16	16	19	14	5	2	697
MAXIMUM =		9	18	9	49	26	92	37	43	40	79	74	159	315	378	330	248	599	93	64	65	102	109	15	7	1629

BUREAU OF LAND MANAGEMENT - NUMBER OF AIRTANKER PLANE-DAYS

D-F= 6,121 GAL/FIRE G=14,042 GAL/FIRE D-F=50% OF FIRES GET RETARDANT G=100% OF FIRES GET RETARDANT

BLM DATA		JAN	JAN	FEB	FEB	MAR	MAR	APR	APR	MAY	MAY	JUN	JUN	JUL	JUL	AUG	AUG	SEP	SEP	OCT	OCT	NOV	NOV	DEC	DEC	
PLANE DAYS		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
AREA	YEAR	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM
ALL-BL	1980							0	1	1	4	1	8	6	26	11	6	4	1	3	1					72
ALL-BL	1981							1	1	1	1	3	19	12	17	15	22	6	7	2	1					107
ALL-BL	1982							0	1	0	0	1	5	7	6	6	12	4	0	1	1					43
ALL-BL	1983							0	2	1	4	4	8	23	20	15	6	6	5	1	1					97
ALL-BL	1984							0	0	2	5	9	8	23	9	29	15	4	4	2	0					109
ALL-BL	1985							1	1	1	4	4	22	59	19	7	19	2	1	1	0					139
ALL-BL	1986							1	1	0	1	4	13	15	8	39	8	6	1	1	0					96
ALL-BL	1987							3	3	3	1	12	10	7	9	7	13	5	4	4	2					82
ALL-BL	1988							3	2	1	4	9	20	19	17	13	9	6	3	2	3					112
ALL-BL	1989							1	4	1	3	3	10	17	18	7	4	2	2	2	0					71
ALL-BL	1990							1	1	1	5	1	8	35	13	19	4	5	1	1	1					97
ALL-BL	1991							1	1	0	1	6	19	16	8	4	11	2	2	3	3					77
ALL-BL	1992							2	0	3	4	10	9	5	9	18	12	2	3	3	0					82
ALL-BL	1993							0	2	3	4	13	11	8	15	12	4	3	2	1	2					80
1980-1993																										
AVERAGE =								1	1	1	3	6	12	18	14	14	10	4	2	2	1					90
MAXIMUM =								3	4	3	5	13	22	59	26	39	22	6	7	4	3					139

FOREST SERVICE AND BUREAU OF LAND MANAGEMENT - NUMBER OF AIRTANKER PLANE-DAYS

FS/BLM DATA		JAN	JAN	FEB	FEB	MAR	MAR	APR	APR	MAY	MAY	JUN	JUN	JUL	JUL	AUG	AUG	SEP	SEP	OCT	OCT	NOV	NOV	DEC	DEC	
PLANE DAYS		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
AREA	YEAR	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	D-G	SUM
FS+BLM	1980	2	2	2	13	15	11	17	26	22	11	20	68	42	116	62	42	17	19	36	10	35	109	15	4	713
FS+BLM	1981	4	15	0	18	24	59	35	13	4	9	6	66	19	94	59	250	10	72	2	7	11	11	9	2	798
FS+BLM	1982	0	2	0	7	7	9	9	5	0	6	6	13	13	19	27	26	22	4	4	19	9	4	0	0	211
FS+BLM	1983	2	0	0	7	9	13	2	13	8	24	11	19	67	43	26	14	14	13	1	5	4	2	0	0	297
FS+BLM	1984	4	5	4	2	0	4	4	22	22	57	20	32	95	59	88	58	18	35	2	6	5	2	0	7	549
FS+BLM	1985	0	2	2	7	11	18	37	19	12	17	36	130	374	82	20	48	9	8	8	18	2	0	0	4	863
FS+BLM	1986	7	18	0	4	24	57	21	19	38	5	10	33	91	32	369	37	66	1	10	6	5	0	0	2	854
FS+BLM	1987	0	4	9	0	15	22	32	36	29	1	86	59	65	44	58	205	603	97	51	9	102	7	13	0	1548
FS+BLM	1988	2	13	7	49	26	92	29	24	42	24	63	179	240	184	236	258	178	40	17	19	7	2	11	2	1741
FS+BLM	1989	2	2	7	9	18	45	19	47	14	25	42	61	147	396	21	12	31	4	11	9	26	13	11	4	974
FS+BLM	1990	9	0	9	2	4	9	8	6	11	16	10	83	64	44	294	13	48	10	23	8	25	27	4	2	731
FS+BLM	1991	0	11	5	4	15	33	13	18	9	8	8	31	48	25	46	63	15	16	67	68	22	15	2	5	549
FS+BLM	1992	0	0	7	15	7	5	22	9	20	13	48	67	30	31	159	235	22	57	11	11	0	0	0	0	769
FS+BLM	1993	0	0	2	0	2	2	4	7	20	83	50	35	29	24	30	24	10	25	12	51	7	4	4	0	424
1980-1993																										
AVERAGE =		2	5	4	10	13	27	18	19	18	21	30	63	95	85	107	92	76	29	18	17	19	14	5	2	787
MAXIMUM =		9	18	9	49	26	92	37	47	42	83	86	179	374	396	369	258	603	97	67	68	102	109	15	7	1741

Figure 5 contains a graph of the 1980-1993 average at the bottom of Table 7C. The fire occurrence data is for 1980-1983 to interface both Forest Service and BLM data. Note the increase of D-G fires in March mainly from the Eastern and Southern Area. The Alaska fire season can be seen in the peak in BLM occurrence in late June. The traditional western fire season starts in June and peaks on August. The late fire season due to East and Santa Ana in the western coastal areas and dry cold frontal winds in the intermountain areas is seen in late October and November.

Figure 5

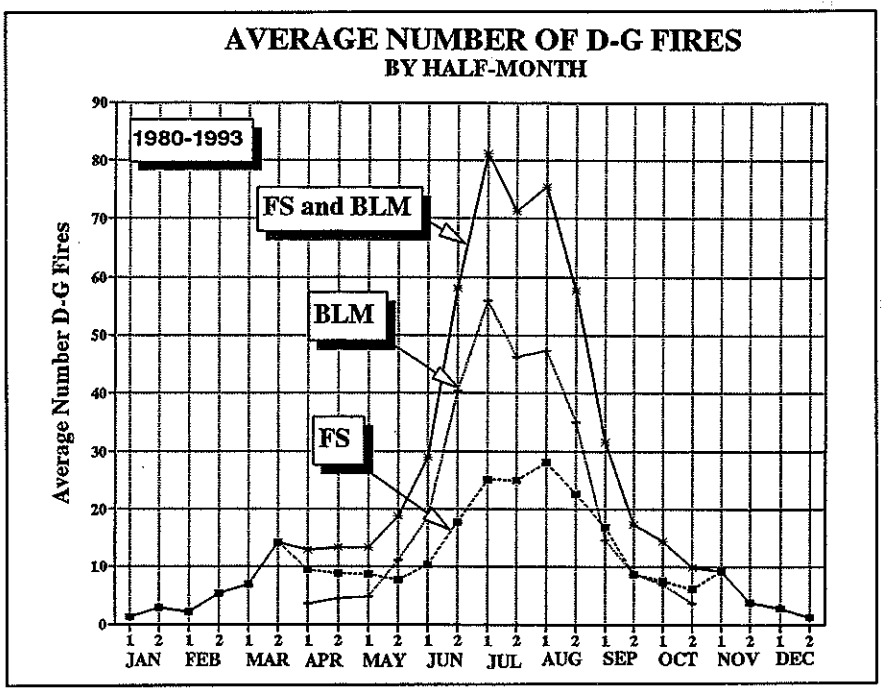
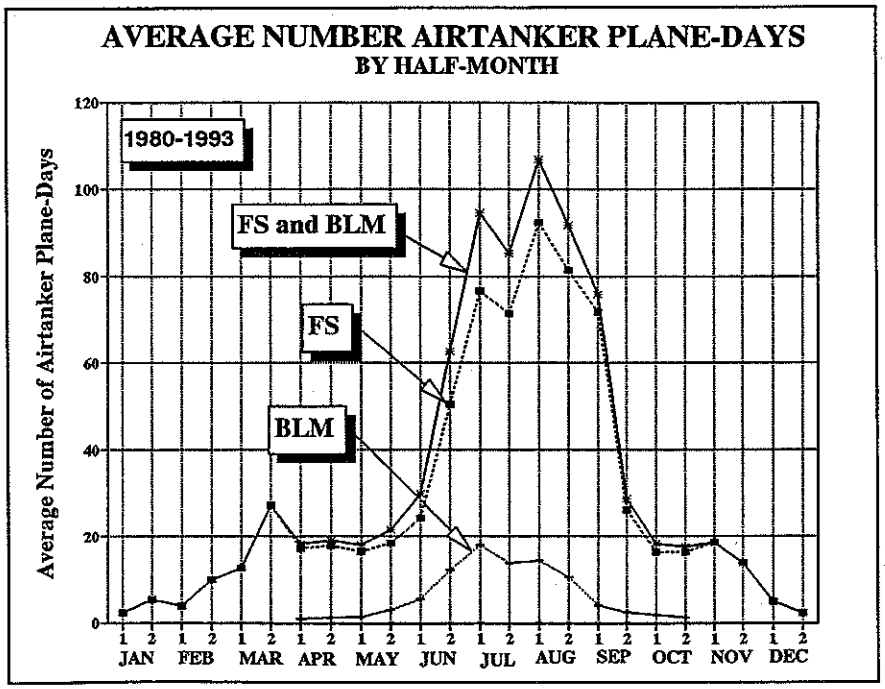


Figure 6 graphs the associated airtanker plane-days requested to meet this large fire occurrence. If the demand was an even flow over the half-month (15 days), then the number of retardant planes needed to meet the requested demand can be estimated by dividing the number of airtanker plane-days by 15. This would be a conservative estimate as most demand would be for a shorter period of time.

Figure 6



Staffing an additional number of airtankers to meet this demand would provide a benefit to large fire support as well as include a reduced compromise to initial attack by the drawing away of airtankers which support initial attack.

The study committee recommends staffing one airtanker in the South at Knoxville to support the large fires in the Southern and Eastern Areas. This also has a benefit as the fire season is during a time of year that other resources from the west are more than 24 hours away. The study committee recommends staffing two large airtankers in the Southwest for large fire support during the southwestern fire season and three airtankers in the Western United States for large fire support during the western fire season.

STEP 5. INFORMATION on the PHYSICAL STATUS of AIRTANKER BASES

Airtanker bases have evolved through the years as products and aircraft have changed. These changes have responded to short term needs rather than long range planning. Maintenance for facilities and equipment has been less than what is needed to meet acceptable standards of safety, health and sanitation. These issues and concerns have been recognized by government employees and the airtanker industry.

Information was requested from each base to determine the physical status and associated capital improvements needed.

Responses were received from 74 tanker bases. Information received was generally very complete. Some bases reported capital improvements were needed, but failed to include dollar estimates. Detailed responses to the questionnaire are included in Appendix N.

Personnel Staffing

Most of the staffing issues raised shows the need for some type of career appointment for the Air Tanker Base Manager. Responses show 30% of the bases are staffed with Permanent Full Time employees, and 19% are staffed with Permanent Part Time employees. There are bases with a Temporary employee as the Air Tanker Base Manager.

There is a shortage of trained personnel available for extended operations and in some cases for seven day coverage.

There are 12 bases where the mixing and loading are accomplished by contract.

Capital Improvements Needed

Item	%of Bases	Estimated Cost
Facilities	52%	$800,000
Base Equipment	26%	$539,600
Waste Disposal/Treatment	66%	$8,428,574
Base Relocation	25%	$39,408,000
Ramp Maintenance/Repair	38%	$9,187,000
		$58,363,174

Facilities include office space, equipment storage and maintenance, crew rest area, kitchen, showers.

Base equipment includes retardant storage tanks, mixing, pumping, retardant recirculation and loading hose.

Waste disposal/treatment includes the proper containment and disposal of waste water from aircraft and ramp washdowns, fuel/oil and retardant spills.

Base relocation includes the relocation of the base to a different location on the airport or to a different airport.

Ramp maintenance includes the repair and replacement of the asphalt/concrete surface of the ramp. Some of this provides for containment of spills and washdown fluids for proper disposal.

STEP 6. DISPLAY STAFFING, BASES, PROCUREMENT, and DISPATCH FLOW OPTIONS

Staffing of Airtankers and Bases for the 1996-1998 Contract Period

The box on the next page contains the large airtanker staffing based on the results of the analysis of initial attack effectiveness and large fire support. Based on geographic area analysis, additional airtankers are located at West Yellowstone and Hill AFB. In addition, two large fire support airtankers are located in the Southwest Area in early June thought mid-July. One of these aircraft goes to the Hill AFB contract in mid-July while the other one becomes a large fire support airtanker stationed in LaGrande. Additional large fire support airtankers are staffed from mid-June to mid-July in Redding and Boise. The intent of the large fire support airtankers is to provide support to the entire airtanker fleet based on the analysis of large fire support needs.

Options to address solutions to the physical condition of airtanker bases have not been developed. Further development of options with analysis should occur in Phase 2.

It is expected that the hosting unit will make adequate provisions to support the airtanker. With the new Interagency Retardant Base Planning Guide Fixed and Rotor Wing now available, the expectations should be clear.

Procurement of Airtankers for the 1996-1998 Contract Period

This topic will be fulfilled by the schedule defined in procurement documents. At this time, the use of the private sector to provide airtanker support using an exclusive-use contract is recommended. Use of MAFFS at times when availability of airtankers from the private sector is not possible is recommended as has occurred in the past.

Dispatch Flow

Mobility of critical firefighting resources is the key to providing as much as possible successful initial attack of ignitions during the episodal ignition events. Airtankers are a unique resource that can fly significant distances within logical mobilization times to provide relatively high fireline production rates on fires. A key to this mobility is maintaining an adequate dispatch flow managed at an organization level that maximizes flexibility and utilizes broadscale analysis in decision-making.

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.)	5/18-11/17	157	AT2200
C-FS	Hemet (San Bern Co.)	6/15-11/17	134	AT2200
C-FS	Lancaster	6/03-12/01	156	AT2200
C-FS	Lancaster	7/02-11/15	118	AT2200
C-FS	**Mather (Chico)**	**7/03-10/16**	**90**	**AT2200**
C-BLM	**Mather (Porterville BLM)**	**6/02-08/17**	**66**	**AT2200**
C-CA	Paso Robles	6/01-10/31	153	AT2200
C-FS	Porterville	6/02-10/24	124	AT2200
C-FS	Ramona	4/30-11/30	184	AT2200
C-FS	Redding	6/11-10/14	108	AT3000
C-FS	**Redding (D-G Fires)**	**6/15-9/15**	**93**	**AT2200**
C-CA	Redding	7/01-10/15	107	AT2200
C-FS	Santa Barbara	6/02-11/02	132	AT3000
C-CA	Santa Rosa	7/01-10/15	107	AT3000
E-MN	Hibbing	4/15-5/29	45	AT2200
E-MN	Bemidji	4/15-5/29	45	AT2200
E-BIA	Brainerd	4/05-5/19	45	AT2200
GB-FS	Boise	7/13-9/28	67	**AT3000**
GB-FS	**Boise (D-G Fires)**	**6/15-9/15**	**93**	**AT2200**
GB-FS	**Hill (SLC)**	**7/17-9/30**	**76**	**AT3000**
GB-FS	McCall	7/17-9/21	57	AT3000
GB-BLM	Minden	6/16-9/13	90	AT3000
GB-BLM	Pocatello	6/23-9/29	85	**AT3000**
GB-BLM	Stead	6/01-9/08	100	AT2200
N-BLM	Billings	**7/13-9/28**	**80**	AT2200
N-FS	Coeur'd Alene	7/15-9/29	66	**AT3000**
N-FS	Grangeville	7/16-9/16	54	AT2200
N-FS	Helena	7/29-9/18	44	**AT2200**
N-FS	Kalispell	7/13-9/14	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	5/27-9/30	109	AT3000
PNW-FS	LaGrande	6/26-10/15	95	AT3000
PNW-FS	**LaGrande (D-G Fires)**	**7/15-9/30**	**77**	**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	98	AT3000
PNW-FS	Wenatchee	6/11-10/03	98	**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	100	AT2200
S-FS	Asheville	2/23-5/04	62	**AT3000**
S-FS	Ft. Smith	**2/27-5/29**	**80**	**AT2200**
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	4/29-7/12	**65**	AT2200
SW-FS	Ft. Huachuca	**5/14-6/21**	**33**	**AT3000**
SW-FS	**Ft. Huachuca (D-G Fires)**	**6/01-7/15**	**45**	**AT2200**
SW-FS	Phoenix	5/06-8/17	88	AT3000
SW-FS	Prescott	5/11-7/27	67	AT3000
SW-FS	**Prescott (Old GCN)**	**5/11-7/27**	**67**	**AT2200**
SW-BLM	**Roswell (D-G Fires)**	**6/01-7/14**	**44**	**AT2200**
SW-FS	Silver City	5/06-7/26	70	AT3000
SW-FS	Silver City	4/19-7/11	72	AT2200
SW-FS	Winslow	5/10-7/11	54	AT2200

Figure 7 - Northern Region, Forest Service, 1994

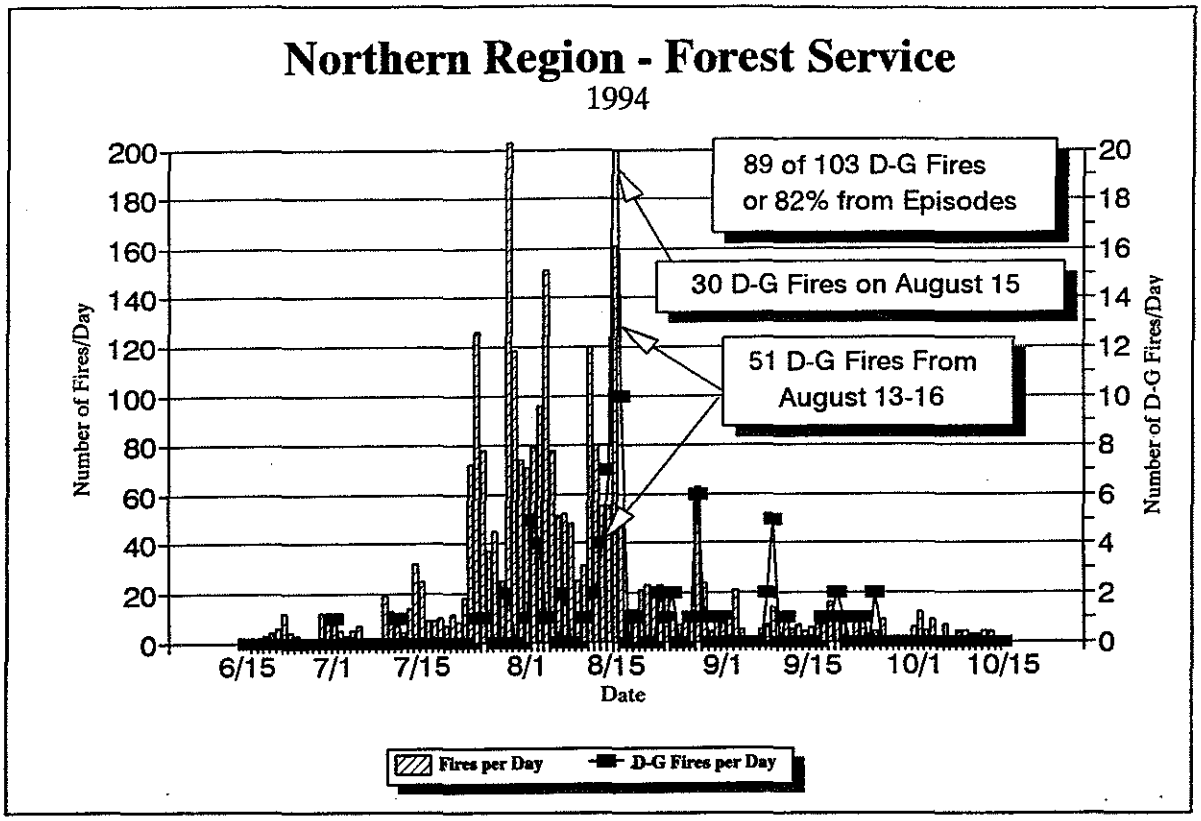


Figure 8 - Intermountain Region, Forest Service, 1994

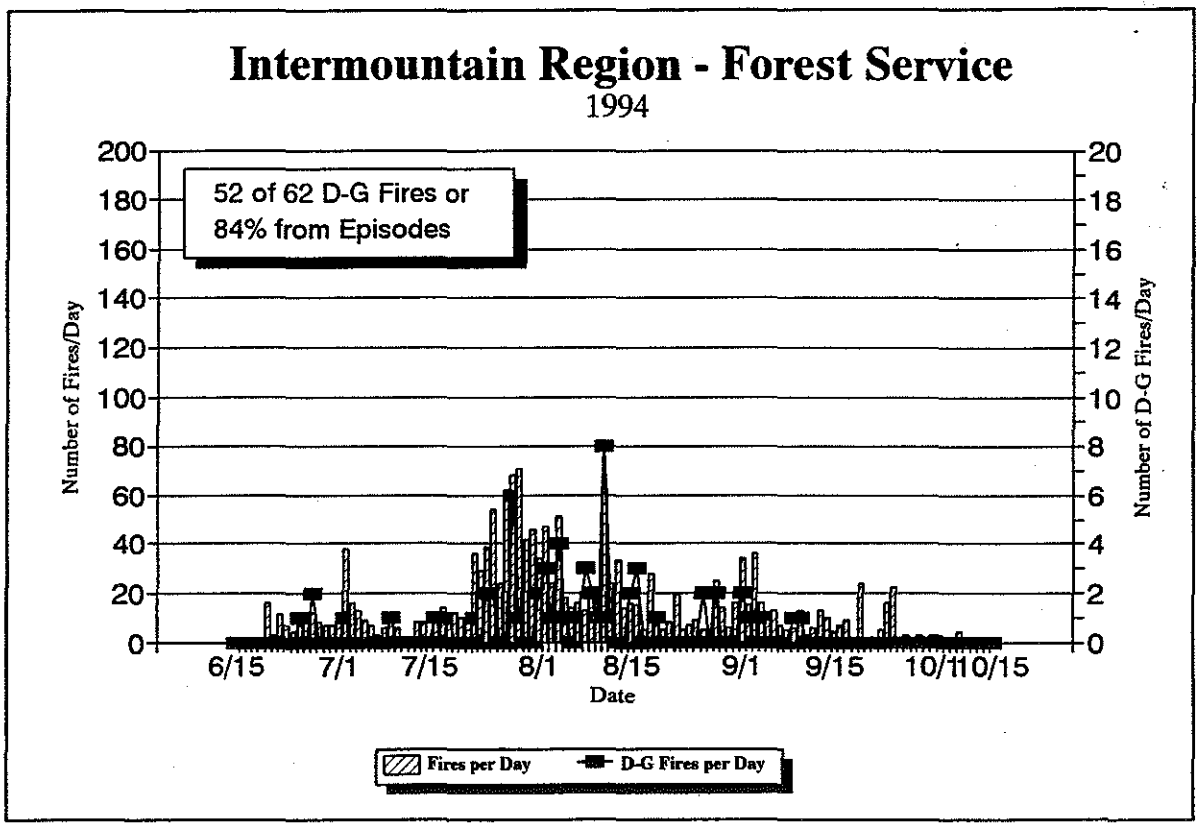
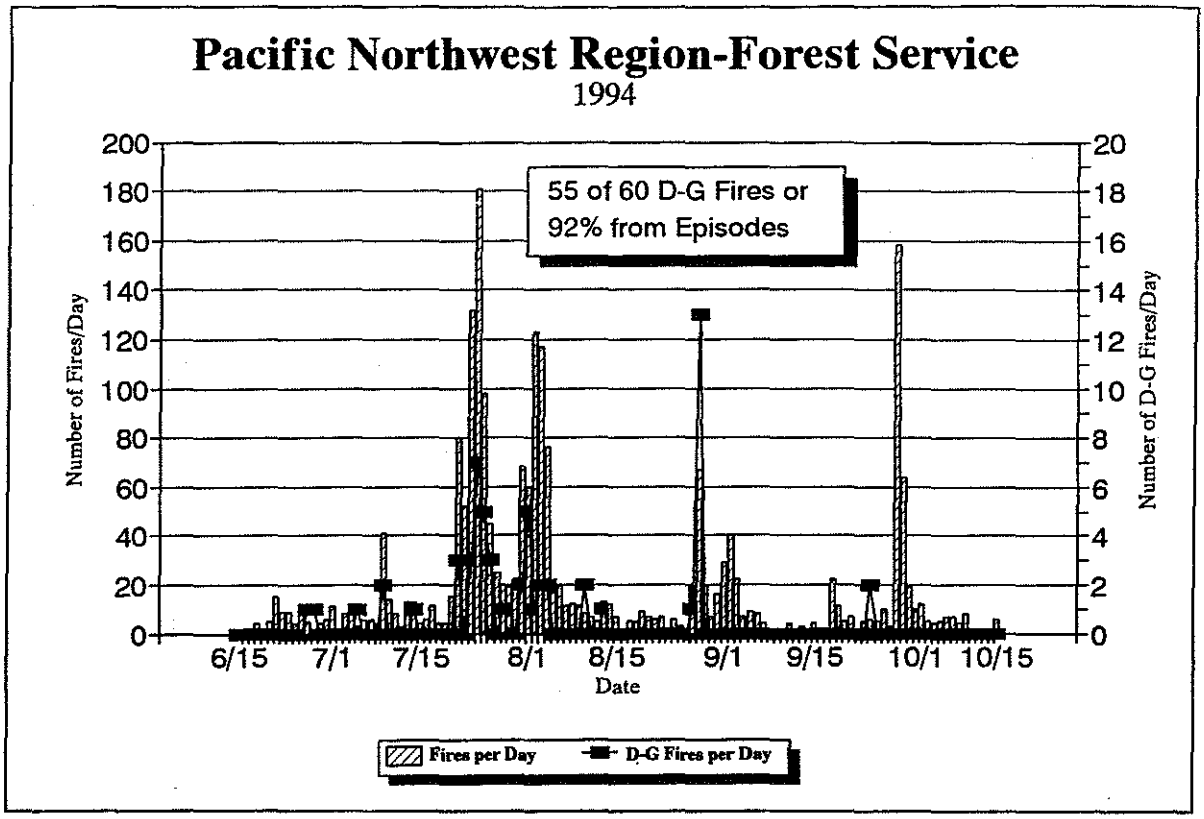


Figure 9 - Pacific Northwest Region, Forest Service, 1994



The current control of airtankers is via geographic area coordinators. Verification of priorities is best achieved from a perspective which maximizes effective utilization of these national scarce resources. To demonstrate this point, observe Figures 7-9. The 1994 fire season occurrence for the Forest Service's Great Basin, Northern, and Pacific Northwest Area is graphed. On the left vertical axis and noted by the vertical bars is the number of fire that occurred each day for the "core of the summer." On the vertical axis on the right and noted by the solid line with square data points is the number of size class D-G fires (100 acres and larger) that occurred on that day.

Note the that there is a high correlation between the number of fires in the size class D-G and the episodal way fires start, mainly from lightning storms. This is an example but similar correlation like this occur around the Western United States in the summer and in other areas of the country during their defined fire seasons.

In the Northern Region, the average from 1970-1993 for the percent of fires in the size class D-G that result from episodal ignition events is 77% (Figure 10). Similar results appear in Figures 11 and 12 for the Intermountain Region (Great Basin-Forest Service) and the Pacific Northwest Region. Figure 13 shows the 25 year average number of D-G fires by half-month for June through September for these same three Forest Service Regions. Note the high occurrence of fires in all three Regions simultaneously during most half-week periods.

Figure 10 - Northern Region, Forest Service, 1970-93

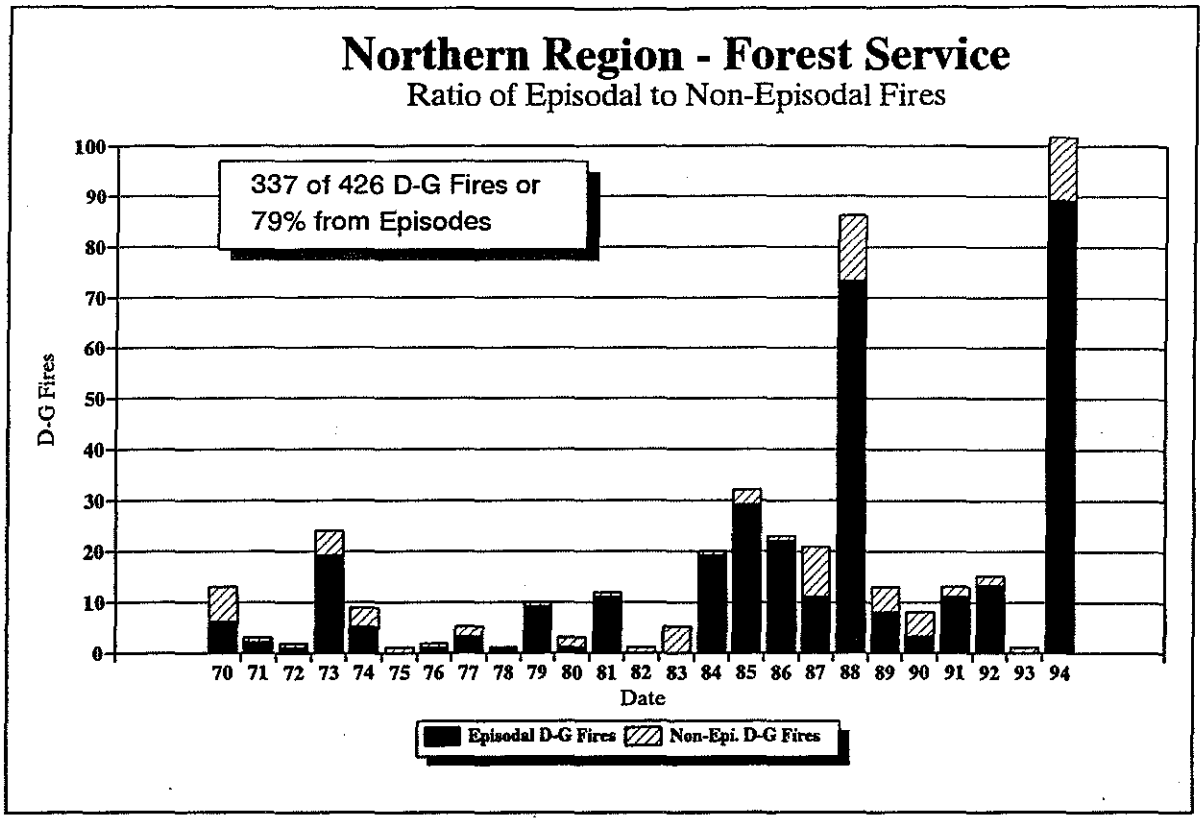


Figure 11 - Intermountain Region, Forest Service, 1970-93

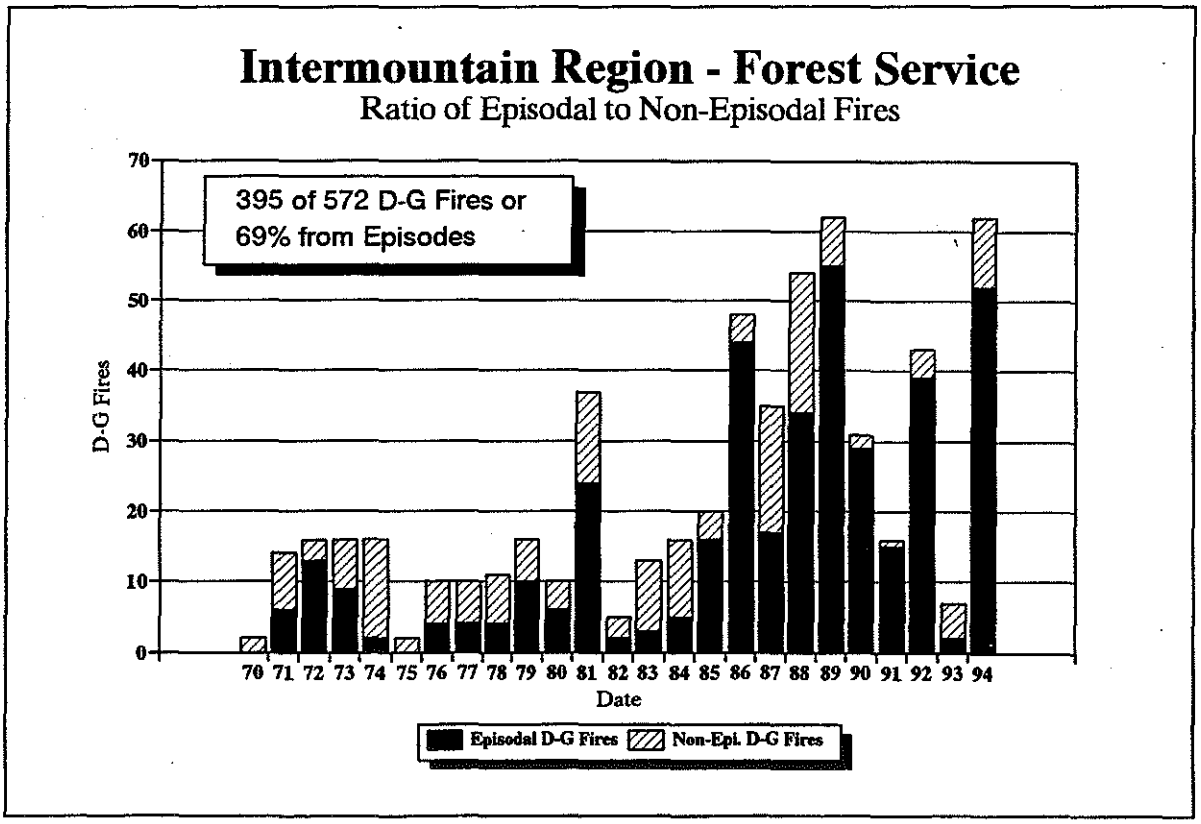


Figure 12 - Pacific Northwest Region, Forest Service, 1970-93

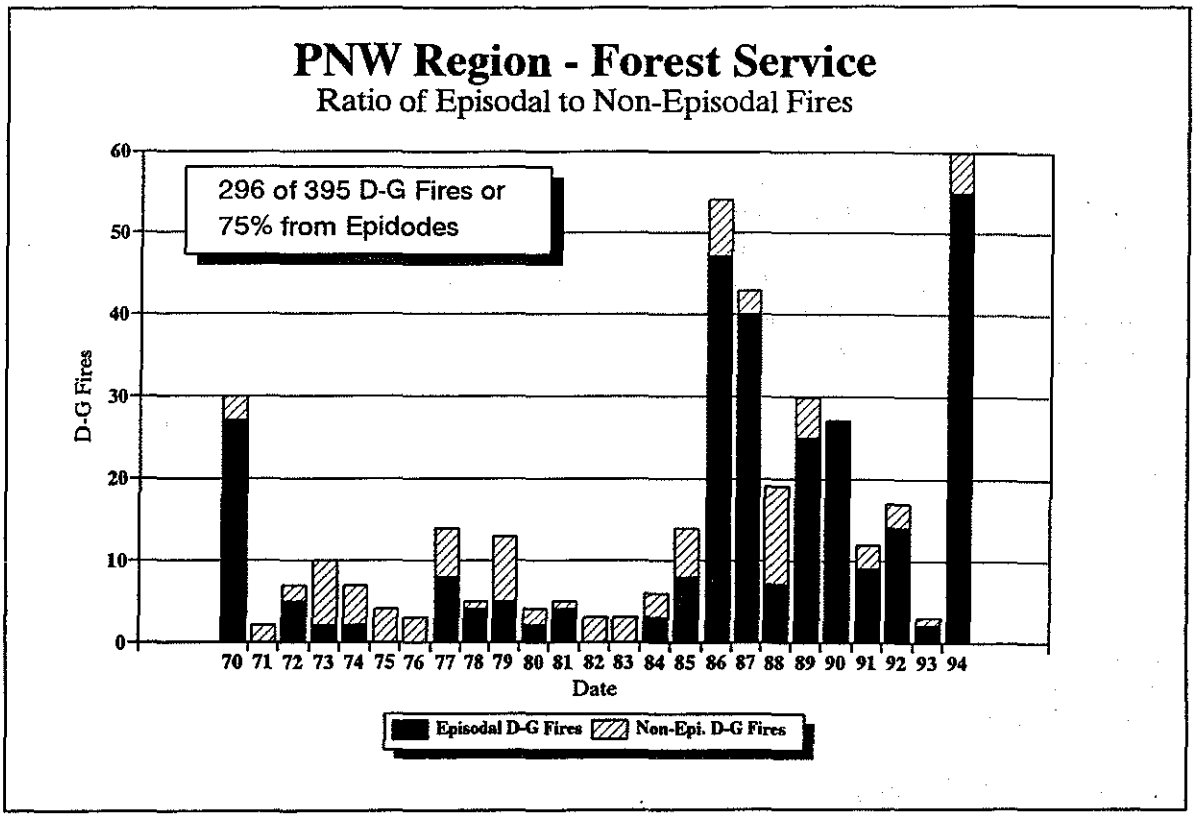
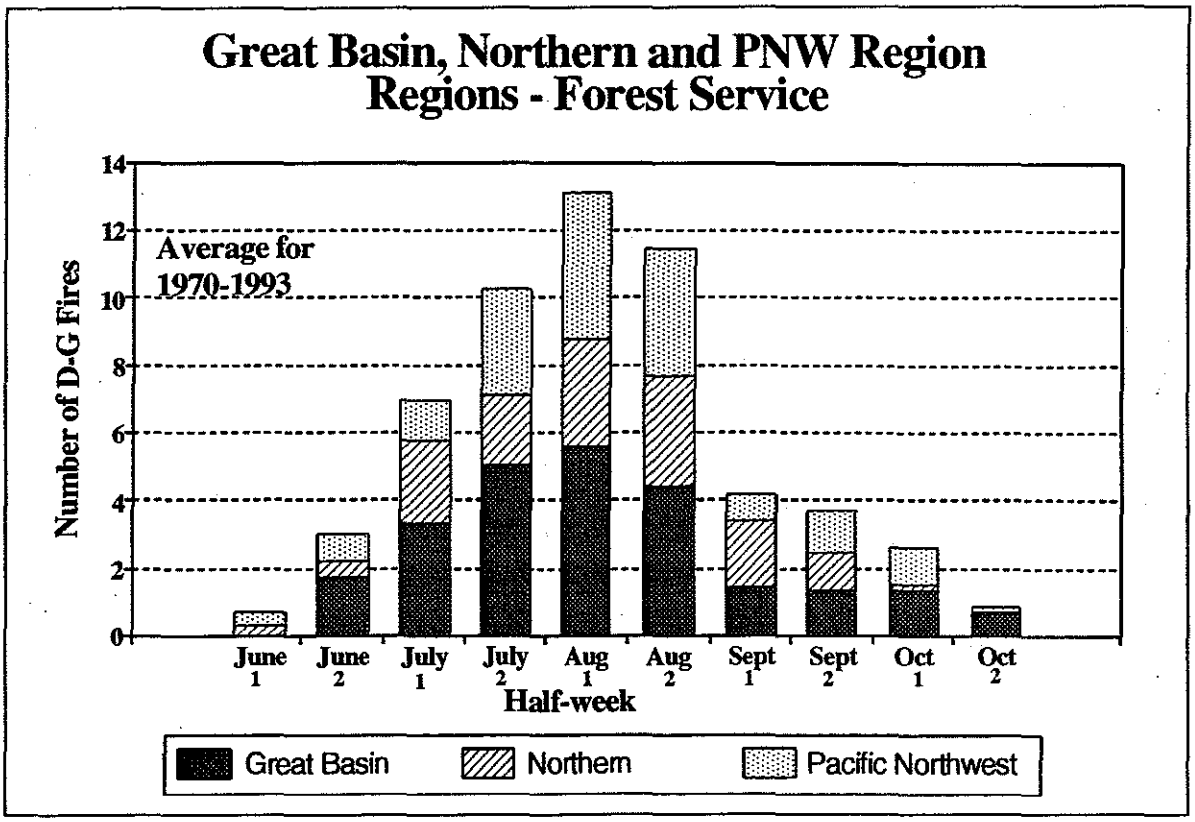


Figure 13 - Forest Service D-G Fire Occurrence In Great Basin, Northern, and PNW Regions for the Months June-September.



Throughout the study effort, it became apparent that in some areas, dispatch of airtankers is automatic during some times of fire danger rating. In other areas, airtankers are not dispatched until someone is observing the fire and orders the airtanker. Both of these situations indicate a need for adequate information to determine if dispatch of airtanker resources is the reasonable action to employ. Issues of safety and economic efficiency arise immediately. The value of information to aid in the dispatch of firefighting resources can be high particularly when the consequences of an inadequate dispatch can result in an escaped fire. In addition, a resource dispatched will be delayed in responding to higher priority alarms until released hence an opportunity cost may also be appropriate in some situations.

Phase 2 of this study has the opportunity to explore these issues and provide possible recommended solutions.

STEP 7. RECOMMENDATIONS

The Number and Size of Airtankers by Location for the 1996-1998 Contract Period

The table on page 43 contains the committee recommendations for staffing of large airtankers for the 1996-1998 contract period.

Based on initial attack efficiency, the committee recommendations staffing airtankers at Hill AFB and West Yellowstone.

Based on the need to support large fire suppression and minimize the effect of this support on initial attack efficiency, the study committee recommends: 1) staffing one airtanker in the South at Knoxville to support the Southern and Eastern Areas as during the fire season is during a time of year that other resources from the west are several days travel away; 2) staffing two large airtankers in the Southwest Area for large fire support during the southwestern fire season; and 3) staffing three airtankers in the Western United States for large fire support during the western fire season.

The committee estimates the cost to procure and staff these additional airtankers to be $900,000-$1,000,000 annually.

Study Committee Recommendations on Airtanker Bases

Adopt committee recommendations documented in Scenario 3 on pages 18-23 and as follows:

California Area

Pursue development of airtanker base a Mather AFB and relocation of airtanker base at Hemet-Ryan to San Bernardino County Airport. The committee recommends that the Area analyze Ramona airtanker base as safety issues are of concern.

Pacific Northwest Area

Pursue relocation of new airtanker base at Wenatchee.

Rocky Mountain Area

Pursue necessary capital improvements at Jeffco. Pursue necessary maintenance at Rapid City so base can function as a reload airtanker base.

Southwest Area

Pursue consolidation of airtanker bases within the area with the closing of the airtanker base at Grand Canyon.

The committee recommends that a subcommittee of area and agency airtanker base specialists and a project engineer from San Dimas be tasked to evaluate and determine actual needs and detailed costs to upgrade bases to standards set in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995). This task should be accomplished during Phase 2 of the National Airtanker Study with findings and recommendations due by November of 1995.

The committee recommends the Forest Service and Department of Interior Washington Office work with EPA to address environmental issues.

The expectation from the National level is that the hosting unit will support airtanker base staffing and the physical plant in accordance with the standards in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995).

Indication of Need for Airtanker in the 1000-2000 Gallon Size Class

Two Areas analyzed T1500's in Scenario 7. Most areas were not able to analyze this alternative given the time to do Phase 1. The committee recommends further study in Phase 2.

Indication of Need for Nighttime Capability

The focus of the committee on accomplishing the data analysis to support the earlier questions, analysis was not performed on this topic. The committee recommends further study in Phase 2.

Airtankers Versus Airtanker Bases

A key to efficient utilization of airtankers is having fully functional airtanker bases. Without the physical plant in place, airtankers must fly from further distances to provide service to fires. On the other hand, airtankers need to be mobile which reinforces a need to manage airtanker flow at the highest practical coordination level.

Resolution Of Issues Identified In Phase 1 and To Be Resolved In Phase 2

The following issues were identified in Phase 1. Due to time and analytical constraints, it was not possible to resolve the issue in Phase 1. The study committee recommends that the issue(s) be resolved during Phase 2.

Alaska Area

The Committee recommends updating the BLM analysis in Alaska using more current data obtained and developed during Phase 1. The Alaska Division of Forestry should be included in this update. Pursue upgrading McGrath, Galena and Ft. Yukon airtanker bases to the standards in the Interagency Retardant Base Planning Guide Fixed and Rotor Wing (1995).

California Area

The Committee recommends that the Area analyze Ramona airtanker base. Safety issues are of concern. The runway is too short for all but two types of existing heavy airtankers, the requirement to land and sit loaded means that aircraft are not loaded to contract specifications and there is a great deal of encroachment to the runway area. Resolve the issue in the initial attack analysis where ground-based forces where being allowed to substitute for the airtankers.

Great Basin Area

The Committee endorses the desire of the BLM to explore the best airtanker base location in western Nevada. The Committee recommends gathering of data to define the proportionate use of Minden, Stead and Pocatello airtankers by agencies receiving retardant from these airtanker bases.

Northern Area

The Committee recommends that the Montana BLM and Northern Region conduct analysis not possible in Phase 1 on the capital investment value of Billings given initial attack benefits and the need to support large fires. Addition of an airtanker at West Yellowstone may provide influence on this analysis.

Pacific Northwest Area

The Committee recommends pursuing construction of new airtanker base at Wenatchee. Continue to pursue working with all agencies to allow for inclusion of all agency initial attack and large fire support data in Phase 2 analysis.

Rocky Mountain Area

The Committee recommends pursuing necessary capital improvements at Jeffco. Pursue necessary maintenance at Rapid City so base can function as a reload airtanker base. The Committee recommends gathering of data to define the proportionate use of Jeffco and Grand Junction airtankers by agencies receiving retardant from these airtanker bases. The Area should resolve the value of maintaining a reload base at Greybull.

Southwest Area

Pursue consolidation of airtanker bases within the area with the closing of the airtanker base at Grand Canyon.

Southern Area

The Committee endorses updating of NFMAS analysis. As a high priority, airtanker use at calibration must be at historic level. Analyze appropriate alternatives to display tradeoffs to other methods of initial attack. Continue to pursue working with all agencies to allow for inclusion of all agency initial attack and large fire support data in Phase 2 analysis.

The Committee Further Recommends

1. Establishment of and adherence to minimum training and performance standards for airtanker base personnel.

2. Adequate airtanker base facilities promotes efficient and safe use of airtankers. If the hosting unit is unwilling to support minimum base standards (as defined by the "guide"), then relocation of airtanker should be pursued.

3. Reaffirmation 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.

4. The airtanker base cost and airtanker availability should be funded on an interagency basis.

5. 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.

6. Phase 2 of this study should provide focus to the finding that significant benefits from using airtankers with larger capacity can be attained in certain defined situations. In addition, this phase should define the roles and interrelationships of all platforms that can deliver fire retardant.

STEP 8. CONCERNS and OPPORTUNITIES

1. Some areas have a concern with the assumptions used in the IAA as they apply to airtankers. Specificly, the assumption that the fireline production rate drops linearly from a maximum at zero rate-of-spread to zero fireline produced at a rate-of-spread of forty chains hour.

2. 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.

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