Mitchell & Hot Air Prescribed Fires
After Action Review

Apache-Sitgreaves National Forests
Clifton Ranger District
Clifton, Arizona

May 12 - 18, 2004

EXECUTIVE SUMMARY

Mitchell & Hot Air prescribed fires were the first attempt by the Clifton Ranger District, Apache-Sitgreaves National Forests District to implement a landscape scale project of this size (5,000-7,000 acres) and complexity. Ignition operations for the burn were planned for May 11th but were delayed a day due to strong winds associated with a weather front passing through the burn areas. Ground firing operations started the following day, May 12th, and hand firing operations along with aerial ignition continued on May 13th. On May 14 a dry air mass moved into the area producing conditions that led to problematic fire behavior and shutting down ignitions by the 15th. Complex ignition patterns to meet resource objectives and multiple fuel models created large areas of unburned fuels that were allowed to burn freely under burn plan prescriptions as the weather became warmer and drier. As a result, the increase in fire behavior produced spotting problems that daily challenged the resources assigned. On May 18, after persistent holding problems and the inability to return the burns to prescription with assigned resources, the burns were converted to the Rose and Pigeon wildfires.

A Type 2 Incident Management Team (IMT) ordered for the KP Incident (a human caused wildfire just north of these prescribed fire activities, on top of the Mogollon Rim) was delegated suppression responsibility for the Rose and Pigeon wildfires. The IMT controlled the escaped prescribed fires at 1537 acres. Following release of the IMT, the Forest Supervisor for the Apache-Sitgeaves National Forests elected to conduct a review of these prescribed fires and assembled a review team for that purpose. The review was conducted from June 7 to June 9, 2004 in Springerville, Arizona.

KEY FINDINGS FROM REVIEW:

1. The main factors that contributed to the escape were: current weather conditions including lower RH recovery than expected; insufficient depth and existence of unburned areas within black lines; concurrent operations on two burn blocks separated by about 15 miles; and burn block boundaries located at mid-slope and canyon bottoms with continuous fuels.

2. There were no significant safety issues identified. The Clifton District and the Prescribed Fire Team are to be commended for the use of daily Incident Action Plans (IAPs), which contributed to good briefings and communications with personnel, and for conducting safe, professional, and well documented air operations.

3. Everyone interviewed felt that the project was appropriately staffed until the fires escaped the burn blocks.

KEY LESSONS LEARNED (summarized below are key statements from the Review Team'sobservations.)

- Because of the different prescriptions involved, burn projects with multiple fuel models should be staffed appropriately to allow for both day and night operations.
- If aerial ignition is to be applied concurrently to more than one burn block with separate boundaries, and the same aerial resource is to be used for holding and/or contingency actions, an additional aircraft should be considered. If this consideration is deemed cost prohibitive, then only one block at a time should be treated.
  It is apparent that on May 16, the fact that the helicopter was involved with bucket operations on the Mitchell, instead of the planned aerial ignition to strengthen the line along Highway 191, was a major contributor to the escape on Hot Air.
- Black lines must be adequate in depth and have enough fuels removed to assure that fire is unable to spread over or through the fuel bed under any conditions. Burn Boss must take time to assess and evaluate these conditions to assure that the proper reduction in fuels has or is occurring before ignitions.
- During multiple block ignitions with long travel times separating them, support for each block must include separate holding forces to deal with the potential for multiple escapes.

- When designating burn block boundaries on landscape scale projects, factors such as terrain influences on fire behavior, natural barriers, and fuel changes need to be considered. Drainage and mid-slope lines in continuous fuel situations should be avoided if possible. Due to the "Free Burning" nature of landscape scale burns, managers should look for opportunities on the land that present optimum conditions for holding fire.

INTRODUCTION and BACKGROUND

As part of the Clifton Ranger District, USDA Forest Service, Apache-Sitgreaves National Forests, fuel treatment program, prescribed fire treatment was planned for Mitchell, Hot Air, Mesa, and Robinson Mesa Units. Each individual burn was rated low to moderate in complexity. However, combining the burns for simultaneous ignition significantly elevated the complexity. Additional factors influencing elevated complexity were aerial ignition and increased logistical support. Ground travel between burn units ranges from 1-5 hours. Access to control lines and necessary hand ignition points is motor travel restricted in many instances.

The objectives of the Mitchell & Hot Air Prescribed Fires were to reduce hazardous fuel accumulations, restore functionality of fire adapted systems, and reduce the risk of large uncontrollable wildfires in the area. This application is guided by the following land and resource management planning documents for the Apache-Sitgreaves National Forests and Clifton Ranger District: Forest Plan, and Fire Management Plan – Apache-Sitgreaves National Forests. The detailed implementation procedures were described in the Site Specific Burn Plan for Mitchell & Hot Air Prescribed Fires.

Prescribed fire is one of several accepted practices for hazard fuel reduction and other resource management purposes utilized routinely and successfully by federal, state, and private agencies. Currently, the program averages over 5000 prescribed fires completed per year for federal agencies nationwide. Over 99% of these federal prescribed fires do not escape. The implementation of the National Fire Plan has escalated the magnitude of the fuel treatment program and numbers of treatments are increasing. Accomplishments, while increasing somewhat, are being spread across the spectrum of treatment types as more projects are implemented in wildland-urban interface areas using non-fire treatment types. These treatments are more costly and generally accomplish fewer acres than broadcast burning. Figure 1 shows the prescribed fire accomplishments for federal wildland fire management agencies in the United States from 1993 to 2002.

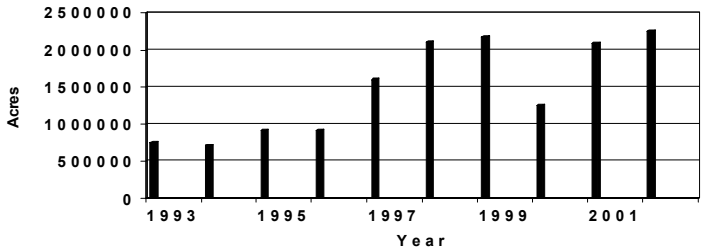

Figure 1. Federal wildland fire management agencies prescribed fire accomplishments, 1993 – 2002.

The Mitchell & Hot Air Prescribed Fires were planned and implemented under an approved Prescribed Fire Burn Plan with qualified individuals. A test burn was conducted on May 12th to confirm that conditions were appropriate for full project implementation. The Arizona Department of Environmental Quality (ADEQ) was notified and daily monitoring of the smoke column was planned. Local communities were notified of the burn activities and proposed timelines.

Ignition operations for the burn were planned for May 11th but was delayed a day to strong frontal wind passage. Ground firing operations started the following day. Hand firing operations along with aerial ignition occurred on May 13th. On May 14 a dry air mass moved into the area producing conditions that led to problematic fire behavior and shutting down ignitions by the 15th. Ignition patterns to meet multiple resource objectives along with multiple fuel models led to large areas of unburned fuels that were allowed to burn freely under burn plan prescriptions as the weather became warmer and drier. As a result, the increase in fire behavior produced spotting problems that daily challenged the resources assigned. On May 18, after persistent holding problems and the inability to return the burns to prescription with assigned resources, the burns were declared wildfires.

Following containment of the escaped fires, the Forest Supervisor convened a team to conduct an After Action Review of the Mitchell and Hot Air Prescribed Fires.

Specific objectives for the review were:

- **Review the Prescribed Burn Plan to determine whether it was followed and whether it was adequate.**
- **Identify the factors that contributed to the escaped fire.**
- **Review safety plan for adequacy and compliance.**
- **Review the Burn Organization and Qualifications to evaluate whether the fire was appropriately staffed for project size and duration.**
- **Identify Lessons Learned and Recommendations.**

The review team addressed these objectives in preparation of this report, which consists of descriptions of background information concerning the prescribed fires, the review team process, observations and recommendations, and lessons learned.

REVIEW TEAM and PROCESS

Members of the Review Team included:

Kate Klein	Team Leader	Acting Deputy Forest Supervisor	USDA Forest Service Apache-Sitgreaves National Forests Supervisor's Office Springerville, AZ
Mark Empey	Team Member	Fire Management Officer	USDA Forest Service Apache-Sitgreaves National Forests Black Mesa Ranger District Heber, AZ
Roy Hall	Team Member	Assistant Director, Fuels & Smoke Management	USDA Forest Service Southwest Region Regional Office Albuquerque, NM
Larry McCoy	Team Member	Fuels Specialist	USDA Forest Service Kaibab National Forest Williams, AZ

The Review Team was convened on June 7, 2004 at 9:00 am in the Apache-Sitgreaves Supervisor's Office Conference Room in Springerville, Arizona. The team was briefed by the Apache-Sitgreaves National Forests Acting Forest Supervisor, Clifton Ranger District Ranger, and Fire Management Staff. The team completed an on-site review of the burn area to observe directly the topography, fuel conditions, and other specific

factors associated with the project, and to observe the burn intensity and severity, location of roads, past burn units, and values to be protected. On June 8th and 9th, the team met at the Supervisor's Office Conference Room and reviewed information from Regional 5140 manual direction, the Mitchell & Hot Air Prescribed Fires Burn Plan, and implementation direction. The review team then developed this report and presented observations, recommendations, and lessons learned to the Forest Supervisor, District Ranger, and Forest staff.

COMMENDATIONS

- This was the first attempt by the District to implement a project of this size (5,000-7,000 acres) and complexity. The extra effort and professionalism with which they carried it out is to be commended.
- Contingency lines were identified and used to control the escaped fires. While not required for a prescribed burn, this was valuable information when the fires spotted outside the burn block boundaries.
- Use of daily Incident Action Plans (IAP) was helpful in documenting fire operations, and communicating information to fire personnel.
- The Plans Chief was vigilant in communications with the National Weather Service. Discrepancies in spot forecasts were fully disclosed.
- Air operations were well documented, and conducted in a safe and professional manner.
- There was good support for this project, with personnel from 3 National Forests and numerous districts participating.
- A number of personnel received quality training assignments, with 5 tasks books being completed and recommended for certification.
- The project file was complete, well organized and provided to the review team in a timely manner.

OBSERVATIONS and RECOMMENDATIONS

PLANNING:

1. Observation: Maximum spotting distance not identified/modeled in Burn Plan. Width of black line needed to mitigate maximum spotting not identified.

Lesson Learned: Probability of Ignition P(I) was modeled in the BEHAVE runs but not followed up with the modeling of Maximum Spotting Distances under the same variable environmental conditions used to determine the P(I). Depth of black lines must match realistic spotting distances for fuel model and torching tree species as calculated from the spot module in BEHAVE for the various combinations of acceptable burn prescription parameters. Depth of black lines must then be adjusted by the maximum spotting distance and P(I). The higher the P(I) the closer the depth must match the average calculated maximum spotting distance possible during the duration of the burn.

2. Observation: A critical weather parameter of night time relative humidity was consistently over-forecasted by the National Weather Service for the burn site. Daily spot weather forecasts were requested by the burn as required for complex burns. Daily validation of forecasted values as required by the National Weather Service in order to assure the accuracy of forecast for site specific locations occurred but over predictions continued throughout the duration of the burn.

Recommendation: Discuss failure at the next Tucson Customer Service Meeting hosted by the National Weather Service for the Fire Service Agency's within their County Warning Area this fall. Larry McCoy will elevate this to the Predictive Services Branch Leader in SWCC for further discussion and resolution with forecasters involved

3. Observation: Inconsistencies with Region 3 burn plan format, documentation and direction exist.

Recommendation: Burn Plans need to follow R3 5140 Burn Plan template.

4. Observation: Contingency Plan does not identify Fire Management Actions points or further identify critical decisions and actions.

Recommendation: Revisit and evaluate value added for complex burns.

5. Observation: Contingency Plan and actions are not fully developed within Burn Plan. Burn Plan and Fuel modeling identified high spotting potential for both fuel types; however Contingency and Holding Plans do not address problematic spotting. i.e. Contain and Spot Models were not documented and applied to Burn Plan.

Recommendation: Fully developed fire behavior modeling to include contain and spot modules used to document and identify amount and type of holding resources required.

6. Observation: Complexity Analysis – Item #1, potential for escape mitigation stated "Spring Burning will be done in the interior with established black on the down wind side". However; black lining was inadequate for burn prescriptions.

Lesson Learned: Fall and spring burning to create black lines was attempted but burning conditions were not adequate to get the depth and reduction of fuels required to establish adequate black lines. Monitoring of black lines for adequate depth and reduction in fuel to assure good holding lines is critical when burning at the low end of prescription windows and under drought conditions especially when large acreage of fuels are not ignited but fire is allowed to free burn until all fuels are consumed.

7. Observation: Complexity Analysis – Item #5, Fire Behavior Technical difficulty mitigations address modeling outputs in a Fuel Model 8. The Burn Plan prescription uses Fuel Model 4 and Fuel Model 9 which are more volatile fuel models. Complexity analysis is <u>not</u> accurate or reflective of Burn Plan documentation.

Recommendation: Review requirements for complexity analysis and accurately reflect all elements.

8. Observation: Burn Plan does not specify monitoring protocol components for landscape scale fire applications. It is important to identify this protocol and provide appropriate funding.

9. Observation: Excessive winds precluded operations on first planned day of ignitions. Had conditions not postponed initiating operations, the RXB1 trainee would have had only "hours" to review burn plan and familiarize with burn area prior to operations beginning.

Recommendation: Provide planning timelines, with advance notification to prescribe burn overhead and crews. This allows adequate time for quality pre-ignition briefings and physical familiarization with the proposed burn area. This is critically important for off-unit primary and trainee individuals functioning as Burn Boss, Ignition Specialist and Holding Boss. Additionally, primary and trainee individuals in these positions should be provided a copy of the Burn Plan and Burn Area Map sufficiently prior to planned ignitions to allow for complete familiarization with all documentation.

10. Observation: Prescribed Burn Plan specifies the prescribed burn organization and identified multiple RXB2s responsible for individual burn blocks. Due to the burn being identified as high complexity, these RXB2s positions should have been filled by RXI1s. (Tie to #8 Operations)

Recommendation: Burn Plans for complex burns need to accurately identify organization and positions.

11. Observation: Prescriptive criteria identified in the Burn Plan were not followed. Dead fuel moistures in 10, 100 and 1,000 hour classes and minimum RH values on May 14th – 18th were exceeded. This is allowed due to stated caveat of "fire behavior, fire effects and general climate trends will be monitored. An element which is considered out of prescription will not necessarily stop the burn. It is the responsibility of the Burn Boss and Line Officer to determine effectiveness of environmental conditions and ability to continue the burn and meet objectives." This practice negates the value of prescriptive parameters and projections for resource needs to

identify adequate resources for holding actions. The decision to embrace this practice has inherent risk and liability.

Recommendation: Revisit and fully evaluate increased risk and liability based on current vegetative and drought conditions.

12. Observation: Inconsistencies in Burn Plan prescription for maximum winds, i.e. three maximum values for wind speeds are stated in the Burn Plan; "acceptable range 2-10 M.P.H. at eye level, up to 25 M.P.H. at Burn Boss and Line Officer discretion, and maximum sustained 20 foot winds of 15 M.P.H. under drought conditions". This statement limits eye level winds to 3-5 M.P.H. Eye level winds of 10 M.P.H. produce flame lengths greater than 5 feet which is the maximum level identified in the Burn Plan.

Lesson Learned: Burn plans must be reviewed by a number of different qualified individuals to assure all aspects of the burn plan are adequately addressed, accurate, and inconsistencies removed. It's advisable that with complex burns, Line Officers have more than one RXFM review the document. Burn Boss's that were not involved in the production of the document must be given adequate time before ignition for review. The Burn Boss is ultimately responsible for overall effects and for any adverse actions that occur on the burn.

OPERATIONS/IMPLEMENTATION:

1. Observation: Black lining not adequate to hold fire behavior. (Tie to #1 Planning)

Lesson Learned: Black lines must be adequate in depth and have enough fuels removed to assure that fire is unable to spread over or through the fuel bed under any conditions. Burn Boss must take time to assess and evaluate these conditions to assure that the proper reduction in fuels has or is occurring before ignitions.

2. Observation: Contingency lines were appropriately identified and located on the landscape; however burn operations personnel were not briefed on use and application.

Recommendation: Fully develop and disclose Fire Management Action Points/Suppression actions relative to established contingency lines.

3. Observation: Conscious decision was made to simultaneously ignite two blocks with significant geographical separation. This led to: increase in complexity, organization, logistic load, coordination and potential for escape.

Recommendation: Use experience gained in this undertaking to validate similar decisions for future landscape scale endeavors.

4. Observation: Simultaneous holding problems with both burn blocks contributed to resource shortages which directly led to conversion of prescribed burns to escape status.

Recommendation: During multiple block ignitions with long travel times separating them, support for each block must include separate holding forces to deal with the potential for multiple escapes.

5. Observation: Aerial ignition and support required by simultaneous ignitions on geographically separated burn units can jeopardize objectives. Especially if air resources are critical for ignition and holding support.

Lesson Learned: If aerial ignition is to be applied concurrently to more than one burn block with separate boundaries, and the same aerial resource is to be used for holding and/or contingency actions, an additional aircraft should be considered. If this consideration is deemed cost prohibitive, then only one block at a time should be treated.

It is apparent that on May 16, the fact that the helicopter was involved with bucket operations on the Mitchell, instead of the planned aerial ignition to strengthen the line along Highway 191, was a major contributor to the escape on Hot Air.

6. Observation: Location of burn block boundaries required holding actions with most ignitions under warmer and drier prescription conditions. Especially in Ponderosa pine fuel type. This significantly distracted from timely and efficient implementation.

Lesson Learned: When designating burn block boundaries on landscape scale projects, factors such as terrain influences on fire behavior, natural barriers, and fuel changes need to be considered. Drainage and mid-slope lines in continuous fuel situations should be avoided if possible. Due to the "Free Burning" nature of landscape scale burns, managers should look for opportunities on the land that present optimum conditions for holding fire.

7. Observation: Ignition Specialist's control and direction of ignition sequence, pattern and timing may have been unclear. This led to control problems that were immediately mitigated. Subsequent ignition strategy was better directed and more deliberate to minimize further holding problems. (Tie to #10 Planning)

Lesson Learned: Complex burns often require specific ignition sequence, pattern and timing in order to meet the objectives of the burn and facilitate safe implementation and holding actions. It is imperative that the Ignition Specialist provide clear and concise oversight and direction to those igniting the burn. Pre-ignition briefings are essential and should establish clear understanding of existing organization, communication, chain-of-command (ignition sequence, pattern, and timing are left to chance) without these critical elements intact. Safe implementation and holding operations may become a grave concern and issue.

8. Observation: Without reliable and adequate block boundaries, igniting free burning fire in spring/summer burns will pose problematic fire behavior leading to holding problems.

Lesson Learned: Well defined block boundaries along with well constructed containment lines must be constructed if landscape ignitions are allowed to freely burn until all fuels are consumed or weather extinguishes the burn. These containment lines must have much stronger construction specifications due to the inability to monitor 24 hours a day and the potential fire behavior that they may ultimately be exposed to as weather, especially in the spring, has the potential to move into much hotter and dryer conditions leading to unwanted and problematic fire behavior.

9. Observation: Landscape scale burns require extended duration and commitment of resources to successfully accomplish objectives.

Recommendation: Resources assigned to prescribed fire activities are committed until released by Burn Boss. This commitment includes longer durations associated with landscape scale burns.

10. Observation: Multiple fuel models will require the flexibility for day/night and spring/fall operations in landscape scale fire treatments.

Lesson Learned: Because of the different prescriptions involved, burn projects with multiple fuel models should be staffed appropriately to allow for both day and night operations.

11. Observation: Based on the Region's priority to restore the functionality of fire adapted systems, commitment of resources to landscape scale prescribed fire activities during elevated preparedness levels is appropriate and essential.

Recommendation: Continue to balance priorities for resources required for prescribed fire and fire suppression activities.

12. Observation: Current policy and direction were followed in decisions to convert prescribed burns to escape status.

13. Observation: Considerable effort and attention were given to Operational Briefings of all personnel on the burns.

14. Observation: Transition from prescribed fire operations to escape fire suppression activity was timely, efficient and announced.

KEY LESSONS LEARNED (summarized below are key statements from observations listed above):

- Because of the different prescriptions involved, burn projects with multiple fuel models should be staffed appropriately to allow for both day and night operations.
- If aerial ignition is to be applied concurrently to more than one burn block with separate boundaries, and the same aerial resource is to be used for holding and/or contingency actions, an additional aircraft should be considered. If this consideration is deemed cost prohibitive, then only one block at a time should be treated.
  It is apparent that on May 16, the fact that the helicopter was involved with bucket operations on the Mitchell, instead of the planned aerial ignition to strengthen the line along Highway 191, was a major contributor to the escape on Hot Air.
- Black lines must be adequate in depth and have enough fuels removed to assure that fire is unable to spread over or through the fuel bed under any conditions. Burn Boss must take time to assess and evaluate these conditions to assure that the proper reduction in fuels has or is occurring before ignitions.
- During multiple block ignitions with long travel times separating them, support for each block must include separate holding forces to deal with the potential for multiple escapes.
- When designating burn block boundaries on landscape scale projects, factors such as terrain influences on fire behavior, natural barriers, and fuel changes need to be considered. Drainage and mid-slope lines in continuous fuel situations should be avoided if possible. Due to the "Free Burning" nature of landscape scale burns, managers should look for opportunities on the land that present optimum conditions for holding fire.

SUMMARY

The Mitchell and Hot Air Prescribed Fires were landscape scale burns that were successful in accomplishing resource objectives on 6135 acres. High complexity prescribed fire projects such as these warrant a high degree of detail and analysis during the planning process. Complex prescribed fire burn plan implementation requires increased situational awareness, appropriate resources and monitoring. After Action Reviews, conducted at the appropriate level, are a useful tool to improve success and reliable prescribed fire planning and implementation procedures.

The After Action Review Team for the Mitchell and Hot Air Fires, was guided by the objectives provided by the Forest Supervisor. A brief summary of the objectives and how they were addressed follows:

Review the Prescribed Burn Plan to determine whether it was followed and whether it was adequate.

The burn plan and supplemental information, including weather observations and daily IAPs, were reviewed to address this objective, and the following Observations address this Objective: Planning – 1, 3, 4, 5, 6, 7, 8, 9, 11, 12; Operations/Implementation – 2, 3, 6, 10.

Identify the factors that contributed to the escaped fires?

In addition to reviewing the project documentation, the review team interviewed personnel from the fire to address this objective.

The main factors that contributed to the escape were: current weather conditions including lower RH recovery than expected; insufficient depth and existence of unburned areas within black lines; concurrent operations on two burn blocks separated by about 15 miles; and burn block boundaries located at mid-slope and canyon bottoms with continuous fuels.

The following Observations address this objective: Operations/Implementation – 1, 4, 5, 6, 8.

Review safety plan for adequacy and compliance.

In addition to reviewing documentation, the review team interviewed fire personnel to address this objective. There were no significant safety issues identified. The Clifton District and the Prescribed Fire Team are to be commended for the use of daily IAPs, which contributed to good briefings and communications with personnel, and for conducting safe, professional, and well documented air operations.

The following Observations address this objective: Planning – 2, 9, 11; Operations/Implementation – 12, 13, 14.

Review the Burn Organization and Qualifications to evaluate whether the fire was appropriately staffed for project size, expected fire behavior, and duration of project.

Review of documentation and interviews with fire personnel were used to address this objective. Everyone interviewed felt that the project was appropriately staffed until the fires escaped the burn blocks. A copy of the burn organization is attached. All personnel assigned were qualified for the positions held, based on a review of documentation of qualifications.

The following Observations address this objective: Planning – 9, 10; Operations/Implementation – 3, 4, 7, 9, 10, 11.

Identify Lessons Learned and Recommendations.

Review of the project documentation as well as the interviews with fire personnel helped the team to meet this objective, and the main body of the report focuses on this objective.

CONTACTS

The review team met with numerous individuals and discussed information relevant to the planning, implementation, and communication of the prescribed fire; overall fire program management; and current situation. Other information associated with wildland fire, prescribed fire, and resource management on the Apache-Sitgreaves National Forests was also discussed. The following individuals participated in discussions with the review team:

Frank Hayes	District Ranger	USDA Forest Service, Apache-Sitgreaves National Forests Clifton Ranger District
Kim Kuhar	District Fire Management Officer	USDA Forest Service, Apache-Sitgreaves National Forests Clifton Ranger District
Michelle Gonzales	Fuels Management Technician	USDA Forest Service, Apache-Sitgreaves National Forests Black Mesa Ranger District
Steve Wallace	Engine Foreman	USDA Forest Service, Apache-Sitgreaves National Forests Lakeside Ranger District
Thomas Palmer	Rangeland Management Specialist	USDA Forest Service, Apache-Sitgreaves National Forests Clifton Ranger District
Shane Baca	Engine Foreman	USDA Forest Service, Apache-Sitgreaves National Forests Lakeside Ranger District

Bill Jackson	Fire Management Officer for Fuels	USDA Forest Service, Apache-Sitgreaves National Forests Supervisor's Office

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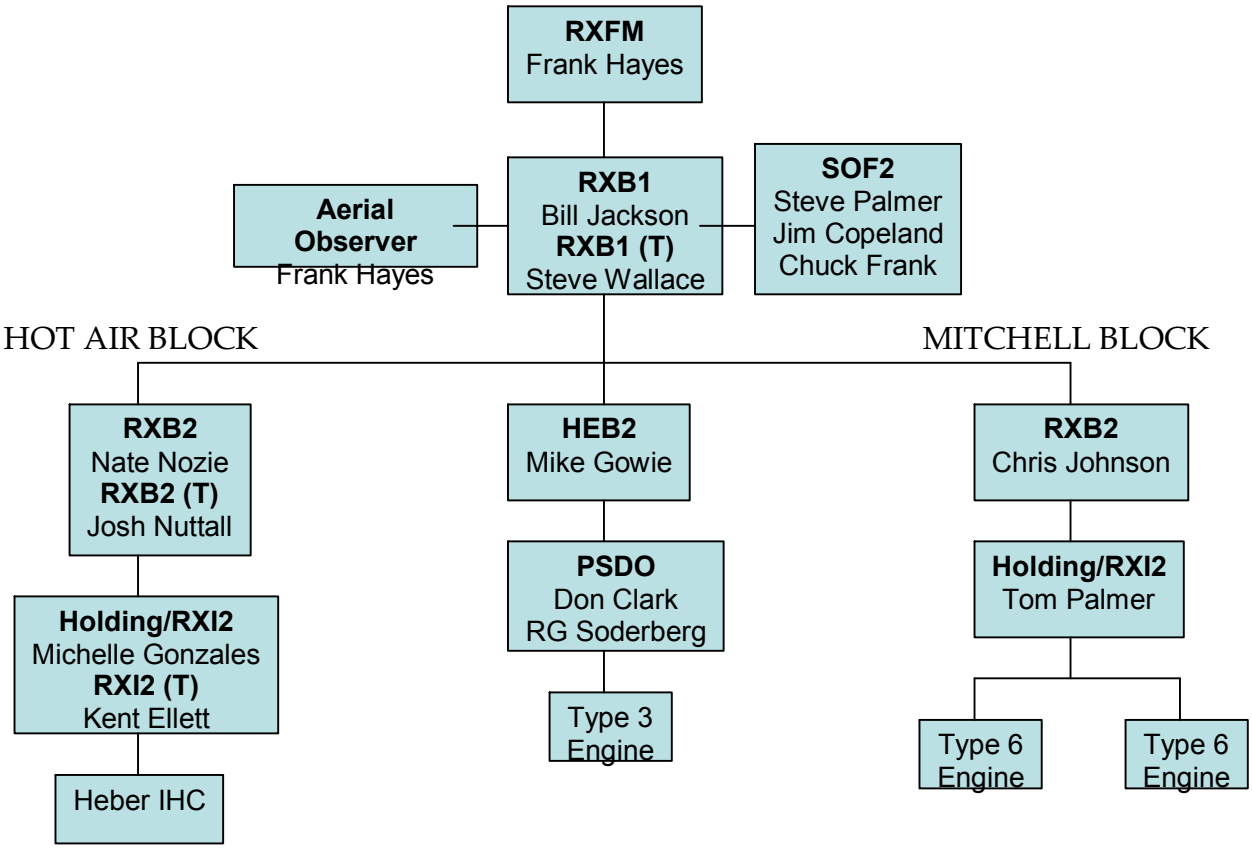

HOT AIR/MITCHELL Rx BURN ORGANIZATION
For OPERATIONS