Fire Program Analysis (FPA)

Business Process Review and Technical Review

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Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

The Fire Program Analysis (FPA) system was developed in response to congressional direction to develop a common interagency process for strategic fire management planning and budgeting. FPA represents the first step toward a culture of coordinated national level budget formulation for the multiple federal wildfire management agencies, which includes agencies and bureaus from the United States Department of Agriculture (USDA) and the Department of the Interior (DOI). This effort is helping the agencies create a common interagency budgeting analysis framework that encompasses the full scope of fire management activities, where the initial goal was to replace legacy systems in use by the Bureau of Indian Affairs, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and U.S. Forest Service. FPA is serving as a coordination layer added on top of these systems. FPA leads a cultural shift that transitions the stakeholder community from "bottom-up" agency-specific budgeting toward integrated, national budgeting based on an empirical understanding of the probability of wildfire across the national landscape. For more than 100 years, these agencies have created individual budgets based on regional and local activities. Over the past 6–7 years, stakeholders have begun to simulate "what-if" analyses, to introduce the use of empirical data to determine the impacts of multiple budget scenarios on managing the risk of fire through coordinated investment.

Booz Allen Hamilton (Booz Allen) was commissioned to assess the FPA's business and technical processes, as mandated by FPA's Charter. This review analyzes the business and technology aspects of FPA to examine the current state of the project and to determine next steps. This report provides a consolidated overview of the history and development of FPA, explains the genesis and evolution of the system, identifies key themes, strengths, weaknesses, observations, and recommendations related to business processes and technical modules. Booz Allen conducted 48 interviews and analyzed multiple documents to understand each core area, using a source of maturity measurement based on best practices in the Federal Government to craft recommendations. The recommendations in this report provide opportunities for improvement in program transparency, communications, best practices, and science. Moreover, the report offers an unbiased, empirical, and repeatable measurement system, which was accomplished by examining core processes with established baseline maturity levels, consistent with best practices.

FPA offers the opportunity to understand how changing fire regimes affect fire frequency, intensity, and cost. Thus, a key focus of this review is to examine the state of FPA in terms of moving the FPA stakeholder community from a retrospective view to a forward-facing, coordinated risk management view of fire investment across agencies.

The review concludes that FPA has made significant strides in transitioning toward an integrated national budget formulation process based on an empirical understanding of the probability and cost of fires within Fire Planning Units (FPU, regional landscapes). FPA's current governance structure enables consensus and coordination across agencies, generating longer-lasting results. The governance body is well poised, with the support of the Science Team, to implement upcoming enhancements that will add significant value to FPA outputs and further provide supporting information for budget formulation. These enhancements include improvements to gridded weather, spatial fuels, and the data layer for Wildland Urban Interface/Highly Valued Resource (WUI/HVR).The external review also notes that FPA is successful at providing empirical information for goal programming and that goal programming now is providing national-level strategic information that can be used to inform the overall wildland fire budget process.

An important component currently offered through FPA modeling is the use of weights to manage the relative impact of each performance measure in the "what if" analyses. Weights enable FPA output to reflect evolving budget coordination discussions across the Bureaus and Departments. Weights enable FPA flexibility to respond to business-driven decisions for the agreed upon performance measures that have previously been built into the system. The Hubbard Report and OMB guidelines require FPA to offer cost effectiveness analysis to support national budget coordination. FPA output supports this mandate by modeling suppression costs as a performance metric, with weights to manage the relative impact of this performance metric to the other agreed upon performance measurements. FPA goal programming and cost-effectiveness are based upon time-proven technology and models.

While FPA has made significant strides and is starting to address budget formulation in an integrated manner, deficiencies were also uncovered during this external assessment. These deficiencies present opportunities for FPA to improve its processes, re-build trust from frustrated stakeholders, and successfully implement upcoming enhancements to the system. Key findings in the review include the fact that FPA currently does not adequately address regional or local resource allocation or fire planning, which is topic still being discussed by the FPA Oversight Group (OG).

Historical challenges that continue to impact FPA include a lack of stakeholder expectation management at the lower and middle management levels. This problem began early in FPA's history when modules and models were not tested in a laboratory environment before being released, exposing users to software bugs that led to significant frustration. In addition, the lack of fire planning functionality for field-level users, and a lack of transparency related to investments, enhancements, and overall functionality of FPA, has negatively impacted the morale of fire planners at the local to regional levels. Regaining the trust of stakeholders is important if FPA is to reach its full potential outlined by the 2010 FPA Charter.

Other challenges include not managing the relationship of FPA to local fire planning tools as an integrated portfolio. FPA stakeholder expectations would best be managed by a portfolio framework for architecture, investment, and systems development life cycle activities and mechanisms for planning, training and communicating with a view of how these different modeling systems affect each other. To achieve its potential, FPA should continue to improve communications and training so that the entire user community better understands how goal programming, a time-tested discipline, uses empirical outputs from FPA to make informed decisions that takes into account any limitations in the range of confidence in the data, making the outputs be more widely embraced and utilized.

Although tough obstacles remain, FPA has been successful at engaging, at a national level, fire-fighting resources that have operated fairly independently for over 100 years. The task of integrating budget planning across the Bureaus and Departments is a difficult one and represents a significant cultural shift. FPA has made significant progress in achieving the Congressional mandate to coordinate the planning of national fire budgets. FPA's recent success is illustrated by the use of FPA information to support the FY2013 budget requests with empirical "what if" analyses. FPA also has a science team that has proven its ability to overcome many challenges, and with the support and direction of the OG, is well poised to implement upcoming enhancements such as adding geospatial detail of fuels, updating the WUI/HVR data layer, and gridded weather. FPA is currently the best, and only, tool for national coordination of fire investments to reduce risk and control costs at the national level.

1 INTRODUCTION

1.1 FPA Mission and Vision

The Fire Program Analysis (FPA) is an interagency effort between the United States Department of Agriculture (USDA) and the Department of the Interior (DOI) in response to a congressional request calling for coordination in developing budget and allocation processes across the federal agencies responsible for wildland fire management. FPA's vision is "to develop a comprehensive interagency process for fire planning and budget analysis identifying cost-effective programs to achieve the full range of fire management goals and objectives" (*FPA Desk Guide*, April 2011). In supporting that vision, FPA's mission states that "the purpose of the Fire Program Analysis system is to provide managers with a common interagency process for strategic fire management planning and budgeting. It will be used to evaluate the effectiveness of alternative fire management strategies to support land management goals and objectives." FPA assesses "effectiveness" in terms of multiple performance measures that are consistent with agency land-management goals and objectives (*FPA Charter*, October 2010).

At the core of the system's design, FPA contains a web-based interface that models the effects of agency preparedness, fuel treatments, and prevention programs on initial response effectiveness, and large fire consequences through a software application that consists of four primary modules:

1. Fire Ignition Generator (FIG)
2. Initial Response Simulator (IRS)
3. Large Fire Model (LFM)
4. National Goal Programming (GP).

The implementation of FPA and its incorporation into the agencies' planning and budget development and execution processes represents a fundamental shift for Wildland Fire Management. Adoption of FPA will fundamentally restructure the different agency and departmental budgeting processes currently in use into a single collaborative interagency process. In order to reach full implementation, the program envisions a three-phased transition of the system and its associated business processes.

- Phase 1: Ongoing Learning and Calibration
- Phase 2: Establish Confidence
- Phase 3: Establish Ownership and Full Implementation.

As part of Phase 2, Booz Allen Hamilton (Booz Allen) was commissioned to provide an independent assessment of FPA's business and technical processes. Leveraging Booz Allen's Mission Engineering® (ME) methodology, the external review analyzed the connection between business needs and performance measures with operational processes, technical models, data, and systems. The methodology, described in detail in Section 1.3, provides a sequential and logical flow that begins with mission and business needs, examines the processes involved, and, ultimately, ties supporting technology into the findings. This assessment reviews both the business and technology aspects of the following analysis processes:

- Fire Preparedness Budget Formulation Analysis
  - As FPA prepares for O&M, a major enhancement is needed to mature the capability for FPA to inform the formulation of Fuels Budgets. Although fuels were not in scope of this review, this review documented the comments captured from the interviews around this topic.
- Governance Analysis
- Performance Measures Analysis
- Stakeholder Expectations Management Analysis
- FPA System Modules Analysis.

Interim findings and recommendations based on the business process review and the technical review were provided in a Mid-Point (Interim) Report. The FPA Oversight Group (OG) reviewed the analysis provided in the Interim Report and provided feedback to ensure that the information captured the viewpoints of all stakeholders. Further analysis and validation of the technical characterizations were conducted to support development of the Final Report, which integrates the FPA concept of operations with recommendations for improvements. This product provides the FPA Program with a mission-driven set of functional recommendations that are traceable, defensible, comprehensive, and user- and developer-friendly.

1.2 Scope

Over the past 10 years, the USDA and DOI have been developing the FPA system to provide managers with a common interagency approach for supporting budgetary decisions and requests related to wildland fire management. A project charter was developed to manage and oversee the progress of the program. Along with describing the roles and responsibilities assigned to each stakeholder group and the Advisory Team, the charter requests an external independent review of the technical and business underpinnings of the FPA system.

The overall objective of this external review, and, therefore, the scope of this report, is to conduct an independent review of the business processes and technical elements of the existing FPA system. The business process review focuses on the following elements:

- Assess the extent to which FPA can provide credible information to support the formulation of wildland fire management budgets.
- Assess the extent to which project governance facilitates conclusive, end-to-end, effective decision-making processes. These decision-making processes govern project organization, roles, responsibilities, and accountability.
- Assess the extent to which the performance measures analyze the factors that are consistent with current fire policy (i.e., the ability to manage wildfires for multiple objectives), land management objectives, and agency missions. A main Forest Service concern for examination is that the IRS model assumes suppression when multiple objectives may exist, instead of a model that also captures whether the intent was suppression vs. a different objective.
- Assess the relationship between FPA, and Landscape Fire and Resource Management Planning (LANDFIRE), Ecosystem Management Decision Support (EMDS), Hazardous Fuel Prioritization and Allocation System (HFPAS), Cohesive Strategy, Land and Resource Management Plans, Fire Management Plans, Secretarial Priorities, Government Accountability Office (GAO) Audit Recommendations and the Office of Management and Budget (OMB) direction.

- Assess the value and practicality of goal programming outputs in informing the formulation of budgets.

The assessment of FPA's business processes is supported and enhanced by a technical review of the system's analytical and scientific approaches, models, and data. In order to ensure that the technology fully supports the business needs and overall mission of the program, the technical review addressed the following major areas:

- Assess the extent to which the FPA analytical approach, models, and data are consistent with current available scientific approaches given the mission and constraints of the project.
- Assess the extent to which the documentation of the analytical approach, models, and data is adequate for understanding the FPA system.
- Assess the technical merits of the Fire ignition Generator (FIG), Initial Response Simulation (IRS) module, the Large Fire Module (LFM), the Goal Programming (GP) approach, and the integration of these modules to achieve the mission of FPA (e.g., a national strategic budget model used to inform the wildland fire budget formulation process).

The external assessment report provides an independent review of the current state of the FPA program and provides actionable recommendations that will help FPA derive value for its extensive stakeholder group (see Section 2.2, Table 2), while reducing costs and meeting the needs of GAO, OMB, and agencies' leaders.

Out-of-Scope

When topics out of the scope of this review provided relevant insight during the interviews, comments were captured as findings. However, these topics were not explored in detailed, given the scope of the review. Such topics include:

1. Fuels Management
2. Multiple fire objectives
3. Enterprise Architecture and Project Management
4. Historical aspects of FPA that are unrelated to FPA's current decision support needs

This report does not constitute a full review of FPA, to instead serve the intent of providing guidance to selected priority areas related to moving FPA from phase 2 to 3, (per the phase definitions described on page 4 of the 2010 FPA Charter).

1.3 Approach Overview

The Booz Allen methodology to assess the FPA system connects business needs and performance measures with operational processes, technical models, data, and systems. This approach is designed to provide a sequential and logical flow that begins with mission and business needs, examines the processes involved, and, ultimately, ties supporting technology to the findings to produce an overarching assessment of program effectiveness. The first step was to collect and review an extensive amount of data, by interviewing stakeholders and analyzing documentation. The team conducted various internal sessions to analyze and understand the issues and challenges collected during the data-gathering phase. This analytical process led to the development of key themes and identification of opportunities for improvement. Section 3 Business Review Findings presents key themes, strengths, deficiencies, and observations; the Technical Review

presents essential inputs, outputs, and flow, and strengths and deficiencies. Both sections support the assessment and recommendations for FPA.

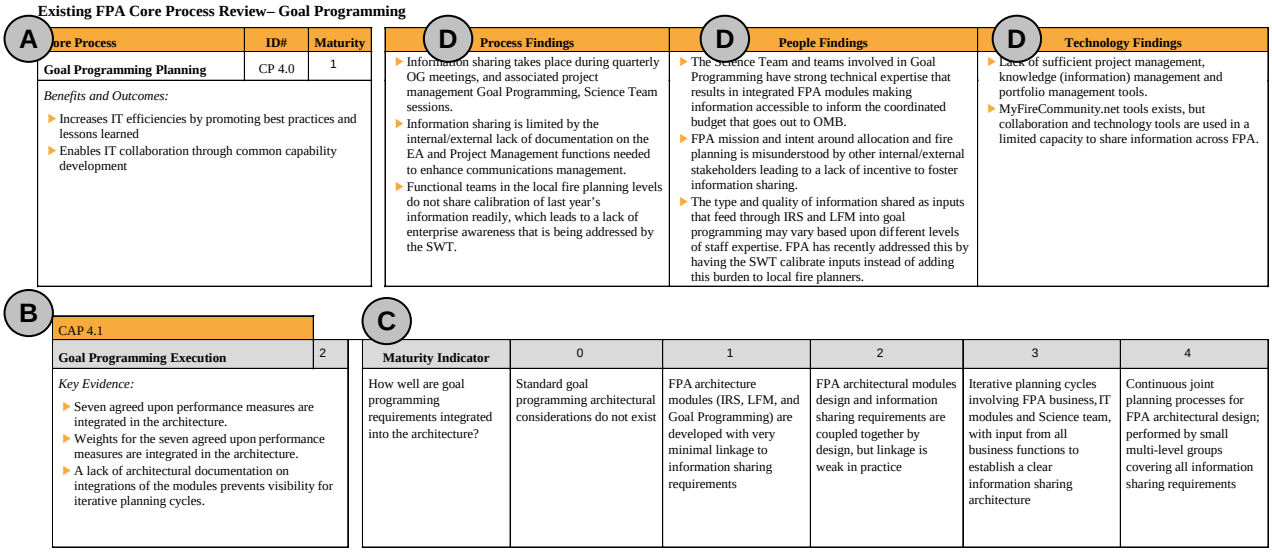
Our data-gathering approach was stakeholder focused and analytically based. At project kickoff, the Booz Allen team conducted three facilitated interview sessions with key groups in the FPA Charter: the Oversight Group (OG), the Project Team, and the Science Team. In each of the interview sessions, Booz Allen used a proven approach to conduct the analysis and gain significant insight into FPA's operations and technical foundations. The initial interview sessions shed light on the complexity of FPA and the need for additional discussions to further understand the business processes and supporting system modules. The team held many follow-up interviews (see Section 1.5 for a list of interviews conducted), asking detailed questions and capturing extensive notes. The meeting notes, along with the information gleaned from analyzing the FPA-provided documentation and from reviewing open-source scientific literature, helped identify key themes, strengths, and deficiencies. This understanding of the challenges and key themes related to budget formulation, governance, performance measures, stakeholder expectations management, and FPA modules, enabled the review team to objectively assess the FPA system, providing an independent perspective on the state of the program and on potential areas for improvement.

The assessment of FPA also reviewed the Core Business Process and Technical underpinnings to identify the maturity of the system modules and associated scientific models. To conduct the process assessment and generate maturity ratings, the Booz Allen team analyzed FPA organization across five Core Processes (CPs). The CPs, based on FPA priorities and industry best practices, are as follows:

- 1.0 Fire Preparedness Budget Formulation
- 2.0 Governance
- 3.0 Performance Measures Coordination
- 4.0 Goal Programming
- 5.0 Stakeholder Communications.

Section 3 of the Report presents the maturity level of each FPA Core Process (CP), including details describing the capabilities, functions, and findings for each CP. Figure 1 provides a legend describing the information provided for each CP.

FIGURE 1: LEGEND–FPA CORE PROCESS (CP) ANALYSIS



Key/Legend

A **FPA Core Processes & Benefits and Outcomes:** Identifies the specific FPA CP and the capabilities that comprise the CP. A maturity assessment (Harvey Ball indicator) is provided for each CP.

B **FPA Capabilities & Key Evidence:** Identifies the capabilities (CAP) that comprise the FPA CP and a maturity assessment (Harvey Ball indicator). A list of the key evidence to support the capability maturity rating is provided as well.

C **Maturity Indicator:** Displays a "roll-up" of the criteria used to assess the maturity of each CAP.

D **Assessment Observations:** Data and findings from the analysis conducted, grouped by Process, People, and Technology.

The scorecard's maturity ratings are supported by key themes, strengths, deficiencies, and observations. Each section also contains a recommendations section, which presents improvement opportunities in the hopes of providing traceable, actionable, and impactful ways to continue to enhance FPA.

1.4 Document Overview

This document is structured to provide the reader with a thorough analysis of the current state of the FPA system. The intent of the report is to serve as an assessment of the Program while communicating the findings in a clear and concise manner. Last, the report is written so that it can be understood by technical and non-technical stakeholders, which is important given the diversity of the audience that interacts with the FPA system. The overall document structure consists of the following sections:

- Section 1–Introduction, Background, and Scope
- Section 2–Overview of FPA
- Section 3–Business Review Findings
- Section 4–Technical Review Findings

- Section 5–Assumptions, Terms, and Conditions
- Section 6–Conclusion
- Appendices

1.5 Sources of Input

To ensure that this assessment and the resulting report incorporate as many perspectives as possible, the Booz Allen team analyzed multiple sources of inputs. These inputs included existing FPA documentation, open scientific literature related to FPA, one-on-one interviews, and facilitated group sessions. The existing documentation and interviews laid the foundation for the analysis and provided the insight necessary to understand and assess the current state of the FPA system. The Interim Report consolidated the initial analysis and was submitted to the FPA External Review Project Officer for review and comment. On receipt of comments from the Project Officer, the review team conducted additional interviews and analyses to develop the Final Report. Table 1 lists all stakeholders interviewed during the external assessment.

TABLE 1: INTERVIEW LIST

Interviewee	Organization	Role
Ahmed, Faisal	DOI	Detail Executive Project Manager; OG
Bastian, Henry	DOI	Fire Ecologist; LANDFIRE Business Lead
Beebe, Grant	DOI / BLM	BLM Budget Lead; IAT
Berrichoa, Kole	DOI / BLM	Technical Support (IRS); FPA Project Team
Bevers, Mike	USFS	Science Team Lead; IST; OG
Birkholz, Anne	DOI / NPS	Fire Planner; SWT
Bradshaw, Scott	DOI / BIA	Fire Planner; MAT
Brooks, Becky	DOI/ USFWS	Fire Planning Specialist
Carlile, Lyle	DOI / BIA	Fire Director
Christiansen, Eric	DOI	Fuels Program Lead
Duhnkrack, Jesse	DOI / NPS	Wildland Fire Management Specialist; GA Lead
Dumpis, Marty	USFS	Forest Supervisor; MAT; OG
Epps, Joe	DOI / BLM	National Fire Planner
Finney, Mark	USFS	Research Forester; IST
Fischer, Tate	DOI / BLM	Fire Management Specialist; IAT; OG
Fojtik, Jaymee	DOI/BLM	DOI Business Lead; FPA Project Team;
Frost, Joe	USFS	FS Business Lead; FPA Project Team;
Gale, Cal	Private	Project Coordinator: FPA Project Team (Retired)
Harbour, Tom	USFS	Director for Fire and Aviation Management; OG; BoD
Hinds, Kathy	Contractor	FPA Technical Writer
Hood, Larry	USFS	Regional Fire Planner; GA Lead
Johnson, Bill	DOI	Fire Management Specialist; FPA Project Team
Johnson, Roy	DOI	Deputy Director for OWFC
Kaage, Bill	DOI / NPS	Fire Director
Kirsch, Andy	DOI / NPS	Program Analyst; IAT
Larrabee, Steve	DOI / BIA	Fire Planner; GA Lead

Interviewee	Organization	Role
Lee, Danny	USFS	EFETAC Director; IST
Lichtenstein, Mark	USFS	USFS budget lead; IAT; OG
Lien, Lindsey	DOI	GA Lead for Alaska
Manley, Jeff	DOI / NPS	Fire Planner
Mauney, Louis	DOI	OWFC budget lead; OG
Murphy, Tim	DOI / BLM	Fire Director; OG; BoD
Nalle, Darek	USFS	Research Forester, IST
Nichols, Tom	DOI / NPS	Chief of Fire and Aviation; OG; BoD
Phipps, John	USFS	Deputy Chief for State & Private Forestry; OG; BoD
Quigley, Tom	Private	Science Advisor at METI, Inc.; IST
Rowdabaugh, Kirk	DOI	Director for OWFC; OG; BoD
Scott, Jeff	DOI / NPS	NPS Budget Lead; OG
Segar, John	DOI / USFWS	Fire Director
Short, Karen	USFS	Research Ecologist, IST
Thompson, Craig	DOI / BLM	GIS Coordinator; FPA Project Team
Timothy, Brent	DOI / BLM	Statistician; FPA Project Team
Weber, Sue	Private	Project Coordinator; FPA Project Team: SWT (Retired)
Whitney, Jeff	DOI / USFS	FPA Executive Director; OG; BoD
Wiley, Christie	DOI / USFS	Communications Director
Wright, Liz	USFS	Regional Fire Planner; Assistant GA Lead
Ziegler, Amy	USFS	Fire Planner; SWT

Following is a list of the acronyms used Table 1. For a complete list of acronyms, see Appendix B.

- BIA: Bureau of Indian Affairs
- BLM: Bureau of Land Management
- BoD: Board of Directors
- DOI: Department of Interior
- EFETAC: Eastern Forest Environmental Threat Assessment Center
- FPA: Fire Program Analysis
- USFWS: U.S. Fish and Wildlife Service
- GA: Geographic Area
- IAT: Interagency Analysis Team
- IST: Interagency Science Team
- MAT: Management Advisory Team
- NPS: National Park Service
- OG: Oversight Group
- OWFC: Office of Wildland Fire Coordination
- SWT: Support Working Group
- USFS: United States Forest Service.

2 OVERVIEW OF FPA

The Wildland Fire Management Program comprises budgets for three major program components: preparedness (pre-suppression and prevention resources), suppression, and fuels reduction:

- **Preparedness.** Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.
- **Suppression.** "When the management goal is full suppression, aggressive initial attack is the single most important method to ensure the safety of firefighters and the public and to limit suppression costs. When the management goal is other than full suppression, or when conditions dictate a limited suppression response, decisiveness is still essential and an aggressive approach toward accomplishment of objectives is still critical." (*Interagency Standards for Fire and Fire Aviation Operations*, Chapter 1, Federal Wildland Fire Management Policy Overview, pages 1–8, January, 2012).
- **Fuels Reduction.** Manipulation (including combustion) or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

The five federal wildland fire management agencies have developed and historically used agency-specific wildland fire planning and budgeting analysis models to address these program components in harmony with their respective agency's mission and land and resource management objectives.

The annual federal budget cycle begins 2 years before the fiscal year for which funds are being requested. The agencies begin developing their respective budgets in the spring of each year, with a final submission sent through their respective departments to the Office of Management and Budget (OMB) in the fall. OMB prepares the budget documents for submission to the President in January. The President approves a budget package and sends it to Congress by the first Monday in February.

2.1 Historic Budget and Planning Approach

Federal wildland fire management planning and budgeting analyses historically have been driven by policy as well as by agency missions. As a result, differences have occurred in many cases because laws, legislation, and Department and Agency direction have not been consistent between the USDA and DOI. These differences have resulted in departures to the approach of fire management planning and budget analysis. A discussion of this subject can be found in USDA Forest Service General Technical Report PSW-GTR-173, 1999.

Federal wildland fire management planning and related budget analysis began to evolve into a computer-based process in the early 1980s. In the mid to late 1980s, the U.S. Forest Service developed the National Fire Management Analysis System (NFMAS), which also was used by the Bureau of Land Management (BLM) and the Bureau of Indian Affairs (BIA). The NFMAS provided a tool for managers to evaluate alternative fire management programs against such things as land management objectives, program budget levels, and dispatch strategies. The NFMAS model was based on historic fire occurrence, fire behavior, initial attack organizations, and the results of simulated fires that are captured or escape initial attack. The Interagency Initial Attack Assessment (IIAA) model within NFMAS provided a simulation of wildland fire initial attack response and applied an economic efficiency to each response. By varying the dispatch strategy, resource mix, and/or location of firefighting resources, a number of simulations could be analyzed, leading to the determination of one mix of initial attack organization and dispatch strategy that was most efficient. The

cost associated with this "most efficient level" (MEL) then could be predicted by aggregating the costs of providing the respective initial attack organization, cost of fire suppression, and cost resulting from potential damage to land management resources. This aggregated cost was referred to as "cost plus net value change" (C+NVC). This cost-benefit analysis approach was the approach OMB requested to support wildland fire budget requests in the most recent years before development of FPA.

During this period, the National Park Service (NPS) and U.S. Fish and Wildlife Service (USFWS) collaborated on the development of a fire management planning and budget analysis process called FIREPRO, which took a different approach to answering the questions of programmatic efficiency and effectiveness. This difference in approach was driven by the number of non-market and non-use resources, such as historic properties, rare species, critical habitats, and special concern biological communities. The NPS and USFWS have long recognized that wildland fire can be a threat to some of these resources and a benefit to others. For this reason, fire management within these bureaus has emphasized a balance between aggressive suppression and fire used as an ecological tool. Therefore, FIREPRO does not use the C+NVC approach to identify the least cost fire program. FIREPRO attempts to define a program that effectively accomplishes resource management objectives while protecting life, property, and other resources for which NPS and USFWS were established. FIREPRO and the USFWS version (called FIREBASE) are workload and complexity analysis tools used to determine appropriate staffing and funding targets for a given budget that supports resource and land management objectives and achieves a 95 percent initial attack success rate on fires designated to be suppressed. NPS inputs fire occurrence data into FIREPRO and the model translates work into staff and budget outputs using several algorithms. Unlike NFMAS, which was bottom-driven, FIREPRO is much more akin to FPA and represents less of a shift in funding that could have a significant impact on any one agency and/or unit. The NPS and USFWS felt that this approach best suited their respective missions by focusing on the effectiveness of various budget levels and response strategies to achieve land and resource management goals and objectives.

All of the respective planning processes were able to define what was termed the Most Efficient Level (MEL) for a program within a given budget. The MEL concept was used for several years before FPA in the federal wildland fire budgeting process. However, congressional concerns arose in the late 1990s and early 2000s because of an increasing number of escape fires and escalating fire suppression costs. Congressional and OMB confidence in the MEL approach to budget formulation was being questioned, which led to an OMB recommendation for a review of the federal agencies' wildland fire budget and planning models. This review, initiated in 2001, led to development and submission (November 2011) of a report entitled *Developing an Interagency Landscape-scale Fire Planning Analysis and Budgeting Tool*, referred to as "The Hubbard Report." The respective findings and outcome of this review resulted in the genesis of FPA. The functional processes of the MEL and C+NVC were to be dropped and the budgeting and planning process was to become objective driven and performance based. This new planning process was intended to complement the principles and goals identified in the *10 Year Cohesive Strategy–A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment* (August 2001).

2.2 Genesis of FPA's Creation

The Hubbard Report recommended development of a software application tool to support wildland fire management budgeting and planning. The application would "address the direction from the House and Senate Appropriations Committees and OMB that the Departments of the Interior and Agriculture develop a coordinated and common system for determining the most efficient wildland fire management program." A

key Hubbard Report finding was that "a comprehensive interagency fire planning and budget analysis identifying the most cost effective program to achieve the full range of fire management goals is possible and desirable." Recommendations from the Hubbard Report include the following:

- The Departments of Agriculture and the Interior develop and implement a common interagency fire management analysis process.
- The system will be objective driven and performance based.
- The analytical approach will be focused on achieving the full scope of fire management activities, including:
  - Protecting life and property
  - Using fire and other treatments to restore and maintain ecosystem health
  - Reducing hazardous fuels in fire-prone ecosystems.
- Identify resource needs and the efficiencies of sharing available fire management resources across jurisdictions.
- Provide land managers with the most cost-effective wildland fire management process that meets program objectives.

Following the review and final submission of the Hubbard Report, Congress directed the federal wildland firefighting agencies to develop a focused budgeting system that: is common across all federal agencies, identifies efficiencies, ties to resource values, and provides a mechanism for sharing resources with federal and non-federal partners. Action was taken by Congress in the fiscal years (FY) 2002 and 2003 Appropriations Act to support this endeavor as follows:

> ***House Report 107-234 (FY 2002 Appropriations Act, October 11, 2001):***
>
> *"The managers remain concerned about the variation in methods by which the Departments calculate wildfire fighting readiness and how the Departments plan their distribution of firefighting resources to attain efficiency. The managers direct the two Departments to develop and implement a coordinated and common system for calculating readiness which includes provisions for working with the shared firefighting resources of the States and other cooperators and considers values of various resources on both Federal and other lands."*
>
> ***House report 107-564 (FY 2003 Appropriations Act, July 11, 2002):***
>
> *"The committee is aware that the Forest Service and the four Interior bureaus participating in Wildland Fire Management activities use different systems and procedures for determining their readiness for control of wildfires. We have been informed that the Departments have been engaged in efforts to design and develop tools for fire program managers that would be used by the Forest Service and all of the Interior bureaus. The Committee is encouraged that the Departments have been working together to develop common systems to plan their activities; however, we are concerned that a complex system may require significant funding and take many years to develop. The Committee therefore directs the Departments to design and develop a focused automated system for preparedness resources planning to replace the systems currently in use by the fire management agencies. The Committee believes that a limited system can be designed and implemented by the end of fiscal year 2004. The development and design of the information technology system for fire preparedness will be conducted according to standard Federal regulations for planning, budgeting,*

acquisition and management of capital assets. The Committee further directs that the agencies deliver quarterly progress reports that describe project status and provide updated cost information."

This direction led the way to development of the FPA system.

2.3 System Overview

The Fire Program Analysis (FPA) system was initiated in 2002 to develop a comprehensive system to replace the different legacy systems in use by the federal wildland firefighting agencies. The FPA system is an interagency wildland fire project that is being developed through collaboration between the USDA, Forest Service (FS), and the DOI's BLM, NPS, USFWS, and BIA. The purpose of the FPA system has evolved from its inception. While this review does not analyze the full history of FPA, it is noteworthy that in 2002, FPA's objectives included:

- Providing a common budget framework to analyze firefighting assets without regard for agency jurisdictions
- Examining the full scope of fire management activities, including preparing for fires by acquiring and positioning firefighting assets for the fire season, mobilizing assets to suppress fires, and reducing potentially hazardous fuels
- Considering the availability of nonfederal firefighting assets, such as state and/or county firefighters, that typically help respond to fires on federal lands
- Considering the communities and resources to be protected and agency land management objectives
- Modeling the effects over time of differing strategies for responding to wildland fires and treating lands to reduce hazardous fuels
- Using this information to identify the most cost-effective mix and location of federal wildland fire management assets.

Today, the FPA Charter describes the purpose of FPA as a system to provide managers with a common interagency process for strategic fire management planning and budgeting. The long-term, strategic objective of the FPA system is to perform a federal interagency, objective driven, performance based fire program analysis for budgeting and organization planning. The FPA system is intended to provide managers with analysis tools to support strategic planning and budgeting for a comprehensive, interagency fire management program. Its purpose is to evaluate the effectiveness of alternative fire management strategies through time in meeting land management goals and objectives.

2.3.1 System Development

The impetus for developing the FPA system derives from interagency policy and Congressional direction guiding the coordinated management of federal wildland fire programs. Policy and direction required the federal wildland fire program to develop a standard, integrated, interagency program analysis system. Initial focus was on developing the portion of the model that analyzed the agencies' ability to successfully contain wildfires during initial attack. The selected approach relied primarily on a modeling technique known as optimization. Using this approach, FPA was to analyze, for any given budget level, all possible combinations and locations of the firefighting assets typically available to agency field units and identify the combination of these assets that resulted in optimal protection of communities and resources.

The first version, the Preparedness Module, was completed and released in early Fiscal Year 2005. Following the release of the Preparedness Module, agency officials raised concerns about FPA's underlying science and the extent to which it met agency management and policy objectives. As a result, the agencies conducted a review of FPA in 2006, which questioned FPA's basic modeling approach (*Management Review Team Report of the Fire Program Analysis (FPA) Preparedness Module*, 2006). After this review, the Wildland Fire Leadership Council (WFLC) chartered FPA to address five management concerns (WFLC Briefing Paper: *FPA–Development Alternatives Overview*, December 2006):

- The expanding annual suppressions costs for large fires
- The fires which cause substantial damage in the Wildland Urban Interface (WUI)
- Fires that cause damage to highly valued resources (where definitions vary across the fire agencies)
- Prevention and suppression of unwanted and unplanned fires
- The need to meet fire and fuel management targets on federal lands.

Changes were made to FPA after the 2006 review. The FPA modeling approach was changed from an optimization-based approach, which evaluated all possible combinations and locations of firefighting assets typically available to local units and identified the asset combination that provided optimal protection of communities and resources for a given budget level, to simulation modeling that incorporated a tradeoff analysis approach. The simulation approach evaluates a much smaller number of potential asset combinations, along with different options for fuel reduction treatments, and ranks them according to certain performance criteria.

The revised FPA approach encompasses both a computer model and a management system to help the agencies inform their budget formulation and allocation processes. The revised model was expected to be completed in November 2008, with the results used in the spring of 2009 to develop the fiscal year 2011 budget request. This period represented about a 3-year delay from the initial goal of using FPA's preliminary results in 2006. During this period, there were additional inconsistencies found in the model resulting in continued development work. However, as noted in GAO's November 2008 report (*Interagency Budget Tool Needs Further Development to Fully Meet Key Objectives*, November 2008), "although the system is not yet fully functional, FPA shows considerable promise in achieving some key objectives:

- Provide a common framework for the five federal agencies to analyze firefighting assets and develop budget request across agency jurisdictions,
- Analyze the most important fire management activities,
- Recognize the presence of certain nonfederal firefighting assets that may be available to respond to fires on federal land.

2.3.2 System Implementation

The FPA program is expected to be fine-tuned, calibrated and fully implemented in fiscal 2012. This planning and analysis period will be used to develop outcomes to inform the fiscal 2014 budget cycle.

The implementation of the FPA program, as stated in the FPA Charter, has the potential to represent a fundamental shift for Wildland Fire Management. Its adoption may fundamentally restructure the different agency and departmental budgeting processes currently in use into a single collaborative interagency process. This transition will necessarily occur over several years and will need to be coordinated with internal and

external stakeholders. A three-phased transition is envisioned to reach full implementation of the program and its associated business processes.

- **Phase 1: Ongoing Learning and Calibration.** This is the current phase with teams working to gain insights into FPA analyses outputs, as well as reviewing technical processes.
- **Phase 2: Establish Confidence.** In the spring of 2011, an external independent review of FPA's business and technical underpinnings, as established by 2010 FPA Charter, was initiated to guide further program management. During this phase, the Interagency Analysis Team (IAT) will validate and report confidence in the results of fire planning unit analysis as well as in the results of goal programming and tradeoff analysis. Ongoing feedback from the IAT, the planned external science review, and the Phase 1 and 2 milestones, will provide the opportunity for the Oversight Group to confirm confidence in the results and recommend status and further development of the program.
- **Phase 3: Establish Ownership and Full Implementation.** As confidence is established in model outputs and the implications of those outputs are validated, the agencies will consider program and funding shifts to increase efficiencies and better meet goals and objectives.

The FPA model currently addresses only the preparedness and prevention components (current issues with the prevention model have been identified and led to "workarounds") of the wildland fire programs and although data input comes from the local units, the model runs at the national level. FPA is expected to provide input to the budget formulation process from a strategic perspective using a tradeoff analysis and evaluation through goal programming. The program components of hazardous fuels treatments and suppression will continue to be analyzed as in the past with the expectation that FPA will be able to address these components in the future.

2.4 Overview of the FPA Stakeholder Community

The FPA stakeholder community consists of six primary stakeholder levels, with 55 stakeholder groups, some with multiple members, as follows (Table 2):

1. Executive level, represented by President (Congressional Budget), OMB, GAO, and the Office(s) of the Inspector General (OIG) for both DOI and USDA. Number of stakeholders groups: 5.
2. Departmental level, represented by DOI–Office of Wildland Fire Coordination and the Under Secretary of Agriculture–Forest Service. Number of stakeholders groups: 2.
3. National level, represented by Agencies (USFS) and Bureau Offices (BLM, NPS, USFWS, and BIA) in Washington, DC, and Boise, ID. Number of stakeholders groups: 10.
   - USFS Chief, Staff and Fire Director in DC
   - BLM Director and Staff in DC
   - NPS Director and Staff in DC
   - USFWS Director and Staff in DC
   - BIA Director and Staff in DC
   - USFS Deputy Fire Director and Staff in Boise
   - BLM Fire Director and Staff in Boise
   - NPS Fire Director and Staff in Boise
   - USFWS Fire Director and Staff in Boise

- BIA Fire Director and Staff in Boise

4. National Committees, represented by Fire Planning, Budgets, Fuels and Prevention. Number of stakeholders groups: 8.
5. Regional, State, Areas, District, and Local levels, represented by Agencies (FS), Bureaus (BLM, NPA, USFWS, and BIA), and Non-Federal Offices. Number of stakeholders groups: 12.
6. FPA level, represented by governance groups, working teams, and support staff. Number of stakeholders groups: 18.

TABLE 2: FPA STAKEHOLDER COMMUNITY

Stakeholders Levels	Stakeholders Groups and Individuals	Roles and Responsibilities
Executive Level	President (Congressional Budget)	Provides the funding to DOI and USFS.
Executive Level	Congressional Appropriations Committees/Staffers	Provides legal authority to spend and obligate federal funds.
Executive Level	Office of Management and Budget (OMB)	OMB serves the President and provides oversight of agencies performance, procurement, financial management, and information technology.
Executive Level	Government Accountability Office (GAO)	GAO supports Congress in meeting its constitutional responsibilities and to help improve the performance and ensure the accountability of the federal government for the benefit of the American people.
Executive Level	Office(s) of the Inspector General (OIG) for DOI and USDA	The OIG mission is independent and objective reporting to the Secretary and the Congress for bringing about positive change in the integrity, efficiency, and effectiveness of federal government programs.
Department Level	DOI and USDA	Office of Wildland Fire Coordination manages and oversees the DOI's wildland fire management programs and policies. The Under Secretary of Agriculture for Natural Resources an Environment supervises policy development and day-to-day operations of the Forest Service.
National–Agencies and Bureaus Levels	Washington Offices–FS, BLM, NPS, USFWS, and BIA	Provides leadership and direction under authority of the Line Officers (BLM, NPS, USFWS, BIA, Directors, Forest Service Chief and Fire Director).
National–Agencies and Bureaus Levels	NIFC Offices–FS, BLM, NPS, USFWS, and BIA	Provides leadership and direction under authority of the Fires Directors (BLM, NPS, USFWS, BIA, and Fire and Aviation Management, FS).
National Committee–Fuels	Interagency Fuels Committee	Coordinates with designated groups to provide subject matter expertise in fuels management for projects related to wildland fire.
National Committee–Fire Prevention	National Prevention Group	Coordinates with designated groups to provide subject matter expertise in fire prevention for projects related to wildland fire.
National Budget Formulation	National Budget Leads comprises five interdisciplinary agency personnel	Provides the implementation relative to planning and budget formulation and allocation processes.

Stakeholders Levels	Stakeholders Groups and Individuals	Roles and Responsibilities
National Fire Planning	National Fire Planners	Assists in the development and implementation of FPA and other fire planning support processes.
Regional and State–Agencies and Bureaus Levels	FS, BLM, NPS, USFWS, and BIA	Provides leadership and direction under authority of the Line Officers (BLM, NPS USFWS, and BIA Regional Directors, State Directors, and Forest Service Regional Forester and Forest Supervisors).
Area and District–Agencies and Bureaus Levels	FS, BLM, NPS, USFWS, and BIA	Provides leadership and direction under authority of the Line Officers (BLM, NPS, USFWS, and BIA District Managers, FS Unit Managers and District Ranger).
State and County Levels	State and local governmental, and non-governmental wildland fire management partners	Not currently an active member of an individual Fire Planning Unit (FPU).
FPA–Oversight Group (OG)	The OG comprises fourteen (14) interdisciplinary agency personnel, inclusive of the Board.	The OG provides leadership and guidance for the FPA program including its operation, continued development, implementation, and integration into operational and business processes. This includes incorporating the program and its associated business processes into the agencies' planning and budget systems and procedures.
FPA–Board of Directors (Board)	DOI Director of OWFC IFEC Representative Fire Director Representative USFS Senior Advisor to Deputy-Chief SPF FAM Director or Designee Executive Director	The Board provides executive leadership and guidance for the OG and the program. This includes incorporating the program and its associated business processes into the agencies' planning and budget systems and procedures.
FPA–Executive Director	FS/DOI	The Executive Director informs the OG of items requiring a decision and presents supporting information from the advisory and analysis teams and the program manager in advance of the required decision. Coordinates communications and activities between Advisory Groups, OG, other with other IT Projects.
FPA–Interagency Analysis Team (IAT)	The IAT will include up to six (6) members and have designated DOI and USFS co-leads.	An IAT will work with FPA's national goal programming process and advise the OG on aspects of system outputs and their implementation relative to planning and budget formulation and allocation processes.
FPA–Management Advisory Team (MAT)	The MAT may include up to eight (8) members with similar membership between the DOI and USFS and may include a representative from a cooperating entity such as an advisor, or as a member.	A key focus of the MAT is to represent line officers. The MAT may also be inclusive of other members such as fire management leadership. The MAT's key roles are to offer input relative to issues or concerns regarding the program's implementation and to share information.

Stakeholders Levels	Stakeholders Groups and Individuals	Roles and Responsibilities
FPA–Interagency Science Team (IST)	IST members will be representative of the DOI and USFS science and research community.	The IST's primary roles include: to validate confidence in the results and provide advice and recommendations to the OG relative to those findings to allow the OG to confirm confidence in the results and thereby recommend status and course of the program; and, to provide analysis, advice and recommendations to the OG relative to various program and budget alternatives analyzed in the goal programming process.
FPA–Project Manager	USFS	A Project Manager will provide leadership and direct supervision for the ongoing operation, maintenance, and development of the FPA program.
FPA–Business Leads	USFS/DOI	The Business Leads will provide a linkage between system operation and development and field implementation. The Business Leads will report to their respective agencies, but will work as full partners with the Program Manager.
FPA–Project Team	Project Team comprises twelve (12) interdisciplinary agency personnel	Key personnel dedicated to the accomplishment of the FPA Project.
FPA–Support Working Team (SWT)	SWT comprises ten (10) interdisciplinary agency personnel	Technical experts that will interact with the FPA application in collaboration with the Fire Planning Units (FPU). The SWT works with the FPUs to achieve critical tasks including data validation and model runs on their behalf.
FPA–Geographic Areas (GA)	Geographic Area Leads comprises nine (9) interdisciplinary agency personnel	Provides leadership within GA regarding the implementation of the FPA program, serves as a GA single point of contact for FPA program, and provides assistance and guidance to FPU members to successfully complete FPA analyses.
FPA–Fire Planning Unit (FPU)	FPU Planners and State FPU Partners (Non-Feds)	Technical experts of the FPA local inputs to achieve critical tasks including model runs and outputs.
FPA–Executive Sponsor(s)	Executive Sponsor Deputy Chief, USFS Executive Co-Sponsor Deputy Assistant Secretary, DOI	Serves as the Designated Approval Authority (DAA); and represents FPA in various executive management meetings.
FPA–Business Process Owner	Assistant Deputy Chief for State and Private Forestry, USFS	Maintains active senior-level involvement throughout the development of the system and identifies business processes and products needed to meet the business needs of the user community.
FPA–System Owner	Deputy Chief for State and Private Forestry (USFS)	Establishes business case for the system. This individual makes the business argument for the Project to exist, controls the overall funding of the Project and defines the acceptance criteria of the Product.
FPA–Project Chief Technology Officer (CTO)	CTO, USFS	Provides technology direction to the FPA Project and ensures conformity to the USFS, USDA and NWFEA enterprise technical realm.

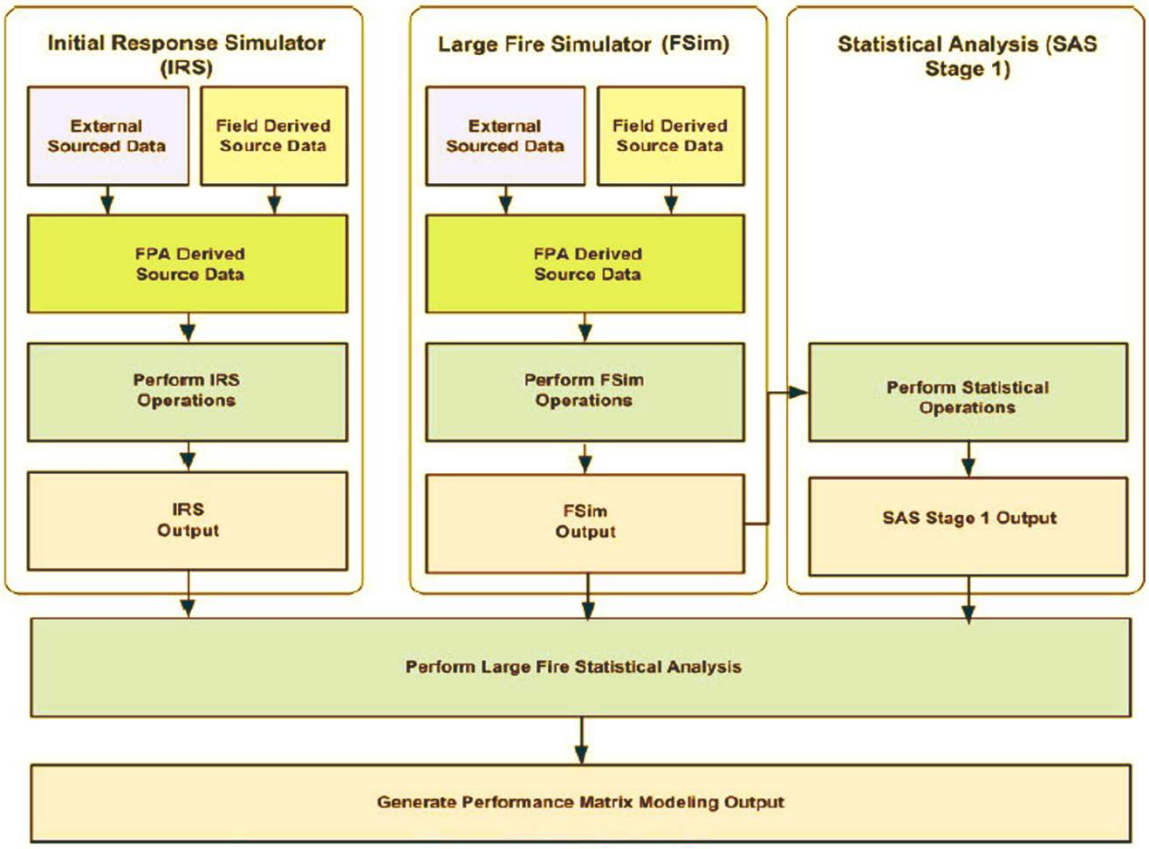
Stakeholders Levels	Stakeholders Groups and Individuals	Roles and Responsibilities
FPA–Solutions Vendor (IBM)	Program Manager and Project Manager	Provides core software of FPA solution (RMS), support, update and maintenance of the RMS product.
FPA–Communications Director/Manager	FS/DOI	Manage all aspect of internal and external non-individual communication of FPA including paper based and electronic communications.

2.5 Overview of FPA as a System

FPA is a strategic tradeoff analysis tool that enables decision makers to investigate the implications of different investment choices. This information is used to demonstrate to the OMB and Congress the effects of the recommended changes on the national wildland fire management preparedness program.

Figure 2 provides an overview of the FPA modeling process. Figures 3–7 provide diagrams of the system modules, accompanied by descriptions, based on the *FPA Desk Guide* (April 2011). Essentially, FPA consists of various computational modules that take external and field sourced data, combine it with data derived from the FPA, and then FPA performs various computational analyses.

FIGURE 2: OVERVIEW OF FPA MODELING PROCESS



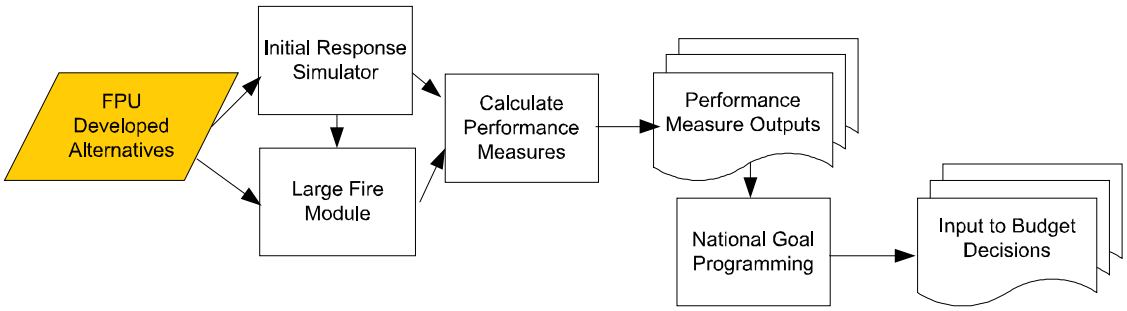
The foundation for FPA is the Fire Planning Unit (FPU), each of which is associated with a specific land base that can be described spatially. The boundaries of FPU land base units are not predefined by agency administrative boundaries. FPUs may consist of a single agency unit, multiple agency units, or any

combination of single or multiple agency units and subunits. Lands included in a FPU may be contiguous or non-contiguous.

Generally, FPA develops investment alternatives (Figure 3), consisting of a preparedness option (prevention and initial response modules) and a fuel treatment option designed by the FPU fire planner. Results from the Initial Response Simulator (IRS) and the Large Fire Module (LFM) enable the FPA system to calculate performance measures.

The Fire Ignition Generator (FIG) Module is initiated before running the Initial Response Simulator (IRS) module. The FIG module creates fire ignition scenarios on the landscape using historic ignitions from the fire management agencies' systems of record.

FIGURE 3: DEVELOPMENT OF ALTERNATIVES FOR FPUs



2.5.1 System Components: Initial Response Simulator

The Initial Response Simulator (IRS) is a strategic module that simulates the initial response to wildland fires within a specific FPU. The IRS (Figure 4) leverages interagency databases from a FPU to build and simulate potential fire seasons, also referred to as "Fire Event Scenarios." The model then calculates fire behavior for each fire in a Fire Event Scenario. Following this calculation, IRS "simulates fire growth and containment considering the interaction between the fire growth and fire line built during initial response" (FPA Desk Guide, April 2011)." Based on user-defined conditions that mirror decisions in dispatch response plans or by duty officers, the model dispatches resources to the simulated landscape (FPU).

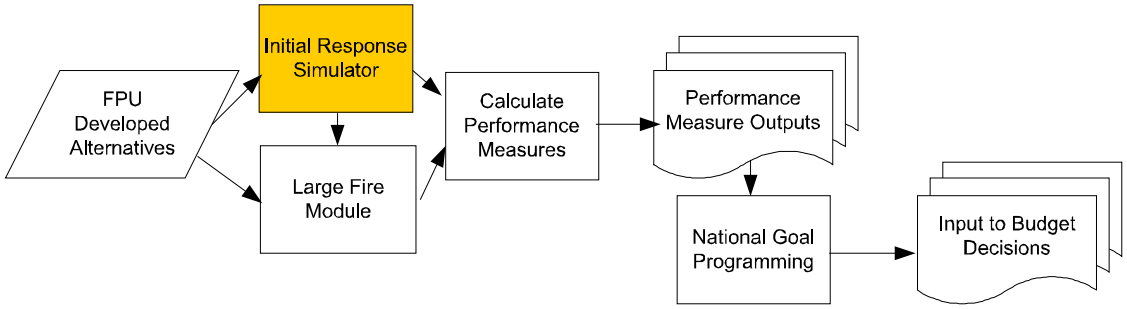
Fuels Treatments Considerations

FPA is limited in the evaluations of fuel treatment alternatives at the national level. The IRS and the Large Fire Module (LFM) have limited ability to change fuel conditions represented by fuels management treatments and simulate the consequences of fuel treatments on performance measures. Additional cross-module documentation is needed to fully understand the multiple modules and instances of modules that offer the full breadth and depth of fuels treatments considerations. The IRS documentation does not explicitly define the relationship of IRS to HFPAS as a fuels budget and planning system. HFPAS has different forms and application between USDA and DOI. This area is currently being defined and developed. In the last year, it became evident that FPA does not handle geospatial fuels well. Therefore, it has been proposed to bring HFPAS outputs into the FPA environment to address fuels treatments. This suggestion would be a worthwhile discussion topic item during the next OG meeting.

Prevention Program Considerations

The prevention model relates prevention actions with changes in the number of human caused ignitions. FPA uses a simple variant of the concepts used in RAMS (Risk Assessment and Mitigation Strategies), along with other relevant studies and data.

FIGURE 4: INITIAL RESPONSE SIMULATOR (IRS)

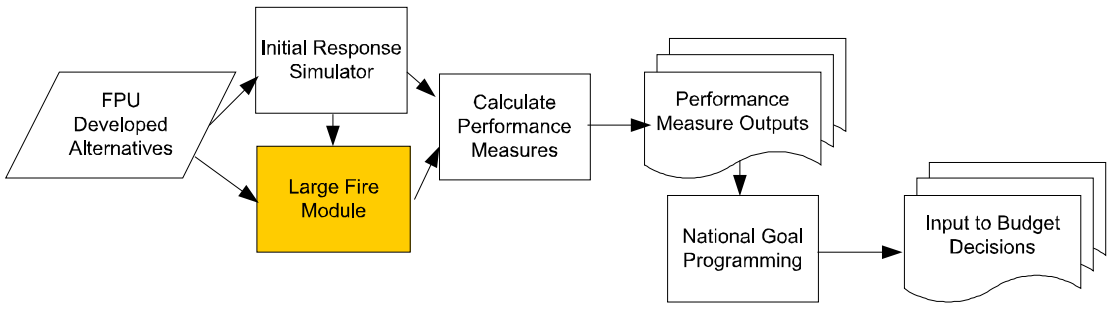


2.5.2 System Components: Large Fire Module

The Large Fire Module (Figure 5) simulates the probability of large fires across the landscape, as well as the cost of large fire suppression efforts. The Large Fire Module combines statistical analysis with fire simulations based on a modified version of the Fire Spread Probability (FSPro) model developed at the Missoula Fire Sciences Laboratory. "The FPA implementation of FSPro, referred to as Fire Simulator (FSim) simulates thousands of possible fire seasons by varying fuels, weather, suppression, and treatments to calculate the probability of large fires for points on a landscape" (*FPA Desk Guide*, April 2011). The statistical model processes the FSim output. A statistician uses a desktop statistics package (SAS) to derive the coefficients (unique for each FPU) for the statistical model's large fire equation. This process is referred to as the "Regression Function Calculator."

Stage 2 of the Large Fire Module estimates final fire size using regression equations. Initial start size, based on Escape Size Limit (ESL, as specified by the user in the IRS module) is not an input to the regression equation. Integrations are one way, from IRS to LFM. IRS feeds escapes into LFM (and passes forward the information from those fires into LFM), but LFM does not feed into IRS, which means that large fire calculations of burned acres are neither started at nor added to the IRS escape size limit). The LFM predicts final fire size and relative costs for different suppression resource investment alternatives at the FPU level.

FIGURE 5: LARGE FIRE MODULE



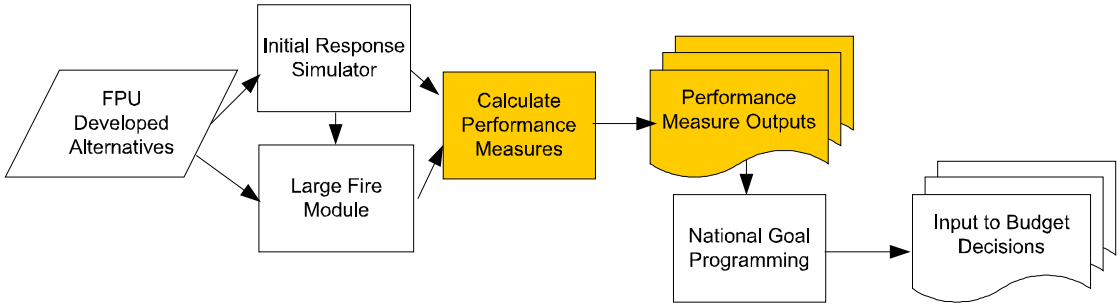
2.5.3 System Components: Performance Measures

The FPA system performance measures (Figure 6) have gone through a number of evolutions, which analyzes the performance of each FPU investment alternative. There are currently seven performance measures (PM) in the FPA system:

- **PM1:** Expected Suppression Cost—Reducing the probability of occurrence of costly fires
- **PM2:** Expected WUI Acres Burned—Reducing the probability of occurrence of costly fires within the Wildland Urban Interface (WUI).
- **PM3:** Acres Treated—Increasing the proportion of land treated to reduce wildland fire risks
- **PM4:** Expected Highly Valued Resources (HVR) Acres Burned—Protecting highly valued resources areas from unwanted fire
- **PM5:** IA Contained + Ignitions Prevented—Maintaining a high initial attack success rate
- **PM6:** Acres Burned Above Threshold—Decreasing the proportion of land burning above the damaging threshold
- **PM7:** Acres Burned At or Below Threshold—Increasing the proportion of land burning at or below the damaging threshold

All the performance measures are calculated and outputs produced from the IRS Module, but only four are currently weighted within the FPA Goal Programming module: 1.) total suppression cost (PM1), 2.) IA contained + ignitions prevented (PM5), 3.) Acres Burned Above Threshold (PM6) and 4.) Acres Burned At or Below Threshold (PM7). PM6 and PM7 are added together for total acres burned. See the Performance Measures and Goal Programming section of this Report for a brief synopsis of why the performance measures were changed.

FIGURE 6: CALCULATION OF PERFORMANCE MEASURES

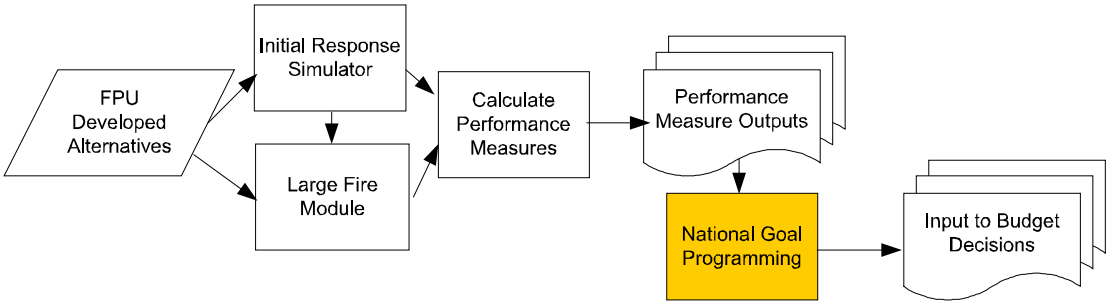


2.5.4 System Components: Goal Programming–National Tradeoff Analysis

Goal Programming (Figure 7) leverages the FPA system outputs to enable budget decision makers to assess tradeoffs between investment alternatives. These tradeoffs are analyzed in terms of multiple effectiveness, efficiency, and performance measures of suppression costs, acres burned and initial attack (IA) success at different proposed budget levels

The national tradeoff analysis module is a separate application from the FPA system. At its core, the analysis evaluates tradeoffs using a multi-attribute Goal Programing approach. The program uses the FPU investment alternatives as primary inputs. Based on user-specified priorities and constraints, the model selects one alternative for each FPU. Each collection of constraints and priorities results in a distinct nationwide fire program alternative.

FIGURE 7: GOAL PROGRAMMING



3 BUSINESS REVIEW FINDINGS

The Booz Allen team conducted interviews, as documented in the previous section, and reviewed the documents listed in the bibliography. During the interviews, a key aim was to understand the state of FPA development and application, as requested by Congress and OMB. This review intentionally avoided providing a retrospective view because that was the approach taken for previous reviews. FPA leads a cultural shift that transitions the stakeholder community from "bottom-up" agency-specific budgeting toward integrated, national budgeting based on an empirical understanding of the probability of wildfire across the national landscape. For more than 100 years, lower and mid-level agency personnel have set local budget priorities, which then are "rolled-up" to the regional and then national levels. For the past 6–7 years, agency stakeholders have begun the transition to an integrated national budget formulation process, rather than the five bureau budget stovepipe processes, based on an empirical (statistical) understanding of the probability and cost of fires within FPUs across the nation.

The frustration of managers on the ground in this effort is understandable because of the historical challenges described earlier, but the guidance from Congress is to coordinate budgeting across agencies at the national level, and FPA is currently the best (and only) option for this. Frustration with the way in which FPA was developed and the lack of practical on-the-ground tools replacing NFMAS and IIAA was apparent during the interview process. Much of the frustration stems from a lack of stakeholder expectations management during the first years of FPA development and a lack of transparency. This was especially apparent in the way in which the IRS was developed and implemented, which led to an overall lack of trust in FPA by the managers who were so heavily invested in, and provided input to, the development of this module. The paramount intent of FPA is to move away from agency personnel competing with one another for budget lines based on historical circumstances. This intent can be achieved by recognizing the need to support local Initial Attack capability and provide those same resources for large fire support during periods of high fire activity elsewhere, and FPA's maturity on this intent was a subject of the business review findings.

FPA offers the opportunity to understand how changing fire regimes affect fire frequency, intensity, and cost. Thus, a key focus of this review is to examine the state of FPA in terms of moving the FPA stakeholder community from a retrospective view to a forward-facing, coordinated risk management view of fire investment across agencies.

3.1 Overview

This section describes the results of the Fire Program Analysis (FPA) Independent Review of Core Business Processes and Technical assessment and maturity ratings. To conduct the process assessment, the Booz Allen team analyzed FPA organization across five Core Processes (CP). The CPs are based on FPA priorities and industry best practices. Based on industry best practices and a congressional mandate, FPA performs and has responsibility for the following Core Processes (CP), as defined in the 2010 FPA Charter:

- **1.0 Fire Preparedness Budget Formulation:** An ongoing process that identifies where multiple agencies and bureaus are now, where they are going, and how they intend to achieve the desired future state with respect to risk management through national budget coordination.
- **2.0 Governance:** The process of coordinating operational management of FPA, performing program and project decision-making activities, and interfacing with external entities such as OMB and GAO.

- **3.0 Performance Measures Coordination:** The responsibility for creating, managing, and conforming the agency's performance measures, which serves as the basis for scientific simulation and goal programming activities, helping coordinate budgets across multiple agencies and bureaus.
- **4.0 Goal Programming:** The process of using empirical measurement and analysis data to inform budget formulation, using best practices in understanding the limitations of empirical data based on range of confidences, to coordinate future budgets across multiple agencies and bureaus. Critical to this time-tested discipline are: strategy, interpreting decisions and optimizing operations, using systematically and intentionally created, shared and applied across an enterprise or within its components, enhancing the ability to coordinate across multiple agencies and bureaus.
- **5.0 Stakeholder Communications (Strategic & Tactical):** The responsibility for identifying specific messages and information, deciding the audience for the messages, and why to disseminate them to chosen audiences. Once the message, audience, and reasoning for dissemination of information is decided, the means for communicating the message may be selected and the results of the effort measured.

3.1.1 FPA Core Processes Assessment

CP#	Core Processes	Maturity
1.0	**Fire Preparedness Budget Formulation**	1
2.0	**Governance**	2
3.0	**Performance Measures Coordination**	2
4.0	**Goal Programming**	2
5.0	**Stakeholder Communications**	1

3.1.2 Summary FPA Findings

Strengths

- FPA has established a governing entity, the Oversight Group (OG), that meets regularly (quarterly) to guide development and application, and to address administrative and technical IT issues. This entity has improved governance and communications between FPA and its stakeholders. This is a strength for national-level coordination, not to be confused with a deficiency noted on the next page about mid-level governance for coordination between national and local levels.
- FPA proactively communicated IT initiatives to other senior level USDA and DOI Stakeholders represented in the OG to help define a strategic partnership to aid the OG in implementing change across the FPA enterprise.
- FPA is beginning to develop and align coordinated fire investment strategies across USDA and DOI through simulations of "what if" analyses, producing empirical inputs to goal programming with a known degree of confidence.
- Leadership has published an updated 2010 FPA Charter that includes its formal strategic plan and FPA is in the process of drafting a revision of its Charter and supporting strategy documents. This is being done to support the transition of FPA to Operations and Maintenance (O&M).

- A quarterly newsletter, as part of a new FPA Communications Framework, is helping improve stakeholder management, establishing advocacy across the stakeholder layers and helping to advocate a common understanding of FPA strategy each quarter.

Deficiencies

- The FPA OG needs to update its 2010 FPA Charter to formalize its Project Management Governance processes, roles and responsibilities, to ensure that FPA is ready to transition to O&M.
- Mid-level governance needs strengthening for Project Manager and Business Leads, who need adequate guidance and decision-making authority over critical IT functions that do not require consensus through OG coordination. Mid-level project managers make decisions with impacts at the local and regional levels, without formally documented governance guidance on roles, responsibilities, and scope of authority at this level.
- FPA is building their IT strategies for enhancements required by the 2010 FPA Charter, however there is little visibility for the regional and local-level fire planners into the planning for coordination of capabilities where strategies are highly interconnected. Lack of formal and up-to-date enterprise architecture documentation is a roadblock for communications, when reference material is needed as basis to guide communications.

Benefits & Outcomes

The benefits and outcomes of improving and implementing Fire Program Analysis are as follows:

- Promote cross-agency coordination in the planning of national wildland fire budgets.
- Facilitate the development of national level tools to aid in the planning of national wildland fire budgets.
- Reduce time spent discovering data for multidimensional analysis, so that researchers know all of the available data, and where to access it.
- Increase data quality through known requirements for data input, format required, level of completion, and location of data access.
- Optionally, a Service-Level Agreement (SLA) may specify increased timeliness of data if increasing the refresh for published data is determined as feasible.
- Transparency of all FPA related modules are needed throughout business, technology, and scientific analysis, to ensure mission success is supported throughout.

Key Evidences

The key evidences for assessing the maturity of this national level tool in Fire Program Analysis are as follows:

- Development of the national 10-year fire ignition cause database is a significant accomplishment and establishes an important baseline legacy dataset. The database, supported by the sound methodology applied to create it, has the capacity to continually update and extend the record. This provides a clear capability to evolve and improve the cost estimates into the future as "rare" events are incorporated into the record.
- Application of the Fire Ignition Generator outputs within the 2011 Cohesive Strategy guiding document underscores the maturity and utility of Fire Program Analysis in providing national level tools to aid cross-agency coordination in the planning of national wildland fire events.
- Development of the Large Fire Module is a major accomplishment, especially given the short time frame. The Large Fire Module provides consistent and accurate assessments that meet the intent and objectives of Fire Program Analysis
- Peer-reviewed publication of the Large Fire Module methodology in scientific literature highlights the maturity of the adopted methodology.
- FPA has been providing newsletters to communicate to stakeholders the latest decisions and directions.

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3.2 Fire Preparedness Budget Formulation

FPA provides empirical budget formulation information at the national level for managing the risk of fire through coordinated investment. The system examines a number of national budget alternatives (12 per 136 FPUs, by steady state budget and +/- 20%), against the probability of selected consequences, against performance measures that are decided and prioritized each year by FPA stakeholders. Through modeled simulation, decision-support information provides high-level understanding of the effects of lowering, raising, or holding steady firefighting budgets on a national scale, but does not answer the question of where to allocate money on a local scale.

3.2.1 Existing FPA Core Process Review–Fire Preparedness Budget Formulation

Core Process	ID#	Maturity
Fire Preparedness Budget Formulation	CP 1.0	1

Benefits and Outcomes:

- Ensures IT investments implement the desired outcome (target state)
- Maximizes the use of organizational resources (people and funding)
- Provides regular review of initiatives to ensure health of programs and projects

Process Findings	People Findings	Technology Findings
▶ FPA should further document the process for using outputs in goal programming to reduce national fire risk, and incorporate stakeholder input to foster buy-in to the plan across agencies. ▶ Formal performance measurement prioritization processes are not fully documented, and are thus not fully leveraged or enforced. Doing so would ensure linkage of IT initiatives to agency and bureau specific strategic goals and objectives. ▶ The process for using FPA outputs to inform allocation of firefighting resources is not currently supported by FPA. If this becomes in scope for FPA, this scorecard should be expanded to evaluate budget resource allocation for fire planning. ▶ Process for leveraging FPA to inform fire planning activities is not documented.	▶ Current year is the first time FPA has used the SWT to calibrate last year's data to become the following year's inputs. This approach needs to be measured and documented as a baseline for comparing future year calibration. ▶ Enhancements mandated by the 2010 FPA Charter after FPA goes into O&M is not clear to internal/external stakeholders, impacting the extent of stakeholder involvement. ▶ Usage of FPA outputs to inform the coordinated national level budget is not clear to regional and local levels	▶ FPA Science Team has overcome many challenges and has successfully released information to be used in goal programming. This information is used in goal programming's scientific modeling to manage and create "what if" analyses that produce empirical data, with known confidence, to inform the 2013 FS budget. ▶ Seven performance measures have been defined and tracked in FPA modules and scientific models, along with weighting functionality, to provide capability to manage changing business priorities for those measures. During the last FPA simulation run, data from four measures were used within goal programming, with relative weights. The remaining 3 PMs were given zero influence on the FY2013 budget to reflect OG consensus on the period. There has not been sufficient time for additional sensitivity analysis to measure the impact. ▶ Artifacts that define the integrations between IRS and LFM lack detail necessary for project managers and the mid to local levels to put into action.

CAP 1.1							
Budget Output Planning	3	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ FPA strategy for using the outputs of FPA to inform coordinated budgets is understood by the OG, which uses Goal Programming to consider empirical decision support provided by FPA that simulates the probability and cost of fires within a FPU. ▶ Fire planning and allocation is not currently supported by FPA. The January 2012 OG meeting discussed whether it will be supported by FPA. If it becomes in-scope, then the maturity score would be lowered based on the following evidence to a score of: [1] – Evidence: currently, mechanisms for defining the national, regional, and local integrated planning across the five federal agencies and incorporation of non-federal cooperator resources are not well developed nor uniformly applied. The result is a degree of confusion at the field level surrounding how FPA outputs are used to inform budgets.		How well is the coordinated budget formulation strategy defined?	No clear coordinated budget formation strategy	Short-term tactics clear, long-term strategy unclear	Coordinated budget formulation strategy clear, but understood and lived only among the top team	Each year's budget formulation simulation is linked to strategic objectives across business units in the broader stakeholder community	Budget coordination strategy clearly defined and understood and lived throughout the IT organization

CAP 1.2							
Enterprise Requirements Management	3	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ FPA has the capability to support up to seven performance measures built into the goal programming module that link FPA to strategic objectives across FS, BLM, BIA, USFWS, and NPS. ▶ FPA has the technology capability to weight each of the performance measures, so that as the business units change priority of performance measures, technology can support by using each performance measure from 0-100%, so that coordinated business discussions set the actual weight of each measure for each year's		How are technology-based opportunities taken into consideration for strategy development?	No formal process; suppliers bring ideas	Key IT and scientific modeling initiatives are linked to a business unit specific strategic objective	Programmatic governance board formally scans emerging technologies and takes ideas to business units	Every IT initiative is linked to a business unit specific strategic objective	Programmatic governance board formally identifies and evaluates new technology on an cross-agency-wide level

simulation run. ▶ The current FPA process does not address all the program functions required to complete the wildland fire management budget. It is important to note the distinction between this capability (Enterprise Requirements Management sub capability within the Budget Formulation capability) and a common federal standard for an Enterprise Architecture (EA) capability; which was not measured by this independent review. ▶ The OG, with representation from business units, formally scans for emerging technology ideas, such as improvements to weather ("gridded weather") and fuels management with improvements to the WUI and HVR layers. ▶ No formal process exists for taking ideas to business units and throughout the stakeholder layers in the mid-to-local levels						

CAP 1.3							
"Standup" of interagency, integrated process (for coordination of budget formulation)	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ Scientifically modeled simulation provides empirical decision-support information to goal programming. Statistical techniques produce empirical goal programming inputs that have a known range of confidence. This data measures the effects of lowering, raising, or holding steady firefighting budgets on a national scale, but does not answer the question of where to allocate money on a local scale). ▶ FPA outputs to goal programming are flexible to adapt and change continuously because "weights" can be set for each of the seven agreed-on FPA performance measure to support changing priorities across FS, BLM, BIA, USFWS, and NPS.		Have processes, information flows and artifacts been developed to support portfolio management process?	No processes, information flows or artifacts have been defined	Artifacts have been defined, but supporting processes and information flows have not been established	Artifacts and processes have been defined, but information flows have not been established	Artifacts, processes and information flows have been established, but do not adapt and change continuously	Artifacts, processes and information flows have been established and adapt and change continuously

▶ The budget formulation processes in key areas are accomplished independently where congressional mandates may differ between the Departments of Agriculture and Interior. This does not cancel out the Hubbard Report, Congressional, OMB and GAO guidance to achieve allocation across the Bureaus and Department level. NOTE: If FPA objectives did not include allocation and fire planning, FPA outputs are already established and through weighting are adaptable for continuous change, which would score: 4 Because FPA objectives include allocation, where no processes, information flows or artifacts have been defined, the score for this section would be: 0 An overall average score can be misleading, without the understanding that national coordination is highly mature while allocation is highly immature. In context to national and allocation dimensions, the overall score is an average: 2						

CAP 1.4						
Investment Selection	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ Collaboration and communication occurred between budget leads for USFS and DOI Office of Wildland Fire before budget requests went forward. ▶ Increased interagency collaboration at the local unit level because of the FPA process. ▶ FPA provides a structured approach to evaluate investments. ▶ The process does a good job in the tradeoff analysis, taking a base concept and building on it. The premises are very strong.		How do you evaluate investment opportunities?	No formal business cases and top-down prioritization	Business units evaluate projects with little input from IT or vice versa and use non-standardized business cases	Limited to simple cost-benefit analysis but no rigorous ROI analysis; sources of benefits not specifically identified	Formal evaluation processes established by business with good input from IT exist; benefits are quantified and sources identified	IT owns joint responsibilities with business units on evaluation; business case examines vendor, technical, & business risk

CAP 1.5

Fire Budgeting Risk Management Analysis	2

Key Evidence:

- USFS consumed empirical FPA outputs to inform the 2013 budget request (see goal programming scorecard for information on how the outputs were used).
  - Budget Request incorporates all of the respective agencies' firefighting resources in the initial attack response mix.
  - Last year's historic data is used as the starting point for inputs, and the Support Working Team (SWT) calibrates the numbers to produce the next year's inputs.
- FPA was run with weighted performance measures, as described in the performance measures scorecard, to provide additional empirical data for consideration during budget formulation that reflects business priority, by leveraging technology that simulates budget scenario impacts through scientific modeling
- FPA's SWT is calibrating previous year's data for the upcoming year, inputting new data, and running the FPA model.

Maturity Indicator	0	1	2	3	4
How are the coordinated fire preparedness budgets determined?	Based on last year; fixed budget with very little reasoning to adjust it up or down	Based primarily on last year's budget; major new projects are reviewed and approved on a case by case basis	Maintenance and operating expenses are based on last year's budget; new projects are reviewed and approved on a case by case basis	Business units and IT together set the coordinated fire preparedness budgets based on business and technology priorities for the existing year	Business units and IT together set the coordinated fire preparedness budgets based on business and technology priorities and long term planning

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3.2.2 Key Themes

FPA has helped DOI and USFS take important steps towards achieving the vision set forth by OMB and the Hubbard report. This system represents progress in achieving coordination in a complex environment, although there have been significant hurdles along the way. The key themes related to budget formulation include:

- FPA represents the first step towards a culture of coordinated national level budget formulation for the multiple federal wildfire management agencies.
- FPA represents the first step to accounting for the multiple costs and complex steps involved in substantiating wildland fire management budgets as an interagency, integrated process.
- FPA has clear potential over the long-term for use as a national level budget preparedness tool, as exemplified by the use of some FPA outputs to inform the 2013 budget request (FPA outputs were used as part of the budget justification for the USFS and DOI).
- Although FPA is not a local level budgeting tool for managers, their field level inputs are critical for its implementation. Given the level of effort to input data into the system, the FPA Support Working Team (SWT) is working to lessen the workload from the field by calibrating previous year's data for the upcoming year, inputting new data, and running the FPA model. Results of this new strategy have not been released by submission of the Final Report, but the strategy appears to be sound and likely to be successfully implemented.
- The culture is going through a transition from bottom-up agency specific budgeting to national budgeting based on an empirical (statistical) understanding of the probability of wildfire across the national landscape. Organizational management is needed to evolve the culture to understand and contribute in a coordinated environment, based on understanding of the probability and cost of fires within a FPU. Currently, mechanisms for national, regional, and local integrated planning across the five federal agencies and incorporation of non-federal cooperator resources are not well developed nor uniformly applied. Thus, there is confusion in the field organizations surrounding how budgets will be allocated. To explain how FPA capabilities will support this function, there is a need for broad and proactive management.
- The inner workings of the FPA modules bring too many fine-scale details into the outputs of the analysis (e.g., callback delays, walk-in delays, diurnal rate-of-spread adjustments, fuel model rate-of-spread adjustments, etc.).
- The OG has made the decision, and is supported in a memorandum by the Fire Policy Council, that FPA will be used as a strategic fire planning and analysis tool that provides supporting information to the budget formulation process.

3.2.3 Strengths

The stakeholder interviews identified the following strengths in the FPA budget formulation process:

- Budget Request incorporates all of the respective agencies' firefighting resources in the initial attack response mix.
- There has been an increase in interagency collaboration at the local unit level because of the FPA process.

- The USFS and DOI Office of Wildland Fire Coordination are starting to collaborate on budget requests before budgets go forward, as demonstrated by communications between budget leads for the two agencies.
- FPA provides a structured approach to evaluate investments.
- The Budget Request process is a good base mode with solid pieces. The process does a good job in the tradeoff analysis, taking a base concept and building on it. The premises are very strong.
- Interagency governance supporting the budget formulation process has come a long way, as discussed in the Governance section.
- Communication and collaboration across agencies have demonstrated much improvement at the national level, as discussed in the Stakeholder Expectations Management section.

3.2.4 Deficiencies

While some progress has been achieved in coordinating budgeting processes, differences remain in how each of the two Departments formulates the fire budget. Moreover, challenges related to the original design of the modules have kept certain elements from providing meaningful outputs. Primary deficiencies in the budget formulation process are as follows:

- Congressional direction to the Department of Agriculture and the Department of the Interior as it relates to wildland fire is at times not well coordinated.
- The current FPA process does not address all the program functions (e.g. administrative overhead costs, facilities, equipment, training, etc.) required to complete the wildland fire management budget.
- FPA does not adequately address the tradeoffs of hazardous fuel treatments on preparedness and suppression costs.
- The current budget formulation only provides three budget options, with thresholds set at +/-20% and +60%.
- NPS was concerned that the resource benefitting characteristics of wildfires are not taken into account, that the negative aspects of wildfire are over emphasized.
- It remains quite unclear how FPA fuels budgeting and HFPAS fuels budgeting will be coordinated.

3.2.5 Observations

In addition, several observations and insights related to the budget process were collected, including:

- Stakeholders observed that it would be beneficial to see the use of FPA to support budget requests, therefore harmonizing the principles for creating the budgets. Since FY13 is the first year using FPA to inform budgets submitted to OMB, this submission could serve as a baseline to be measured against in the future.
- Users suggested an impact analysis could provide tremendous insight and help answer important questions (e.g., what does a 5% budget cut mean? What does a 7% cut mean?). If the agencies in the two Departments are using the same tools to develop decisions, expectations are that the FPA model would provide similar outcomes to support information requests by OMB.
- It was observed that Congressional and/or Departmental budget direction to USFS and DOI wildland fire programs is, at times, not consistent between the agencies. The interviews conducted suggest that these differences could affect the ability to collaborate in developing a coordinated budget request.

3.2.6 Recommendations

FPA has played a pivotal role in moving the federal wildland firefighting agencies toward an interagency, integrated process for developing and coordinating national level budget formulation. To continue to capitalize on the momentum created by the progress achieved to date, the following recommendations are presented:

- Continue collaborating to analyze information, create strategies, inform decisions, and manage risks related to wildland fire management planning and budget.
- Provide up-front, honest, and easy-to-understand communications to FPA stakeholders regarding the status of FPA development, future improvements to the system and how the resulting data will be used to inform decisions.
- Clarify the role FPA plays in providing relevant data to inform the wildland fire budgeting process to help establish credibility within the wildland fire community.
- Leverage lessons learned from using FPA to inform the budget submitted to OMB for FY13, will further harmonize principles and practices for creating budgets across agencies, using the recent request as the baseline to build from and measure against.
- Develop a mechanism and/or process to deliver trade-offs information that help allocate the wildland fire program budget across the agencies that is supported by the FPA outputs. The mechanism and/or process must be transparent to the stakeholders and may require a period of transition for the agencies to implement. Whether the mechanism is in the scope of FPA or beyond the scope of FPA, which was discussion point during the January 2012 quarterly meeting of the OG, the need exists for DOI bureaus in particular to decide how budget adjustments will be applied across BIA, BLM, USFWS, and NPS to ensure coordination. This approach should help stabilize agency's planning efforts and avoid disruptive, unpredictable cuts that lead to the loss in staff that cannot be hired back.
- Involve the local units in scoping their planning and budgeting process needs that are beyond FPA's current capability and evaluate opportunities to meet this need.
- Revisit the Highly Valued Resource layer at the agency director level, with input from agency and external scientists. Define a common layer or system and implement that layer within Fire Program Analysis. Because human development in the wildland–urban interface is inevitable as time progresses, this layer must be dynamically updated nationally on a realistic time step, perhaps once a decade.
- Conduct an impact analysis to gain insight and help answer important questions related to changes to the budget (e.g., what does a 5% budget cut mean? What does a 7% cut mean?). This will help manage expectations of the FPA model and ensure that results are being analyzed and benchmarked for future requests.
- Leverage the information collected and inputs provided to inform the FY2013 budget to create a baseline for future years, allowing FPA to measure improvements and progress as well as build on lessons learned from previous model runs.

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3.3 Governance

The governance of FPA has evolved significantly over the past few years. The new structure has brought the two Departments together and has increased communication and collaboration among the broad stakeholder group. Although most stakeholders agree that the new structure is functioning better than in the past, achieving consensus is a time-consuming process. Some of challenges FPA leadership currently faces revolve around managing expectations and communicating openly and proactively with stakeholders. Clarifying the goals and intent of FPA will reduce confusion and eliminate the expectation that FPA is to be used as a "bottom-up" budgeting tool, as discussed further in the Stakeholder Expectations Management section. Moreover, communicating new developments to all stakeholders will increase support for FPA. (Also see section 3.5.1 for communications analysis).

FPA's governance has progressed significantly over the years and led to several lessons learned. The process, the system, and the governing body continue to evolve, and the knowledge gained along the way should lead to progress in the upcoming years. The following sections outline the maturity ratings, key themes, strengths, deficiencies, and observations related to the governance process.

3.3.1 Existing FPA Core Process Review–Governance

Core Process	ID#	Maturity
Governance	CP 2.0	1

Benefits and Outcomes:

- Ensures accountability for IT decisions throughout the organization
- Defines clear stakeholder roles and responsibilities for IT decisions and processes
- Integrates decision-making across IT management areas (e.g. EA, PfM, Security, and Policy)
- Ensures consistency in execution of IT policies

Process Findings	People Findings	Technology Findings
▶ Consensus on prioritization of performance measures is achieved through representation of FS, BLM, BIA, USFWS, and NPS on the OG. ▶ The 2010 FPA Charter provides clear guidance on roles and responsibilities and decision-making processes for national level coordination of fire budgeting resources. If allocation of fire planning resources were to be included in FPA's scope, guidance does not clarify roles and responsibilities for allocation of fire planning resources. ▶ The OG meets quarterly to revise strategy and resolve issues requiring consensus. ▶ Boards and Groups are being established to carry out FPA transformation initiatives, including SWT, IAT, IST, and MAT.	▶ FPA mid-level project managers do not entirely understand the full extent of their authority to resolve issues affecting the field that do not require consensus through the OG. ▶ Lack of buy-in across the regional and local levels is affecting the ability to improve FPA's quality of inputs and IT capabilities and functions. This is currently being addressed by transferring annual calibration responsibilities to the SWT. ▶ The OG aligns strategic "national" linkages across FS, BLM, BIA, USFWS, and NPS; however, roles/responsibilities are not formally defined and assigned to execute project management tasks below the OG level.	▶ FPA leverages MyFireCommunity.net as a repository to store and distribute governance activities communications. ▶ Automated enterprise architecture and project management technologies are not used to collect, track, store, and report on information inputs and outputs to and from governance activities.

CAP 2.1						
Governance Formulation	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ The 2010 FPA Charter establishes a governance structure with six primary components. An executive Board of Directors, who are also members of a broad-based Oversight Group (OG) comprised of senior leadership empowered to provide leadership and oversight for the Fire Program Analysis program and its implementation. The third essential component of the governance structure is an Executive		How are FPA decision rights structured? What are the decision boundaries for FPA roles and responsibilities?	Project managers make the decisions on architecture; programs and projects do not consistently follow the architectural guidelines.	Architectural guidelines are adhered to for the most part, yet businesses control decisions on exceptions, vendor selection and renewals.	Architectural guidelines are adhered to, and OG has a significant influence on vendor decisions and software purchases; renewal decisions are made by the businesses.	Architectural guidelines are adhered to, and OG has a significant influence on vendor decisions and software purchases; renewal decisions are jointly owned with the businesses.	Decisions on architecture, hardware and software selection rest with OG with significant input from the businesses; businesses and OG work together on all decisions involving renewals.

Director who serves as the full time senior administrator for the OG, working closely with FPA stakeholder groups to monitor FPA development and implementation issues, and keep the OG and FPA stakeholder groups informed. The remaining three components are comprised of management, science and analysis advisory teams. ▶ The OG Charter will need to be updated when FPA IT modules move into O&M, to define the roles and responsibilities for mid-level project managers to define scope of decision-making authority, for ongoing project enhancements not requiring OG consensus.						

CAP 2.2

Governance Administration	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ The 2010 FPA Charter defines the purpose, membership role, sponsorship and funding, and approval structure for: – Advisory Teams (Interagency Science Team and Management Advisory Team), – Analysis Team (Interagency Analysis Team), and – System Management (Program Manager, Business Leads)		How do you address cross-business/cross-functional IT issues?	Cross-functional IT topics are not addressed in any forum.	Cross-functional IT topics are discussed in ad hoc forums.	Cross-functional topics are discussed in regularly formed committees but results are not binding.	Cross-functional topics are discussed in regularly formed committees and the results are reflected or influence major systems	Cross-functional topics are discussed in regularly formed committees, which have significant influence on the IT strategy, core processes and investments.

CAP 2.3

Project Monitoring & Evaluation	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ The FPA governance meets 4 times per year, as mandated by the 2010 FPA Charter ▶ FPA has conducted internal reviews in 2006, 2011, and 2012, including this independent review.		How often do you revisit the investments? Are processes in place to determine whether investments yield expected results?	No revisiting or evaluation	When implementation or O&M cost over-runs or major schedule slippages occur, investment is revisited	Funding revisited for major projects on a periodic basis	Prioritization visited periodically for key projects, but re-prioritization may not be tied to the business objectives	Funding and resources tracked continuously against results and priorities adjusted in accordance with changing business needs as a PfM issue

3.3.2 Key Themes

As described in the items below, the governance of FPA has evolved significantly since the latest restructuring. The current structure is helping foster collaboration while allowing stakeholders to provide insight into the progress of FPA. The key themes discussed during the stakeholder interviews are:

- Governance has progressed significantly to build consensus across two departments and five agency/bureau-level entities. Agencies are now talking to one another, and working together to plan for out-year budget requests.
- The governance structure of FPA has continually evolved to meet requirements of various external reviews; current structure may require further refinement.
- In the absence of FPA providing field-level planning capabilities, some agencies are independently developing local level planning tools to use as a supplement to FPA.
- The history of FPA has shown a lack of continuity in intent, direction and oversight.
- The current governance model is built around consensus, which has been proven helpful but takes longer to achieve than individual project management actions would take.
- Prior to implementing the current governance model, FPA has observed various governance structures to manage the project. While most of these alternative structures were more nimble, those did not yield as many results or generate sufficient positive impacts to FPA.
- Policy changes in the wildland fire program are not well represented in the FPA process. The current interpretation of the Federal Wildland Fire Policy, which allows wildfires to concurrently have a range of objectives from full suppression to managed for multiple objectives, is not a feature of FPA at this time.

3.3.3 Strengths

The recently formed governance structure has brought several benefits to the FPA project, including increased communication and collaboration, stronger oversight, and greater openness. The strengths of the governance process are as follows:

- The current administrative oversight structure appears cohesive and appropriate and empowers the five agencies with more authority in the project's direction.
- The current governance structure has increased its effectiveness, is more collaborative, and enables more open discussions between the different agencies.
- The new governance structure is working better than the previous one. Many of the benefits intended and realized illustrate a greater affinity between DOI and USFS. Individuals now have a better understanding of what the project entails and which activities are currently in progress. As a result, the five agencies have increased authority in the progression of the project.
- The governance structure now provides earnest communication and openness (there used to be a lot of information exchange and decision-making occurring behind closed doors). The governance structure also provides a conduit for stakeholders to provide feedback.
- The revised FPA Charter resulted in an increased level of comfort from the field relative to the governance of the FPA project. Project roles, objectives, mission, and intent were identified.
- Strengths of the governance structure include:

- The charter is providing a way to manage what is currently available to FPA, leading to positive results.
- The acting project manager has provided good suggestions to further streamline the operations and to organize the various teams in a more efficient way.
- The monthly meetings (conference calls) including FPA Project Staff, Executive Director, MAT, GA leads, SWT, IST and IAT have generated increased collaboration and positive results.
- The calibration efforts conducted recently have increased the consistency of data inputted into the FPA system and has vastly improved the actual data as well as confidence at many levels within the community.
- The involvement of the SWT in inputting FPA data has significantly reduced the burden on the field. By alleviating onerous workload on the field, this process has increased consistency in inputted data and generates lessons learned that will benefit future FPA runs.
- The FPA newsletter provides valuable information regarding FPA progress and enhancements, including the efforts to add enhanced solutions to both spatial fuels treatment and gridded weather data.
- Both FY2012 memo and engagement plan recognized that each FPU would likely have different issues and so the field was directed to work with their SWT contact to validate, update, or recalibrate any issues. This approach reflects flexibility in addressing local differences.

3.3.4 Deficiencies

While the governance has progressed significantly since the last restructuring, some challenges continue to hinder the progress of FPA, particularly in terms of communications and expectation management. The primary governance deficiencies uncovered during the interviews include:

- The concepts surrounding the value-add of risk management through coordinated investment have not been fully proliferated throughout stakeholder groups.
- There is a lack of FPA requirements and standard Federal Enterprise Architecture Framework (FEAF) architectural documentation.
- A historic issue is that the field was promised a tool for “on the ground” planning, which they did not receive, producing a dip in morale from field stakeholders related to FPA.
- A field level tool, such as the National Fire Management Analysis System (NFMAS), was removed from the field on the promise that FPA would offer functionality for day-to-day management. This has created a functional gap and negatively affected morale.
- The OG has developed a Communication Framework in place of a traditional Communication Plan, which are rigid, overly prescriptive, and lacking implementation.
- There has been an issue with the timely delivery of direction developed within the OG and sent forward for approval within each agency’s line of authority.
- Over the years, FPA’s development and overall costs have caused various stakeholders (including OMB) some frustration, particularly because of unclear messages and communications.
- Vague terminology (e.g., inform, support, and allocate) have different meanings to different stakeholders. When combined with the lack of formal EA documentation on what FPA can and cannot do, and the need for consensus around whether FPA will or will not be used for allocation, this deficiency created uncertainty among stakeholders at different levels.

3.3.5 Observations

The topic of governance was widely discussed during interview sessions. While it is typical that opinions vary significantly based on stakeholders' roles and experiences with the project, the following observations capture a wide range of opinions related to the governance of FPA:

- FPA would benefit greatly from a Research & Development Program Element. This Program Element would be intimately involved in the tools and techniques used in FPA, while able to question if different system elements are needed or should have been done in different ways. They would be independent from the IST but informed of the science process and would work with the FPA Science Team. Such a group could also coordinate the timely publication of methods in peer-review literature and provide opportunities (via funding) to solicit novel solutions to any persistent challenges identified by the FPA science team.
- Current governance is adequate to finish the development of this project and is adequate to conduct the typical IT O&M efforts of FPA for supporting matters requiring national-level consensus.
- If FPA is to be used as a decision support tool or potentially for contemplating how budgets are created differently and how the allocation process can be done differently, the governance may need to be reviewed.
- Interviewees suggested that obtaining additional support from the Federal Fire Policy Council (FFPC) would be beneficial to further illustrate the value of using available information and enhance the decision-making process.
- Short-term goals for how FPA will support budget requests include determining what the various budget levels mean and managing preparedness assets to reduce suppression costs via Goal Programming tradeoff analysis. The business question exists for whether this can be done without also factoring in the fuels program, if only preparedness assets are used.
- It was observed that understanding ways to leverage all the budget concepts and the tradeoffs between resources would be beneficial to FPA. Long-term goals focus on determining how to intermix resources at the district or local level, and developing a more detailed analysis. The FPA tradeoff analysis for hazardous fuels may result in a decrease of the overall fire intensity, show protection of HVR, provide for restoration, and reduce overall suppression costs. However, this type of tradeoff analysis is not currently a direct goal of FPA, because determining how hazardous fuels can help reduce overall suppression costs is not a direct goal of the Hazardous Fuels program.
- The approach to have the Support Working Team (SWT) work closely with the field to provide greater consistency to the process inputs should dramatically decrease the amount of time spent by staff in the field. This significant paradigm shift from previous planning practices stands a good chance of success in addressing a historic issue: workers in the field spend substantial time on an activity that provides value to national budget coordination and can have an impact on agencies' budgets. Adjusting the large number of input parameters involves complexity, and consistency has been a historic issue because fire is not fought in the same way in different regions with different urban landscapes, topographies, fuels, and weather across the country.
- While early indicators point to SWT assistance with the calibration effort as being a positive business model change, FPA should consider potential impacts to field-level stakeholders to ensure those users do not perceive this support as an effort to alienate users.

- The SWT is heavily involved in supporting the field with their data validation and the calibration that needs to be completed each year before running the model. Several elements required fine-tuning and are still underway at the time of this report.
- Stakeholders suggested that a senior level project manager would play a helpful role in coordinating enhancements and streamlining developments to the system if development of FPA modules is occurring and significant changes are being implemented. It remains unsure if a project manager is needed for a project in O&M, or if this need would be met by formalized governance guidance for mid-level project managers to fill this role.
- An observation was made that the IST and the IAT would benefit from a streamlined decision-making process for simpler scientific requesting, granting the ability to quickly agree on and implement minor updates.
- It was observed that a potential need exists to streamline the project and its processes to increase efficiency and effectiveness. For example, some agencies are independently developing planning tools for the local unit's use as a supplement to FPA, which is needed because FPA is not seeking to offer local unit functionality.
- The OG has no direct power over budget formulation although key agency budget staff are actively involved within the Oversight Group and advisory teams.
- Some stakeholders are not convinced that top-down coordination of fire budgets is a valuable approach, and as such, the perception exists in the field that FPA governance may not be the most cost-effective way to provide supporting information to the fire budget.
- The perception exists amongst interviewed field-level stakeholders that FPA has not answered the goals of OMB or the Hubbard report and that the current FPA objectives have morphed and changed from the original intent. The managers heavily engaged in the early stages of development have not been involved nor have received the necessary communication to understand why and how FPA has evolved. This issue requires attention from a business process point of view.
- The FY2012 Engagement Plan was an attachment to the Federal Fire Policy Council memo, and the field expressed that both the memo and the engagement plan were vague and missed details.
- Stakeholders presented concerns that FPA would be shut down and a new tool would be created from scratch given the delays in finishing development of the system.
- FPA is a decision support tool. The agencies have yet to create the process whereby budgets are created differently. The OG decided on January of 2012 that FPA would provide information to national level managers as they considered formulation and allocations. FPA only addresses a portion of the overall budget and does not produce an allocation for the budgets. Instead, FPA produces only information by way of tradeoffs which national managers can use.

3.3.6 Recommendations

The implementation of a revised FPA Charter and respective governing body has made significant improvements to program governance that has resulted in producing impactful results. The current governance aims at achieving consensus on major issues and is therefore less nimble than previous structures, but the results obtained are lasting and justify having a more comprehensive process for addressing FPA's toughest technical and socio-cultural challenges. In the area of governance, improvements can be made by:

- Continuing to develop and improve communications with FPA stakeholders to help evolve a cultural attitude that embraces risk mitigation on a national scale through coordinated fire investments. It is clear that Stakeholders are interpreting information differently and continue to have differing expectations of FPA.
- In order to gain greater transparency and acceptance, FPA must proactively engage with all stakeholder groups and provide information regarding major changes to the systems, milestones achieved, or processes for informing budget decisions.
  - Define various terms related to FPA processes using "clear text" (e.g., inform, support, and allocate have different meanings to different stakeholders) and overall management of the project (e.g., how does the Information Technology (IT) definition of Operations & Maintenance (O&M) differ from other uses of the term?).
  - Providing clarity to the various terms would help to reduce ambiguity and ensure all users are on the same page.
- Addressing differences derived from inconsistent Congressional and/or OMB budget direction to USFS and DOI wildland fire programs, while a large endeavor involving scope beyond that of an IT system, affords the benefit potential to significantly simplify the national budget coordination process.
- Revisiting the role of the Project Manager as FPA moves towards O&M.
  - If FPA does not find it necessary to allocate a Full Time Project Manager to oversee the System's day-to-day operations, continue to empower the Business Leads with delegation authority to run the project. While the Leads should continue to bring more complex challenges to the OG for discussion, it should be made clear that they have the authority to make simpler decisions and ensure the project continues to evolve.
  - Formal guidance for delivering this clarity would be either a revision of, or companion to, the 2010 FPA Charter. Clarity would be achieved via a section that adds definition around mid-level project management roles, responsibilities, and extent of authority for decisions affecting regions and local levels.
- Continue to support and enable the science team to tackle the difficult technical challenges that FPA faces, given this groups success in dealing with, and overcoming such obstacles.
- Consider the creation of a strategic independent Research & Development (R&D) Program Element. This Program Element would be intimately involved in the tools and techniques used in FPA and be responsible for evaluating proposed future changes and/or enhancements to the program. They would be independent but informed of the science process and would work with the existing FPA Science Team, which is more tactical and issues-focused.
  - A possible execution of this recommendation is to implement this program via external science, which would require a permanent connection with the inner-workings of FPA. This program would need to be more than a Science oversight team. A R&D Program Element needs to have funds to solicit and evaluate improvements prior to final FPA implementation.
  - The proposed Research & Development Program Element in the FPA structure could solicit the broader wildland fire science modeling community to conduct the science and technology developments that become apparent as the system matures.

- The FPA governance structure requires the continued vigilance and support of the Federal Fire Policy Council (FFPC). This will be important as the agencies begin an evolution from their current state to the future, desired outcome.
- Continue the involvement of FPA's Support Working Team (SWT) in inputting data into FPA and helping with calibration, while working closely with the field to provide greater consistency of process inputs and dramatically reduce the amount of time spent by field staff to support the analysis. The actual results (accuracy, improvement of morale, savings) all need to be measured and used to create a baseline for comparison of future FPA runs.

3.4 Performance Measures & Goal Programming

The FPA performance measures directly enable an evaluation of how successful the FPA program has been in attaining its stated goals and objectives by providing a consistent set of indicators that can be used to compare the impacts and tradeoffs of assigning different levels of resources and investments per FPU. As with any evolving system, these performance measures have similarly evolved. Following the results of the 2006 review of FPA, the Wildland Fire Leadership Council (WFLC) proposed seven performance measures be explored for FPA, as follows:

1. The expected total suppression cost for all unplanned and unwanted fires (PM1: Expected Suppression Cost)
2. The total Wildland Urban Interface (WUI) acres burned (PM2: Expected WUI Acres Burned)
3. The total number of acres treated to minimize the effect of hazardous fuels on fire behavior (PM3: Acres Treated).
4. The total Highly Valued Resources (HVR) acres burning above FPU-defined Fire Intensity Levels (FIL) damage thresholds (PM4: Expected HVR Acres Burned)
5. The number of fires contained in IRS and the number of fires prevented in the Prevention Module (PM5: IA Contained + Ignitions Prevented)
6. The number of acres burned above the damaging threshold (PM6: Acres Burned Above Threshold)
7. The number of acres burned at or below the damaging threshold (PM7: Acres Burned At or Below Threshold).

All the performance measures are calculated and outputs produced from the IRS module; only four were weighted within the FPA Goal Programming module during the April 2011 run of FPA: (1) total suppression cost (PM1), (2) IA contained + ignitions prevented (PM5), (3) Acres Burned Above Threshold (PM6), and (4) Acres Burned At or Below Threshold (PM7). PM6 and PM7 were added together for total acres burned. The principal reason given for reducing to these measures was that they were quantifiable "objective" measures that could be derived from FPA.

3.4.1 Existing FPA Core Process Review–Performance Measures Coordination

Core Process	ID#	Maturity
Strategic Budget Formulation Planning	CP 3.0	1

Benefits and Outcomes:

- Identifies the organization's (FPA) Performance Measures needs
- Formulates IT policies through consensus
- Communicates and enforces IT policies and compliance with regulations and legislation

Process Findings	People Findings	Technology Findings
▶ External (USDA Forest Service, and DOI BLM, BIA, USFWS and NPS) policies are available to FPA; the FPA OG complies with external policies. ▶ OG consensus, as described in the 2010 FPA Charter, is the standardized internal mechanism for coordination IT policy development, collaboration and approval process. ▶ There is no formalized policy framework to provide minimal direction and guidance to ensure the processes are in alignment with FPA strategic intent. ▶ FPA OG discussed at its January 2012 quarterly meeting the need to forge a framework for managing investments and enhancement ideas.	▶ Functional staff is aware of the policy actions they need to perform; however, IT policies are not fully mapped to functional roles for mid-level project managers. ▶ Lack of internal policy coordination during workforce attrition & succession leads to loss of policy awareness. ▶ The 2010 FPA Charter is the clear mechanism for communicating to teams supporting senior leadership (the OG), but this does not extend beyond the Charter to a set of policies and procedures at a more detailed level.	▶ Internal policies that govern FPA activities are not available on MyFireCommunity.net. ▶ FPA is not fully using the tools available (MS Suite) to implement a mature IT Policy lifecycle.

CAP 3.1						
Performance Measures Planning	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ Seven (7) clear performance measures have been built into FPA modules, representing the scope of areas that are embraced by top management of the agencies and bureaus. ▶ Each of the (7) performance measures are		How well are the Performance Measures defined?	No clear organizational performance measures	Short-term performance measures are clear, long-term performance measures are unclear	Performance measures are clear, but are understood and embraced only among the OG members	Every FPA run is compliant with the **priorities** of business unit specific (FS, BLM, BIA, USFWS, and NPS) performance measures	FPA performance measures are clearly defined, understood and **embraced** throughout the organization

weighted to enable reflection of business priorities for each of the (7) performance measures, as business units change priorities from year to year. ▶ FPA was run last April with performance measures weighted to reflect business priority, while leveraging technology for scientific simulation through models. Data from only (4) of the performance measures were utilized and given a weight to reflect the priorities of the agencies and bureaus.						

CAP 3.2							
Enterprise Performance Requirements Management	2	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ Performance measures are communicated annually when determining the priorities (weights) for each year's input to goal programming for budget formulation. ▶ Documentation for basing communication on is lacking in the area of Enterprise Requirements Management (including Project Management and Enterprise Architecture); as a result, mid-to-local level managers lack a clear idea of what is going on with the performance measures in the FPA goal programming, and the degree to which FPA intends to support fire planning and allocation. ▶ Note: the level 3 [2] rating indicates evidence of regular communication mechanisms across business units, whereas the level 5 [4] rating evidences the level to which communication is understood across integrated processes.		Are Performance Measures provided and communicated?	No communication – businesses do not have a clear idea of performance measures to be used in FPA goal programming	FPA Performance Measures are crafted to coincide with each FPA run	Communicated annually during the program funding discussions across the agencies' stakeholders (FS, BLM, BIA, USFWS, and NPS).	Frequently communicated throughout the year	Communication is a continuous process and is well integrated into the IT processes

Existing FPA Core Process Review–Goal Programming

Core Process	ID#	Maturity
Goal Programming Planning	CP 4.0	1

Benefits and Outcomes:

- Increases IT efficiencies by promoting best practices and lessons learned
- Enables IT collaboration through common capability development

Process Findings	People Findings	Technology Findings
▶ Information sharing takes place during quarterly OG meetings, and associated project management Goal Programming, Science Team sessions. ▶ Information sharing is limited by the internal/external lack of documentation on the EA and Project Management functions needed to enhance communications management. ▶ Functional teams in the local fire planning levels do not share calibration of last year's information readily, which leads to a lack of enterprise awareness that is being addressed by the SWT.	▶ The Science Team and teams involved in Goal Programming have strong technical expertise that results in integrated FPA modules making information accessible to inform the coordinated budget that goes out to OMB. ▶ FPA mission and intent around allocation and fire planning is misunderstood by other internal/external stakeholders leading to a lack of incentive to foster information sharing. ▶ The type and quality of information shared as inputs that feed through IRS and LFM into goal programming may vary based on different levels of staff expertise. FPA has recently addressed this by having the SWT calibrate inputs instead of adding this burden to local fire planners.	▶ Lack of sufficient project management, knowledge (information) management and portfolio management tools. ▶ MyFireCommunity.net tools exists, but collaboration and technology tools are used in a limited capacity to share information across FPA.

CAP 4.1

Goal Programming Execution	2

Key Evidence:

- Seven agreed-on performance measures are integrated in the architecture.
- Weights for the seven agreed-on performance measures are integrated in the architecture.
- A lack of architectural documentation on integrations of the modules prevents visibility for iterative planning cycles.

Maturity Indicator	0	1	2	3	4
How well are goal programming requirements integrated into the architecture?	Standard goal programming architectural considerations do not exist	FPA architecture modules (IRS, LFM, and Goal Programming) are developed with very minimal linkage to information sharing requirements	FPA architectural modules design and information sharing requirements are coupled together by design, but linkage is weak in practice	Iterative planning cycles involving FPA business, IT modules and Science team, with input from all business functions to establish a clear information sharing architecture	Continuous joint planning processes for FPA architectural design; performed by small multi-level groups covering all information sharing requirements

CAP 4.2

Measurement and Analysis	3	**Maturity Indicator**	0	1	2	3	4
Key Evidence: ▶ Goal Programming established organizational expectations for national what-if analysis for using statistical and other quantitative techniques and historical data, for simulated impact analysis run against established performance measures (quality and process objectives), – The modeled simulation has set the attributes that are critical to understanding national "high-level" risk management through coordinated fire budgets, using a form of root cause analysis to address risk of fire. – FPA measurement and analysis outputs provide to goal programming empirical results with known confidence intervals, aligned to the organizational expectations through the weighted FPA performance measures. ▶ Weighting mechanisms enable analysis to follow changing business priorities. ▶ Documented goal programming policy is not involved in performance management and stakeholder expectations management. ▶ Note: the "measurement and analysis capability" scores agreement across business units, for ability to standardize that agreement, into standardized measurements and empirical data which results in the level 3 [2] rating. This is different from the level 5 [4] rating which is given when integrated processes are understood, agreed upon, and evidenced.		How well aligned are measurement objectives and activities with organizational and business unit objectives and stakeholder expectations, and do measurement objectives answer needs in program and project management?	No formal process; suppliers bring ideas	Objectives of measurement and analysis are specified and aligned with identified information needs across business units (FS, BLM, BIA, USFWS, and NPS).	Business units (FS, BLM, BIA, USFWS, and NPS) agree to measures, analysis techniques, and mechanisms for data collection, data storage, reporting, and feedback Analysis techniques and mechanisms are implemented for data collection, data reporting, and feedback Objective results are provided that can be used in making informed decisions (based on empirical data outputs) and taking coordinated appropriate corrective action	Mechanisms exist to evolve measurement and analysis needs across the business units (FS, BLM, BIA, USFWS, and NPS) as priorities change.	The integration of measurement and analysis activities into the processes of the project supports the following: ▶ Objective planning and estimating ▶ Tracking actual progress and performance against established plans and objectives ▶ Identifying and resolving process related issues ▶ Providing a basis for incorporating measurement into additional processes in the future ▶ The staff required to implement

3.4.2 Key Themes

The following key themes were derived from the information collected during the external assessment of FPA, as information flows from the IRS module, to LFM, to the Goal Programming Module:

- The Large Fire Module offers empirical information to the Goal Programming Module to inform budget decisions, delivering information required by Congress and OMB to coordinate wildland fire budgets across the large and complex FPA Stakeholder Community. LFM is based on sound science and delivery of empirical information that provides a national overview of the probability and cost of wildfire.
- Stakeholders looking for FPA to go beyond the Congressional mandate perceive a problem with FPA performance measures, which do not factor in agency specific goals to determine a budget. See Stakeholder Expectations Management section for more details.
- Based on the lack of IRS Solutions Architecture documentation, IRS appears particularly inflexible for factoring in agency specific goals. Much of the rest of FPA is actually beginning to work, such as the LFM, which accounts for most of the expenditures. Note: since large fires cannot be predicted in advance, during periods of extreme fire behavior, FPA's main goal is to go to full suppression if it can be executed safely. Still, the IRS model does not currently capture whether the intent was suppression.
- It has been proposed that in order for FPA be in line with the first priority in every fire management activity; namely reducing risk to firefighters and the public, that a new performance metric that captures this be developed.
- Suppression costs and area burned are useful and easy-to-understand metrics. When used alone, they are insufficient in describing important aspects of agencies mission where fires are allowed or encouraged to burn; such as the restoration of fire to meet resource management objectives.
- Confusion enters the situation when performance measures are expected to deal with both the field management of day-to-day allocation of resources as well as the national overview of the probability and cost of wildfire.
- It is the national-level coordination that motivated FPA, but the historic issues caused communication challenges. Issues included the overselling of FPA to both the field and to Congress and OMB.
- Contractual processes that hired programmers who did not necessarily have expertise in wildland fire science have been identified as another issue related to the early direction of FPA.
- Weights are used to evaluate management priorities. During the most recent round of budget estimates provided, some performance measures received a weight of zero.
- The model in IRS includes budget constraints.
- Goal Programming includes weights that enable negating the influence of any of the seven performance measures by assigning no weight. This reflects priority discussions across the agencies and bureaus, not the technology or scientific capability of FPA or IRS.
- The goal programming uses averages from the simulations run, providing valid coarse-grained information.

3.4.3 Strengths

The recent modules' updates and calibrations have allowed FPA to start yielding positive results and illustrated the potential to create meaningful outputs to support budget requests. The strengths related to FPA performance measures are as follows:

- In 2007, policy makers implemented a change in FPA from an optimization concept to simulation at the national level, which represented a new approach and revised the vision for the project.
- FPA has evolved its flow, based on trial and error of what works and what does not, and can still optimize at the national scale.
- FPA is using suppression costs as a performance measure, along with weights to reflect coordination of relative importance across the agencies and bureaus in a common unit (conversion to dollars), which allows FPA to meet OMB guidelines for relative cost effectiveness. These elements of the FPA system meet the Hubbard Report intent for cost effectiveness analysis.
  - Strength of FPA has been the ability to support nationally changes to prioritization among the seven performance measures defined in 2006, as evidenced by the weighting used in the April 2011 FPA run.
  - For the last run of FPA, in April of 2011, three of the seven performance measures were given weights. (Note: acres burned above and below threshold were combined into one Acres Burned performance measure, and Suppression Cost was the other performance measure given weight.)
- After evolving the performance measures (setting four of the seven performance measures aside for the time being), FPA proceeded to build the elements (modules) that would answer the decision support questions and provide outputs for these measures: a number of national budget alternatives are considered, 12 for each of the 136 FPUs, at 20% cut, 20%, or baseline funding level.
  - FPA modeling outputs evaluate results for each budget option simulated to inform budget formulation at the national level, such as the FY2013 budget previously mentioned.
  - FPA followed this tenet from an IST proposal in 2007: "a more detailed representation and projection of management influences on wildland fire is warranted at the FPU level than at the National level. Both levels would involve a modular set of component models or analytical tools, but the level of complexity expected in the FPU analysis is considerably higher. For examples, detailed simulation models play a significant role in the FPU analysis, whereas the National analysis would incorporate simpler, probabilistic network models that are logically consistent with the simulation models and are actually informed by simulation results." (Recommendations of the Interagency Science Team for Phase II Development of the Fire Program Analysis System, January 2007).
- Strengths with the LFM and IRS relate to the creation of multiple modules that collectively comprise the FPA system. The intent of FPA was to be a holistic tool and prior to its development, no interagency integrated planning and analysis tool was available to the agencies.
- Per the first bullet in 3.3.2, FPA supports "fire program planning and budgeting by examining the overall efficiency, effectiveness, and performance of various investment alternatives, subdivided by fire program component, agency, and Fire Planning Unit (FPU)" (Recommendations of the Interagency Science Team for Phase II Development of the Fire Program Analysis System, January 2007).

- Goal programming receives very high-level information with a known range of confidence for consideration, which addresses at a high-level the linkage in FPA between preparedness and fuels. The discipline of goal programming takes into account limitations in the data. For example, the lack of geospatial detail in fuels management cannot be analyzed beyond a national level for fuels and preparedness along state borders.
- Goal Programming explores a large amount of data and uses advanced techniques, with a large breadth of information pulled from this analysis.
- The Goal Programming preparedness program makes a difference in suppression cost and sensible results are being seen. Some stakeholders are pleased to have less performance measures – use the results of the model and the outputs based on the measures used.
- Goal Programming represents a proven method to address a complex problem that has multiple outcomes. The module provides comparative outcomes based on multiple objectives. Moreover, it provides a suite of alternatives to managers to evaluate tradeoffs between the options.

3.4.4 Deficiencies

The review team identified the following deficiencies relative to the performance measures.

- The Highly Valued Resource (HVR) performance metric is considered critical by many related to wildland fire management. HVR was not adopted within FPA because a consensus across the agencies could not be reached regarding what to include and how values could be weighted. The overarching challenge is that each agency has its own mission and set of values that are very different and thus difficult to reconcile within a singular data layer.
  - This limits the use of FPA in providing data for a cost-benefit assessment of whether the cost of suppression and / or loss of property are potentially outweighed against the loss or damage of a specific Highly Valued Resource such as a National Monument or an unique habitat.
- FPA is not currently a fully spatially-explicit ("geo-spatial fuels") model. Fuels accomplishments ("Acres Treated") are not adequately portrayed in IRS and only partially in the Large Fire Module, and the inability to assess Point Protection making HVR and WUI PM assessment difficult. For example, if fire planners were to assess a city with highly valued resources, bordering two states, they would need detailed geo-spatial information depicting fuels to optimize the mix of resources from each state.
- The data structure used in FPA goal programming is not detailed enough to produce resource allocation estimates at the FPU levels.

3.4.5 Observations

Additional observations regarding performance measures and goal programming include:

- Stakeholders suggested that the sensitivity between the performance measures for the Goal Programming process is very small. When the simulation is run, as the results for one performance measure changes, the results for almost all other performance measures change in the same direction, making the model very predictable.
- It was observed that there should be objective measures to identify how the system is performing.

- The April output of FPA still had seven PMs but only 4 (PM1, PM5 and the combined PM6 and PM7) were given weights while the other three remaining PMs were not used to support the Budget Request in April of 2011.
- The OG considered and concluded that in its current state, using FPA to help with allocating funds is not feasible.

3.4.6 Recommendations

To address the deficiencies identified above, the following recommendations are presented regarding performance measures:

- The general construct of the system allows for the investigation of new priorities with very little additional work, and allows FPA to further provide useful results for the performance measures.
- Investigate opportunities to revise the current performance measures to provide flexibility to include both future agency concerns (which may change) with long term national objectives (that tend to be more static).
- FPA is not currently an allocation tool. The mechanism for achieving allocation, per guidance in the Hubbard Report, GAO, and OMB needs to be decided.
- FPA currently only uses four meaningful performance measures (PM1, PM5, PM6 and PM7) for in support of the Budget Request, the remaining three PMs should be improved to become meaningful outputs.
- A performance measure should be developed to address federal actions relative to multiple objective fires, including fires with beneficial effects.

3.5 Stakeholder Expectations Management

Managing stakeholders' expectations remains a significant challenge for FPA. As described in Section 2.4, the broad stakeholder community interacts with, and has significant expectations of, the FPA tool. Recent progress in updating specific modules, reducing the burden to the field, restructuring the project's governance, and providing the means for more open communications, has paved the way to address the issues related to stakeholder management. However, FPA is still far from re-engaging a large portion of its stakeholders. Efforts in the upcoming years will play a pivotal role in how the fire community views FPA.

The message to stakeholders must be that the congressional mandate does not require FPA to model all components of Wildland Fire Programs (e.g. administrative overhead costs, facilities, equipment, training, etc.). Congress wants a coordinated, more cost-effective national approach. The technology, science, performance measures, and goal programming are in place to meet this mandate. However, improving inputs will only improve the results that the agencies and bureaus are given credit for achieving. Improving the rigor in inputs to FPA requires improving the rigor in stakeholder engagement.

The following sections discuss the maturity ratings, key themes, strengths, deficiencies, and observations related to stakeholder management.

3.5.1 Existing FPA Core Process Review–Communications

Core Process	ID#	Maturity	Process Findings	People Findings	Technology Findings
Communications	CP 5.0	1	▶ During the systems development lifecycle, user and software requirements communications occur outside formal procedures in a scientific laboratory environment, which has historically caused rework with IRS and Goal Programming modules. ▶ The goal programming staff proactively communicated the requirements met by the Goal Programming Module, as evidenced by the Independent Review Team at the October 2011 and January 2012 quarterly meeting of the FPA OG. ▶ A great deal of information filtering occurs around the IRS module, which adversely impacts timely quality decision-making and further propagates stove-piped processes. ▶ The groups named in the 2010 FPA Charter are involved in a recent communications framework, to improve cross functional communications.	▶ FPA has been championing their mission to start building awareness and support for its IT objectives. ▶ FPA is reaching out to internal/external stakeholders through the quarterly newsletters; however communication messages may need to be further tailored to ensure collaborative efforts support FPA strategic objectives as it moves all or part into O&M in June 2012. ▶ Occasional miscommunications appear to have been happened between FPA staff in the fire planning local levels and the mission/business owners, creating tension when calibrating last year's numbers for next year's budget. This is currently being addressed by transferring calibration responsibilities from local level fire planners to the SWT. ▶ A formal FPA training program is needed to identify training needs, such as enhanced understanding of how FPA outputs are used in goal programming, for national fire risk management. ▶ As FPA moves into O&M, different stakeholders have different expectations about what O&M means. Communications will be needed to clarify what it means to support ongoing improvements to FPA in O&M.	▶ FPA uses MyFireCommunity.net as a technology tool to support the communication outreach for FPA's strategic objectives and supporting tasks. ▶ There are limited collaboration tools in place to support the communication out reach of FPA's strategic objectives and supporting tasks. ▶ FPA newsletters and coordination of communications coming from the agencies and bureaus are helping FPA OG reshape its presence within the agencies' business units (FS, BLM, BIA, USFWS, and NPS).

Benefits and Outcomes:

- Communicates successes and IT initiatives to key stakeholders
- Improves IT quality through a better understanding of customers' needs
- Brings together stakeholder groups and reduces IT stove-pipes and "one off" solutions

CAP 5.1

Strategic Communication	2
Key Evidence: ▶ Newsletters go out quarterly that summarize the strategic direction coming out of each quarter's OG meeting, along with other progress from each of the bodies named in the 2010 FPA Charter. ▶ FPA has a communication framework as of 2011, but not a strategic communication plan. This recent FPA communication framework seeks to add a missing layer of communications coordinating coming from the leadership of each agency stakeholder, when communication beyond the OG is needed. ▶ When the communication framework is next evaluated, consideration should be given to adding a communication plan to guide messaging surrounding FPA enhancements when all or part of it go into O&M in June 2012. ▶ Note: communication capability scores regular communication efforts across business units in the level 3 [2] rating. This is different from the level 5 [4] rating where the degree to which communication is evidenced for clarifying issues across highly integrated processes.	

Maturity Indicator	0	1	2	3	4
Are IT strategies provided and communicated?	No communication – businesses do not have a clear idea of IT strategies	Communications coincide with major project and program releases	Communications occur annually / quarterly, during the strategic planning discussions	Frequent communications occur throughout the year	Communication is a continuous process and is well integrated into the IT process

CAP 5.2

Tactical Communications	2
Key Evidence: ▶ While formal communication plan does not exist, a communications framework has been recently established which has been executed against through 2011, as evidenced by the quarterly newsletters.	

Maturity Indicator	0	1	2	3	4
Are tactial IT needs provided and communicated?	No communication – businesses do not have a clear idea of IT needs	Communications coincide with change requests, projects and enhancements	Communicated annually and quarterly during the project & program discussions	Frequently communicated throughout the year	Communication is a continuous process and is well integrated into the IT process

3.5.2 Key Themes

Stakeholder management remains a key challenge for FPA, due to the size of the community, and what is perceived by many as an overpromising that occurred in the early development years. This may be a breakdown between technology project management and reluctance by bureaus to embrace suggested changes, as late as coming out of FPA Phase I. However, both empirical development and governance have progressed significantly. Key stakeholder management themes include:

- Given the large stakeholder community, and the length of time that agencies and bureaus have acted independently, it is expected to take commitment to transition to a national-level, collaborative budgeting approach. FPA has risen to the challenge by updating and approving a new charter in 2010, and updated in 2011, to ensure governance includes representation from all parties, and by instituting consensus as a key tenet of governance.
- Fire is such an important and expensive social problem that the agencies really need to have a coordinated empirical process that enables them to share information and plan together.
- The Congressional mandate requires FPA to lead a charge across the stakeholder community to "learn together" how to coordinate wildland fire budgets. Both the empirical (modeling) development and governance have come a long way after some tough lessons and this is real progress.
- The field expectations still need to be managed, as FPA is not a day-to-day planning tool.
- Given the historical overpromising of FPA, the field requires careful communication and the implementation of mechanisms that support decision-making while restoring functionality that was removed from FPA.
- BLM, USFWS, and NPS either use or have under development field-level planning tools that may answer some stakeholder frustrations related to the removal of legacy systems and the historic overpromising of FPA. These tools may need to integrate with FPA to fill a significant day-to-day planning functional void, and reduce some of the negative frustration and perception that FPA does not provide benefits to individuals on the ground. Supporting day-to-day planning is not the intent of FPA.
  - Field-planning tools currently explored include BLM's Fire Program Decision Support System (FFPDS), USFWS's FIREBASE, and NPS' Wildland Fire Planning Data System (PDS) and STARfire.
- The approved work for improving the WUI layer or set of WUI layers would move FPA in the direction of getting fuel treatments spatially located in the FPA model. This planned work would mature the capability to model fuel treatments, to improve the ability to protect certain resources from fires above certain intensity. The benefit would only be fully captured if accompanied by improvements to IRS and to related modules. Currently, FPA captures the information in a coarse way, reducing acres burned by workload area, to see benefits in the goal programming. Refined analysis would improve the results for which the goal programming would give credit.

3.5.3 Strengths

Given the challenges of managing an interagency budgeting tool and a complex and changing environment, FPA has recently made important strides in the area of stakeholder management, including:

- Establishment of the Oversight Group (OG), which includes representation of the stakeholder community. FPA's governance processes have been able to achieve resolution where directed. The

OG, chartered in October of 2010, also has the authority to make decisions as well as make recommendations to the Federal Fire Policy Council.

- The FPA stakeholder community is working together to inform the current budget in a coordinated manner, at the national level, as described in the Budgeting section of this report.
- The consolidated, more inclusive, monthly conference call including FPA project staff and members of the various advisory teams has facilitated consistent messaging and development of broader perspective across these teams in an ongoing open collaborative environment. The regular attendees include agency fuels and budget representatives, GA Leads, Business Leads, the Management Advisory Team (MAT), Support Working Team (SWT), the Interagency Analysis Team (IAT), Project Manager, and the FPA Executive Director. Various discussions identified that this approach has increased collaboration and keeps stakeholders more involved.
- Individual Advisory Team working sessions and calls also continue.
- Brochures and quarterly Newsletters have been recognized as beneficial in providing consistent messaging. The pending re-initiation of the Listserv will also be beneficial in keeping the community of Stakeholders informed and involved.

3.5.4 Deficiencies

The deficiencies outlined in this section describe the misalignment of field-level expectations related to the overall goals and objectives of FPA. The primary deficiencies were identified as:

- Historic overpromising of FPA still has mixed or unmet expectations from the field and this problem needs to be addressed. While FPA is not intended to provide the annual budget assessment functionality at the unit level, provided formerly by such models as the National Fire Management Analysis System (NFMAS), interviews have suggested that these models were removed from the field on the promise that FPA would offer similar functionality. Our FPA interviews produced conflicting feedback in regards to whether NFMAS was intended to be used for day-to-day fire management.
- FPA is fundamentally a suppression model that does not model the hazardous fuels treatment component, multiple fires and fire days, fires managed for multiple objectives, beneficial fires, national large fire support needs, organizational structure, and support requirements. Currently, project management communication is not clearly delineating the boundaries between FPA and separate projects to assess and meet any needs that may exist.
- FPA modeling does not have the capability to model the linkage between fuels and suppression costs.
- The Product and Management Scope Statement document should have been finalized at the outset of the development of FPA. The lack of this document created many of the missteps over the years and led to the lack of clarity on what FPA would and would not do.

3.5.5 Observations

A few additional observations were made in the area of stakeholder management, including:

- A Product and Management Scope Statement document will be finalized in 2012, clarifying objectives, overview, validation, implementation, and project timeline for FPA. Discussion suggests that the document may be finalized as early as February 28, 2012. This document should ensure that it clearly

states what FPA will and will not do. Stakeholders recognize this document is a key element for both Project Management and stakeholder engagement.

- Stakeholder discussions indicated that the FPA User Dashboard (Dashboard) is an intuitive and interactive tool that will offer FPU-level support around study areas, recent changes, impacts of potential decisions, and ability to connect with other users online. The Dashboard was described as a key aspect in reaching out to the field to help fill the planning void caused by FPA's historic overpromising.
- It was observed that an updated Fire Ignition Generator (FIG) has been proposed. The IRS model is also being rewritten in a more flexible manner to test new ideas. For example, dispatch logic is currently fixed; the research version will allow users to explore how such logic might be made more effective and efficient. The new, more realistic IRS and search models will be packaged in a user-friendly interface, or "Dashboard". The Dashboard also will contain historical summary statistics, and maps of past fire locations, burn probabilities, etc.
  - Interviewees suggested that leveraging the Dashboard, the field would be able to come up with potential solutions to handling different budget levels, seeing the impacts of those "decisions" in real-time.
  - The Dashboard is intended to address FPA's weaknesses related to allocation and fire planning at the local level. Due to the Dashboard being under development during the completing of this External Assessment, the Review Team did not have the opportunity to review this solution in detail.

3.5.6 Recommendations

- Using the FPA communication Framework, develop a specific focused out-reach effort to key stakeholders. Determine what their expectations are and if they are in alignment with the current FPA program expectations. Develop communication methods that are appropriate for the level of the organization, and that addresses the current expectations of FPA, in an effort to get the stakeholders all on the same page.
  - Ensure "clear text" is used to reduce confusion on terminology.
  - Communication methods should include written messages as well as in person presentations where appropriate.
  - Get feedback from the stakeholders to ensure the message is understood and accepted.
- The culture across independent agencies and bureaus needs to continue its current evolvement of embracing a risk management mentality through coordinated fire investments.
  - Communication needs to continue to evolve at all layers of the FPA community to deepen the conversation about the effects of coordinated fire investment on risk management. All stakeholders need to understand the benefits and impacts achieved through coordinated investment, as related to the costs of contribution in a shared risk management environment.
  - More communication is needed across the Bureaus and Departments about whether funds are expected to move freely across Bureaus and Departments because of FPA outputs, or if budgets will continue to be stove piped, with FPA merely suggesting opportunities for coordination.

- FPA needs to clarify and manage stakeholder perceptions related to O&M. As fire management evolves and major enhancements go forward, all stakeholders need to understand FPA's plan of action, roles and responsibilities, and have a mechanism to manage and track all future enhancements, including:
  - Gridded Weather: This enhancement has the potential to help with fire planning activities and could help give a higher level of confidence to Goal Programming by adding a stronger input into the calculation. While the current Goal Programming provides good results at a high level and is valid, it can be improved by implementing gridded weather capabilities that will provide additional data points and more granular information for formulating the budget.
  - Spatial Fuels: Improvements to the spatial nature of Fuels Treatments, in conjunction with a better data layer for WUI and HVR, will enable better credit to be given for fire borders of States/Tribes/etc., greatly enhancing the usefulness of FPA data. This will require coordinating agreements across the five bureaus on the WUI/HVR layer.
  - FPA should consider implementing a fully spatially ("geo-spatial fuels") model, fuels accomplishments ("Acres Treated") to use better data layer for WUI and HVR PM.
  - LFM will benefit greatly from gridded weather and spatial fuels data. Incorporating the spatial aspects of fuels and spatial-temporal aspects of weather has the potential to overcome several of the current limitations of the approach.
- Continue to encourage the development of field-level planning tools to help address some stakeholder frustrations related to the removal of legacy systems and the historic overpromising of FPA. Explore the pros and cons of integrating these tools to FPA or continue to develop them as stand-alone systems. These tools should help fill a significant planning functional void and reduce some of the negative frustration and perception that FPA does not provide benefits to individuals on the ground.
  - The Unit Level Planning System should have several components:
    1. Complexity analysis that looks at overhead support decisions and cost associated with activities that support the Fire Program
    2. Model that helps look at the fuels program tie in with HFPAS
    3. Use a planning model that analyzes the initial attack capability at the unit level.
    4. Budget component
    5. Clear and transparent requirements
  - FPA discussed at the 1/26/2012 OG meeting whether to pursue full development and deployment of a heuristic 'User Dashboard,' to satisfy many of the observations around unmet expectations and the need for a local planning tool. After gathering information from the interviews on the intended features and purposes of the "User Dashboard," this appears to be a sound approach for meeting the intent of this recommendation.
- Because integrated environments require collaboration, communication groundwork needs to be laid with the field to support and share efforts similar to BLM's and NPS's planning tools, which are outside the scope of FPA, coupled with transparency of requirements of what FPA supports. For example, Federal Enterprise Architecture Framework (FEAF) documentation, coupled with the execution of a communication engagement plan may be added and augmented, thereby managing expectations in the field.

- Tie FPA EA to broader federal fire EA, such as the National Wildland Fire Enterprise Architecture (NWFEA), an effort to which FPA stakeholders already belong. By mapping to NWFEA artifacts whenever possible, such as NWFEA Goals and Recommendations, FPA leverages existing federal EA investment, avoids duplication of effort, and provides clarity for how FPA aligns to a broader federal fire EA involving DOI, USDA, and DHS.
- FPA improvement opportunities, going forward, should be developed and mapped across a line of sight that clearly show alignment of FPA performance goals, business activities, services, technology and data. OMB provides a toolkit for developing, populating and mapping its EA across a FEAF-compliant line of sight, in the Federal Segment Architecture Methodology (http://www.fsam.gov/federal-segment-architecture-methodology-toolkit/step2.php).

3.6 General Observations and Recommendations

3.6.1 FPA Modules

In reviewing the lessons learned from the initial FPA implementation, a clear principle to follow whenever possible is that end-users should not be the first to discover bugs when completing a technology module implementation. Rather, the Science Team should have the first opportunity to discover and fix bugs before users are exposed to new modules and major enhancements. The principle is true beyond any FPA module, and for the modules that feed into FPA modules.

- The IRS implementation was flawed because a working IRS system was not first tested and vetted by research scientists with wildland fire scenarios in a laboratory research and development (R&D) environment before being released to end users. Rather, the IRS Module was developed and released into a live, web-based application production environment accessible by end users in the public community. To accommodate updates or improvements to the IRS, research scientists and other FPA project staff must go through a change request process with the contractor to update access code, to discover bugs, or to install bug fixes, while the end users experience the problems.
- The IRS module provides the Large Fire Module with several inputs that are important and that contribute to the wider success of FPA. These include the number and sizes of fires that Exceed Simulation Limits for each Fire Workload Area, information on fuel treatments (e.g., acres, WUI, non-WUI, fuel models), fire intensity level (FIL) data, in addition to any Fire Workload Area that is excluded from the subsequent analysis.

3.6.2 Relationship of FPA Modules with Specified non-FPA Systems

In reviewing the literature it is clear that the Cohesive Strategy has incorporated the results for FPA into the National strategy and that LANDFIRE has a direct supporting role to the FPA system. Moreover, it has been proposed to bring HFPAS into the FPA environment to address fuels treatments. This proposal should be further explored to understand whether any additional development efforts needed to integrate HFPAS outputs to FPA would justify associated costs. Lastly, no direct relationship between FPA and EMDS, Land and Resource Management Plans (LMP), or Fire Management Plans (FMP) has been identified. Based on the interviews conducted and information collected, the Booz Allen team does not recommend that FPA be integrated or form new relationships with the following:

- **EMDS—**EDMS is already established as a knowledge-based decision support of ecological assessments at any geographic scale.
- **LMP and FMP—**both of these types of plans require approval as per the National Environmental Planning Act (NEPA) approval, requiring FPA to comply with NEPA.

Appendix C provides details on the above systems and guidance related to FPA.

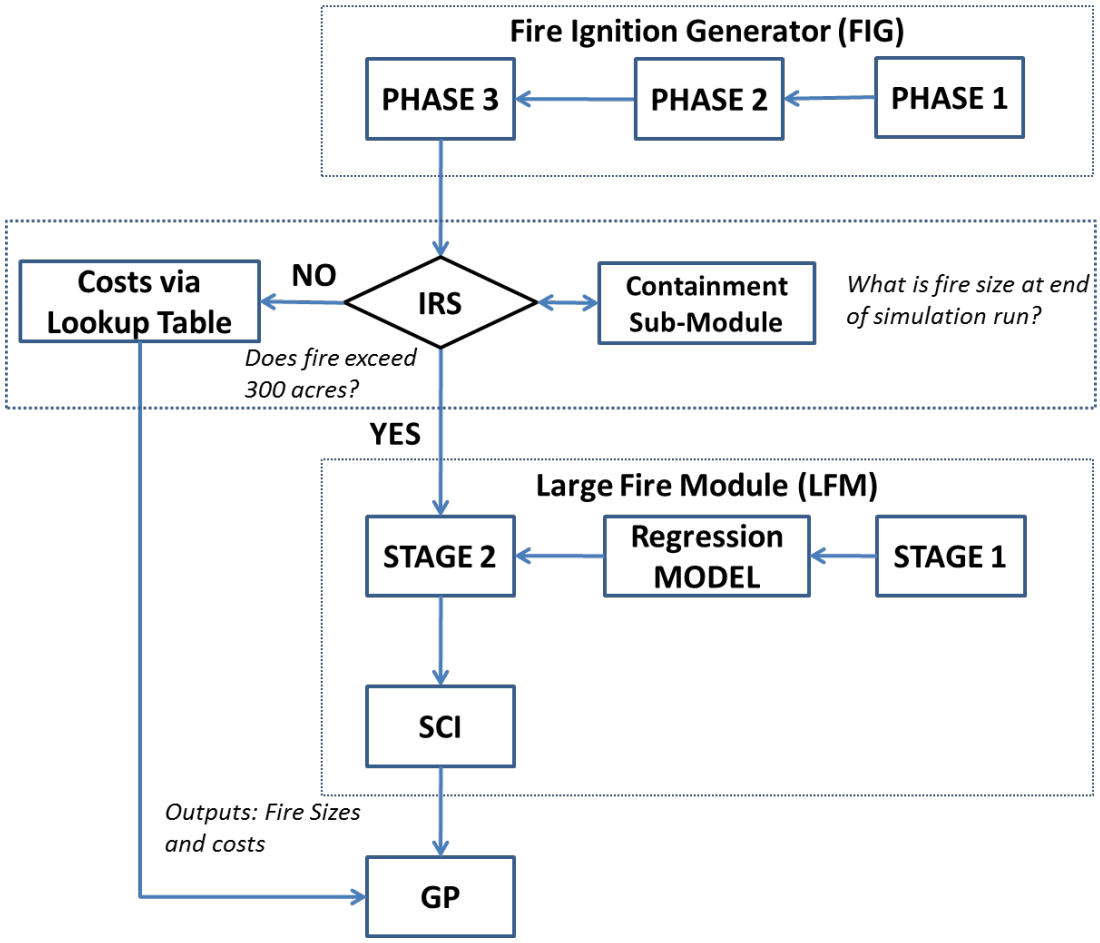
4 TECHNICAL REVIEW FINDINGS

FPA is a complex model composed of multiple modules. The general input/output flow of FPA is sequential, with outputs from one module transferring directly into inputs of the next. The principal modules and steps include:

1. Fire Ignition Generator (FIG)
2. Initial Response Simulator (IRS)
3. Large Fire Module (LFM)
4. Cost Assessment [look-up table and Stratified Cost Index (SCI)]
5. Goal Programming (GP).

Figure 8 illustrates the FPA technical process and outlines the deterministic linkage flow of the system.

FIGURE 8: THE FPA TECHNICAL PROCESS



This section provides a technical review of each module and explains how the modules connect and interact. In each case, we provide an assessment of the technical strengths and deficiencies of each module. This chapter summarizes the major findings and presents initial suggestions for potential improvements.

4.1 Fire Ignition Generator

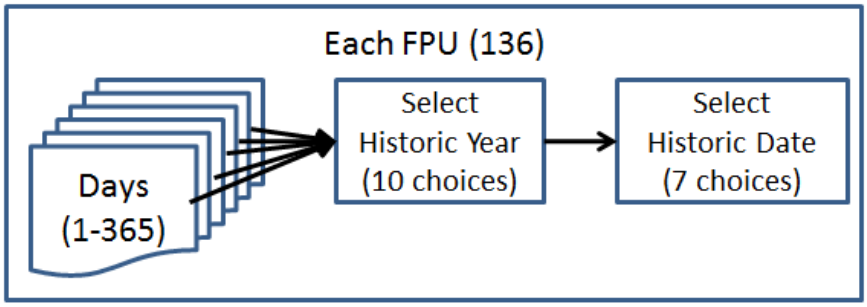
The Fire Ignition Generator (FIG) module was developed by Bighorn Information Systems to develop a set of fire scenarios that represent the range of possible fire seasons that may occur, based on 10 years of historical fires. The goal of the FIG was to evaluate the subsequent probability of fire ignition within each FPU by day of the year. The FIG was developed and implemented in three distinct phases:

Phase 1: This phase, which has been completed, involved creating a central database of known fire ignition causes from a series of agency databases. These records included data from the U.S. Forest Service, the National Association of State Foresters, USFWS, BIA, BLM, Bureau of Reclamation, and NPS. Currently, the weather from the closest weather station is assigned to each ignition regardless of the FPU boundaries. These data are collected from the Remote Automated Weather System (RAWS) stations and include 10 years of fuel moisture data derived from the National Fire Danger Rating System (NFDRS) and wind speeds associated with each ignition.

Phase 2: This phase, also completed, involved assigning causes to ignitions where the cause was unknown. This assessment, although initially attempted via a random assignment based on nearby common ignition causes, was eventually completed based on rigorous cross-checking with the best available historical records.

Phase 1 and Phase 2 enabled the determination of the "statistical cause" of fire ignition to be developed, which linked to the existing U.S. Forest Service cause codes:

1. Lightning
2. Equipment Use
3. Smoking
4. Campfire
5. Debris Burning
6. Railroad
7. Arson
8. Children
9. Miscellaneous.



Within each of the 136 FPUs, the FIG (for each day of the year) randomly selects one of seven defined dates within one of the 10 historic years. The result is the selection of a number of fires and associated weather for that selected "day" per FPU.

Phase 3: This phase re-runs the historical ignitions via a bootstrap approach and determines whether the fires will occur or not, based on a Bernoulli distribution of historic fires. A geometric distribution is then used to determine how many fires will occur on a given day and a Poisson distribution is used to determine the time of day a fire ignition occurs.

4.1.1 Essential Inputs

The essential inputs to the FIG include:

- Historical ignitions and their statistical cause
- Historical weather data
- Location information
- Fuel moistures via daily values from the danger rating system

4.1.2 Outputs and Flow

The principal output for each FPU from the FIG is a distribution of (historic) ignitions for each day of year. This output is directly provided to the Initial Response Simulator.

4.1.3 Strengths

The strengths of the FIG Approach include:

- **Sound Science.** The science behind the FIG approach is sound if one accepts the temporal (10-year historical record) restraints on the methodology. Although greater than 10 years would be preferred, the confidence in the data quality does not make this currently viable. The statistical approach applied provides an easy to interpret output. The fact that exceptional fire years often occur on time intervals greater than a decade is a weakness of the 10-year historical record approach (see below).
- **Robust Methodology.** The FIG workflow is a well thought-out and grounded process and each phase has been diligently followed through. The development of the 10-year fire ignition cause database for each FPU was an impressive and well-executed undertaking. This product should be considered a true success of FPA and will have wider uses beyond its initial purpose. Although the 10-year historical record is limiting, it is reasonable to accept that data prior to a 10-year retrospective assessment of the fire cause cannot be considered reliable.

4.1.4 Deficiencies

The principal weaknesses of the FIG approach relate to the constraints of the methodology that was applied.

- **Limited Historical Record.** The FIG approach by design only reconstructs fire ignition causes for the last 10 years. This "historical" outlook is very limited. Wildland fire is a highly stochastic event and it is unlikely that these 10 years will capture the "rare" events that are large spatial-scale wildland fires: events that are associated with large cost-plus-loss final budgets. This limitation will be pronounced in FPUs with land cover types associated with long fire-return intervals for large spatial scale fires. Furthermore, the short historical record will make it impossible to decouple trends associated with external drivers, such as effect of climate or ocean oscillations (El Nino, PDSO, La Nina, etc.), which can act over longer temporal periods.
- **Data Quality.** The FIG approach is reliant on accurate location and causal information regarding each historical ignition. The precise location of a historical fire ignition is often unknown when doing retrospective assessments; making the associated information on FPU where the fire originated, local weather, and fuel moistures less certain.

- **History Changes the Future.** The FIG approach assumes that past events can be used to accurately predict the future. The approach however does not account for changing fuel conditions, changing climate, or patterns of previous fires, which in turn may change the future ignition potential within a FPU.
- **Random Sampling of Historical Data.** Random sampling method of historical fire occurrence data does not represent the inter-relationships between fire days (episodes of fire activity).

4.1.5 Recommendations

Recommendations for improving the FIG approach are:

- Extend the Historical Range with New Fires. As the FPA partners continue to manage and monitor ignitions in future wildland fires, they could continue to enter and incorporate these new ignitions into FIG to extend the "historical" range.
- Improve Data Management and Quality. Precise location information on ignition starts is necessary to improve results. There is a need for improved ways to describe the FIG input data and consistent methods for ignitions to be recorded.

4.2 Initial Response Simulator

Originally, FPA developed an optimization model for the Initial Response Simulator (IRS) component of the system. This model originally computed a linear optimization of suppression resources for a single randomly generated fire season. The principal drawback of this approach, which led to it being rejected and replaced, was that the approach assumed that all fire seasons are the same and thus the original model did not account for the uncertainty across fire seasons.

The Initial Response Simulator (IRS) now uses ignitions and weather records derived from the FIG's re-run of historical ignitions to determine whether an ignition will be contained or will exceed a given size and burning time. In essence, the IRS tweaks the fire seasons developed by the FIG module to reflect the current field investments, prevention expenditures, fuel management strategies, and available resources. IRS does this to simulate the growth of the fires using the fire resource and dispatch data. A fire that exceeds a set size is passed to the Large Fire Module, while a fire that is contained is directly assessed for costs via a look-up table. The IRS module focuses on the vast majority of ignitions, as they do not exceed containment. Although numerous, these fires typically represent only a small portion of the cost of wildland fires.

The IRS system was contracted and to date, the science team has only received full access to the containment sub-module of IRS. Therefore, the science team can only run the code and investigate the outputs but do not have access beyond this sub-module. Changes can be requested via the formal request process but the team lacks the capability to make wholesale changes in a timely manner. This limits the capability of this technical review to provide a full assessment of the robustness of the IRS method. To date, the FPA science team's ability to reach its potential to succeed is constrained by lack of transparency (i.e. access to the precise methodology of the IRS system).

The only sub-module of the IRS system that the FPA Science team has the ability to run and investigate code behavior is the "Containment Sub-Module" that uses the FIG outputs coupled with Field Dispatch Logic to determine what the final fire size will be at the end of the simulation period. The principal objective of the

IRS containment algorithm is that it models the interactions between the potential fire growth and the impacts of building firelines during the entire suppression efforts of the fire.

The Field Dispatch Logic includes factors such as:

- What is the travel time of available resources?
- What is the availability of those resources?
- What is the travel time under different weather scenarios based on the NFDRS Burning Index (BI)?
- What is the maximum number of each resource type that will be sent to individual fires based on NFDRS burning index and rate of spread?

For a given FPU, the IRS system models a fire event scenario and predicts both fire spread rates and fire size based off the interactions between the rate of fire growth and the speed/effectiveness of the fire line put in during the initial attack.

4.2.1 Essential Inputs

The essential inputs to the IRS include:

- Re-ran ignitions and weather derived from the FIG approach
- Field Dispatch Logic

4.2.2 Outputs and Flow

The principal outputs of the IRS at the end of each simulation run are:

- Fire size
- Rate of spread

The above outputs are aggregated to produce a count of the number of fires contained and the number of fires exceeding simulation limits. Fires in the IRS system are defined as escapes under several scenarios: (i) no resources are available to be applied to the fire, (ii) the fire is not contained after a pre-defined time limit, (iii) the fire growth exceeds a pre-defined size, or (iv) suppression efforts reach their pre-defined work shift length and the fire is abandoned (Finney, Unpublished Data). Escapes, along with its associated outputs such as area burned, moves to the Large Fire Module. If the fire remains within pre-defined acres by the end of the simulation period, the final cost of the fire is calculated via a look-up table and the result passed to the Goal Programming module. (Finney, *A Description of the Initial Response System for Fire Program Analysis*, Unpublished as of January 2012).

4.2.3 Strengths

This review can only comment on the Containment Sub-Module and its principal strength:

- **Sound Science.** The Containment Sub-Module uses the modified Fried and Fried algorithm to evaluate the fire size and rate of spread at the end of the simulation run. This algorithm was initially developed for the California Fire Economics Simulator version 2 (CFES2) and is widely published and accepted in the scientific literature (Finney et al 2009, Fried and Fried, 2010).

4.2.4 Deficiencies

The main deficiencies of the IRS module are:

- **Flawed Development Process.** As outlined in section 3.3.1, although the contractors delivered exactly what they were tasked with, the IRS implementation was flawed in that a working IRS system was not first tested (including sensitivity analysis of inputs or validation of outputs) by wildland fire research scientists in a laboratory research and development (R&D) environment before releasing to end users. The absence of documentation or access to the source code to the FPA Science Team exemplifies IRS' lack of clarity, difficulties in explaining how IRS works, what specific inputs are used, or how the model functions.
- **Unclear Wildland Fire Process.** It is uncertain whether those involved in the development of the IRS understood the scientific underpinnings of wildland fire science or Field Dispatch Logic.
- **Black-Box Process.** The IRS system is predominately a black-box system. The precise inputs can only be inferred or speculated, as these are not known. The lack of scientific transparency embedded in the IRS hampers the long-term viability of the entire FPA modeling process.
- **Input Sensitivity.** Given the uncertainty of what is contained within the IRS module, it is not clear whether the exhaustive list of IRS inputs provided in the various FPA documents are "known or inferred" inputs. These inputs include:
  - Topographic data
  - LANDFIRE fuels model data
  - Fire Planning Units and their components
  - Fire Workload Areas (if any)
  - Dispatch locations
  - Initial Attack Fire line Production Rates (NWCG)
  - FPU-designed preparedness options with
  - initial response organizations, and
  - prevention programs
  - FPU-designed fuel treatment options
- **Input Detail.** It is also unclear to what level of detail these "inputs" are used. For example, topographic data could include solar isolation, aspect, slope, etc. The scale of data applied is also unclear. Regardless of whether this list represents all or a sample of the actual inputs used in the IRS module, it is not clear which inputs are given greater relevance in the decision-making process. The absence of a formal sensitivity analysis presents challenges in determining whether these variables are important to model fire growth and rate of spread. Also, according to interviews, IRS does not capture an input on whether suppression was intended, when another fire objectives was pursued. Current guidance for when to let fires burn mandate only to do so when specified adverse effects are avoided. Although the initial intent may be to initially let a fire burn, when weather conditions change, the decision to not suppress may be reversed. This is difficult to model due to the factors that contribute to the unpredictable nature of when an initial decision to not suppress will be reversed. Work is currently underway at FPA to explore what information to capture in a revised model.
- **Spatially Limited.** Although the original intent of IRS was to develop a non-spatial module, the inherent spatial nature of wildland fire management highlights the lack of science underpinnings within

the IRS module. The IRS Containment Sub-module assumes homogenous fuels (of a given treatment) within a FPU; the result is that if the ignition is adjacent to a treatment, the treatment will have no impact on the fire's growth. This lack of geospatial consideration may significantly reduce the potential of the system to reliably predict fire growth and spread in different fuels and fuel treatment conditions.

4.2.5 Recommendations

Recommendations for IRS include:

- **Develop Replacement IRS Module.**

  A replacement module, or lookup table, should be developed following a science-orientated methodology. This replacement module should have the following properties:

  - Openly available source code in control of the FPA Science Team.
  - Code developed via a development process guided by scientific principles, including testing and sensitivity analysis.
  - Code developed by using knowledge of wildland fire management, including fire behavior and Field Dispatch Logic.
  - Code developed by using more than suppression.
  - Oversight of IRS developments by external, but informed, scientists.

  If a new IRS module is developed, it could replace the existing IRS module following sensitivity analysis, testing, and validation. Options for a replacement module could be solicited via a competitive competition from the wider wildland fire science modeling community and viable options could be developed for testing and validation within 3 years, with candidate successor modules tested and validation over a further 2-year period.

- **Comprehensive Sensitivity Analysis Required.**

  The precise number of IRS inputs is unclear. However, if the intent of FPA is a national level planning tool, it is then quite possible that the number of necessary variables used to conduct the assessments could be reduced to only those that are of the upmost importance. To evaluate what inputs are important and necessary in either the existing or a new version of IRS, a comprehensive sensitivity analysis is necessary. The impact of choices in the Field Dispatch Logic or fuel management choices to the IRS model results remains unclear.

4.3 Large Fire Module

Originally, FPA employed a wild fire susceptibility index statistical approach instead of the Large Fire Module (LFM). This approach was developed, tested, and subsequently rejected. The principal reason was that the fires did not grow over the landscape (the effects of very large fires were only related to the ignition point). The conclusion was that at least a pseudo-spatial method was needed. The availability of viable LANDFIRE data around 2006 further added to the push to use spatial data.

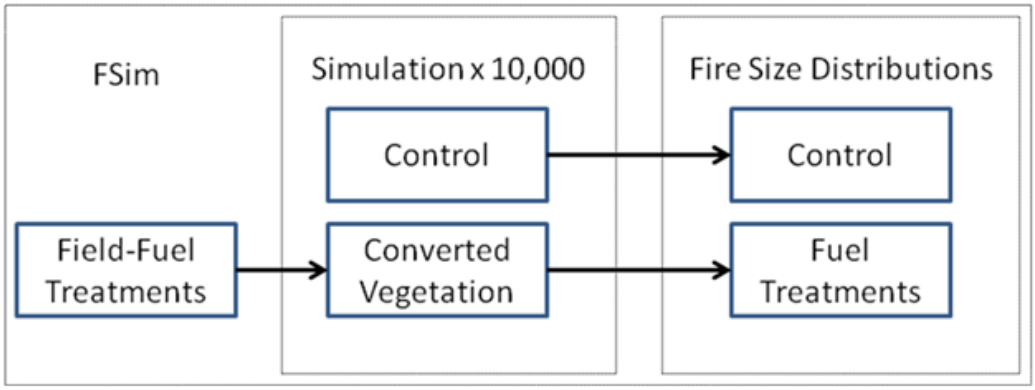
Prior to the development of the LFM, FPA considered an optimization approach, but eventually decided to develop a simulation methodology. The reasoning for this decision was driven by the fact that impacts, in terms of cost-plus-loss, of large fires typically occur long distances away from ignitions and at relatively

long temporal periods after ignitions. As a result, the spatial distribution of fuels and the temporal distribution of weather become significant in considering the patterns and progress of the fires. As a result, there are simply too many variables in fire modeling that change unpredictably, with too many perturbations to make an optimization approach viable. This led to the development of the LFM simulation approach in 2008.

The goal of the LFM was to use the fire size and fire spread rates from the IRS "escapes" to model the intensity, size, and impacts of the fires. The outputs are then passed to the SCI stage and GP. In a similar manner to the FIG, the LFM was developed and implemented in three distinct phases:

Stage 1: This phase, which has been completed, was run completely independent of the rest of the FPA process. This stage involved the development of the FSim simulation model. The FSim simulation model is a variant of the Fire Spread Probability (FSPro) model developed by wildland fire scientists' at the Missoula Fire Sciences Laboratory. The FSPro model is published in the scientific literature (Finney et al. 2011) and is widely accepted by wildland fire practitioners via the WFDSS system.

FIGURE 9: FSIM SIMULATION MODEL



In stage 1, each FPU used FSim and simulated over multiple weeks the growth and spread of the large fires identified as escaping containment in IRS. The simulations were run using both control and fuel treatment layers. The fuel treatment layers were developed through conversation between the relevant FPU field personnel and the FPA scientists. The FPA team members converted the applied fuel treatments into specific changes to the vegetation properties (such as canopy heights, fuel loadings, etc.). The treatments were then assigned to occupy 15% of the FPU. This simulation was run 10,000 times and two sets of fire size at end of simulation run distributions were produced (control and with fuel treatments)

Regression Model: This phase, which is an intermediate step within LFM, developed a regression model to predict fire size, fire intensities, and fire impacts from fuels, weather, topography, and fire duration. The concept of using the statistical approach is to by-pass the need to re-run the FSim simulator approach for each modification that FPU planners may want to explore.

Stage 2: This phase takes the results of the regression model and estimates the impact of fuel treatments and suppression on the large fires.

4.3.1 Essential Inputs

The essential inputs to the LFM include:

- The "escapes" and the associated weather (from FIG) from the IRS module
- Fire Planning Units Fire Workload Areas
- FPU-designed fuel treatment investment options
- Field staff discuss with the FPA science team what prescriptions have been accomplished and then the FPA science team edit vegetation properties per FPU to match the aim of the field fuel treatments (canopy cover reduction, etc.), with a total of up to 15% of the entire FPU.
- Comprise method based on WFLC decision to add Large Fire Probability Surrogate (WFLC Briefing Paper: FPA–Development Alternatives Overview, December, 2006)
- Most common fuel treatment prescriptions:
  - Inputs allow FPA to create a "fuels landscape file" for use in the FLM
  - Scott and Burgan 40 Fuel Model from LANDFIRE
  - FPUs to add additional descriptors to describe fuels:
    - Surface fuel model
    - Stand height
    - Canopy cover
    - Canopy base height and/or
    - Canopy bulk density

FSim Inputs:

- Landscape characteristics: Surface fuel model, aspect, elevation, slope, and canopy coverage
- Historic Energy Release Component (ERC)
- Wind Data from a representative weather station or from NARR GRID data

4.3.2 Outputs and Flow

The principal outputs of the LFM include:

- The intensity, size, and impacts of actual ignitions that exceed containment and then are passed to the SCI stage and GP.
- Fire Intensity Level (FIL) table for each fuel model and percentage of the surrounding area treated, generated from both the control and fuel treatment runs.

4.3.3 Strengths

The strengths of the Large Fire Module are:

- **Fast Solid Progress.** The LFM is relatively new in the FPA arena. LFM started development in 2008 and already meets its stated objective.
- **Solid Science.** The Large Fire Module methodology was developed in direct response to a need that arose from a previous unsuccessful module. The science behind the FSim has been published in the peer-review literature (Finney et al 2011).

4.3.4 Deficiencies

The principal deficiencies of LFM approach arise due to assumptions applied in the modeling process. These include:

- The model randomly assigns a location (thus equal probability) within each FPU where the location of the large fire starts. As outlined by Finney et al. (2011) this likely leads to errors in the predicted fire behavior and subsequent fire effects. However, in 2011, this limitation was reduced through usage of a spatial ignition grid based on historical large fire densities.
- The assignment of 15% of the FPU to a fuel treatment may be unrealistic given that literature reports that typically only 1-2% of FPU landscapes have actually had fuel treatments.
- The effect of suppression on large fires is currently unknown (i.e. what are the consequences? what are the consequences of multiple tactics?)
- The FSim simulation time is long. Each full set of simulations takes approximately 4 months to complete ostensibly conducted annually. However, once it is completed, a new run is only needed following significant updates of input data (such as following the recent LANDFIRE refresh) on a longer multi-year timescale.
- The spatial resolution of the re-sampled LANDFIRE data (30 meters to 270 meters) limits the ability of the fire spread model to account for fine-scale variations in the fuels.
- Since LANDFIRE data is a primary input into LFM, errors or uncertainties in this dataset propagate into the outputs of the LFM model. This is not a LFM deficiency, but rather a deficiency generated from the inputs that feed into the LFM module.
- The FIL values are hard to use within the regression model, as it is not viable to assign a single FIL value to each fire in a FPU.
- FSim creates too many large fires. This is apparently an artifact of its design as FSim is overly sensitive to dry years.

4.3.5 Recommendations

The following recommendations have been identified for the LFM:

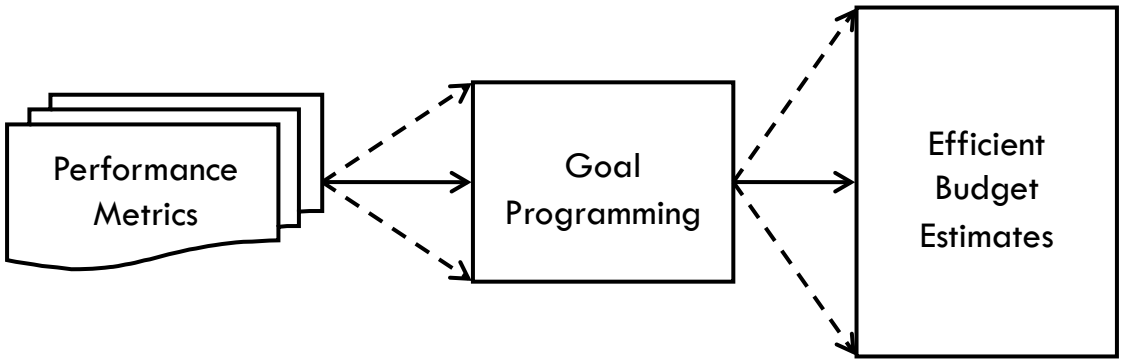
- Considerable sensitivity analysis is required at all levels to determine the importance of all the model inputs: What inputs are actually necessary? What inputs require more weight? What inputs could be removed?
- LFM will benefit greatly from gridded weather and spatial fuels data. Incorporating the spatial aspects of fuels and spatial-temporal aspects of weather has the potential to overcome several of the current limitations of the approach. Although planned, this spatial data will not be ready by Spring 2012. The LFM is in a steady state, providing a repetitive service for supporting large fires, but would benefit from ongoing enhancements to weather and geospatial data even after moving to O&M status.
    - Note about terminology considerations from a change management perspective: Other agencies have used the term “optimization review” to describe enhancements that occur to federal IT systems in O&M mode, but FPA will need to craft different language to avoid organizational confusion as optimization at FPA has a very different meaning, in the optimization vs. simulation concept described in section 2.3.1 and throughout the report.

4.4 Goal Programming

Goal programming, which is a variant of linear programming, is one of the most widely used techniques in natural resource management to optimize solutions when multiple objectives (or goals) are present. Natural resources and in particular wildland fire management are faced with multiple goals. Specifically, within wildland fire management there are multiple goals both within each agency and across all the individual fire management agencies. There are also varying goals between local and federal agencies, especially when allocating resources. In goal programming, a solution is achieved by minimizing variations over the multiple goals under certain constraints. As noted in Dykstra (1984), the challenge of goal programming is that it requires that the specific goals are assigned a preference rank (i.e. that some goals are preferred over others) and that those ranks are decided in an objective manner. In most cases, these preference ranks are achieved by assigning "weights" to the different goals.

Originally, Goal Programming was accomplished through a module developed by a contractor. Some of the FPA science team found this model too time consuming to incorporate changes into the system. As a result, the FPA science team developed a Goal Programming module in 2009, in parallel with the contractor module, as a mechanism to validate the existing module. Once the fire sizes and costs for each FPU have been estimated using IRS or LFM, these data are passed to the Goal Programming module. Goal programming is a singular module that uses mathematical programming to model the likely costs at a national level.

FIGURE 10: FLOW OF GOAL PROGRAMMING



Each of the average performance measure values are inputted into Goal Programming, with preference weights applied. Weights manage the relative impact of each performance measure on the modeled outcomes, in order to provide business with an automated mechanism to prioritize one or more measures over others. While the confidence intervals of these averages can be very large, too large for FPU level planning, a key enabler of national-level risk management is determined by whether averages and associated confidence intervals are known. FPA provides empirical documentation input for goal programming to further process. This enables goal programming to produce reasonable budget estimates with uncertainty built in. Weights are objectively selected by first calculating what weights would produce reasonable budget estimates based on typical initial conditions of current performance, such as current fuels preparedness options that make up the current budget. A cost-effectiveness run is then used to determine budget options and the relative weights calculated that provide the most cost-effective budget when accounting for tradeoffs. Alternative performance strategies reflected through changes in performance measure weights are then considered to see what changes result in a better cost-effective budget.

4.4.1 Essential Inputs

The essential inputs to goal programming are the performance measures; however these can be assigned preference weights depending on the national strategy. To underscore the importance of this flexibility to national coordination, if the national strategy were to escalate the importance of finding a budget strategy to reduce WUI Acres Burned, weights would be set accordingly to focus on measuring the impact of this change in focus, such as decreasing the relative weighting assigned to all other performance measures. Also through the use of weights, any of the supported performance measures may be removed from goal programming cost estimation, in support of nationally-coordinated business direction. Specifically, a weight or zero indicates that a given performance metric exhibits no preference rank on the production of the budget estimate (i.e. that performance metric has essentially been excluded from the goal programming and is not a factor in the production of the cost estimation). Likewise, performance metrics that are given non-zero weights are assigned those weights in a relative manner depending on which performance metric factors more into the best budget estimation.

4.4.2 Strengths

- **Weights Enable Good Estimates.** The current system of applying preference weights to performance measures as needed enables the estimates to focus on the more robust, or more accepted aspects of the performance metrics.
  - For example, when Goal Programming was used to recently inform the budget formulation process, some of the performance measures were assigned a weight of zero and thus given low preference.
- **Meets Intent of Hubbard Report and OMB guidelines for cost effectiveness analysis.** The inclusion of suppression costs as a performance metric and the weights enable the relative importance of different resources.
- **Proven Methods and Sound Science.** Goal Programming and cost effectiveness are an old technology based on time proven and well-used models.

4.4.3 Deficiencies

The principal limitation of goal programming is that it is a model and that any sources of uncertainty that are present in the inputs will be translated through the model. Specifically, limitations apparent with the separate modules will propagate into goal programming. Goal programming is not designed to fix or correct for problems arising in earlier modules and such limitations, such as lack of spatial data or inaccuracies arising from WUI and HVR layers. These inaccuracies are not a limitation of goal programming per se but rather arise due to the quality of data output from the modules it relies on.

Additional deficiencies include:

- The inherent uncertainty within the inputs produces estimates with large amounts of uncertainty.
- Firefighter safety is not included in the formulation of the budget estimates.

4.4.4 Recommendations

To support improvements to Goal Programming, improve the inputs from the performance metrics. The HVR layer is one such example. This could be improved through a better definition from WFLC via the

goals of cohesive strategy. Other new performance metrics, such as metrics relating to firefighter safety, should be considered and developed.

4.5 General Technical Observations and Recommendations

The following sections describe general observations and recommendations related to the Technical Review of FPA.

4.5.1 Observations

A common critique of the FPA Science team is that it has an appearance of "wandering" or having "lack of focus". Our review determined that this perception was a result of a lack of clear direction and was exacerbated by the FPA Science team not having access to critical components of the FPA system or not having the perceived freedom to replace components that they deemed to be failing to meet the objectives of FPA. Throughout the FPA process, the FPA science team has played a critical role in helping design and develop the system. However, the lack of clear direction has created roadblocks to their progress and early success.

A key historical issue with FPA was that it was not developed in a laboratory research and development (i.e. R&D) environment. For example, IRS was developed from a defined task order and immediately released and made available into a web-based environment to end-users, before scientists had the opportunity to assess inputs, test scenarios, validate outputs, or fix bugs. Improvements to FPA and related modules in the future need to occur within a laboratory R&D environment first.

There is broad agreement that the original performance measure of HVR is critical to the success of FPA and that this layer should be revisited within the FPA technical process. Most individuals expressed the concept of protecting HVR as a priority, regardless of what their definitions of HVR are. Others beyond the scope of FPA should be involved in improving the HVR layer, such as considering the beneficial effects of fire on HVRs. It is possible that the Cohesive Strategy would be a proper source for achieving a more respected HVR layer (or set of layers). Improvements to the inputs to IRS at the local level would improve the grain of information available to goal programming, and in turn would improve the results, which the agencies and bureaus can report.

4.5.2 Recommendations

Based on this technical review, we propose the following preliminary steps to improve the FPA science process.

- Shift the FPA science framework to a Research & Development (R&D) laboratory environment, including selection of independent but involved scientists from the wider wildfire science community who could help review and evaluate current and future science needs. These scientists would not replace the existing FPA science team, rather they would be intimately involved in the development of tools and techniques used in FPA and would be able to constantly question progress if things are needed or should be done in different ways. The Research & Development (R&D) laboratory environment would enable the FPA science team the opportunity to assess inputs, test scenarios, validate outputs, and fix bugs prior to widespread release of any future FPA module to the end-users.

Such an environment would allow the science team to work on updates or new modules and to only replace or adopt them in the system when they were ready.

- Provide the proposed Research & Development (R&D) laboratory environment funds to solicit the broader wildland fire science modeling community to conduct the science that was by-passed during the initial phases of FPA implementation.
- Develop a new version of the IRS module that is based on sound scientific theory and tested using scientific principals such as sensitivity analysis and validation. The fact that the IRS module is opaque has been and will continue to be problematic.
- Transparency of the methodology of the module, and its relationship to other FPA modules, is essential for the FPA science team, and in turn the rest of the FPA community.
- Revisit the Highly Valued Resource layer at the agency director level, with input from agency and external scientists. Define a common layer or system and implement that layer within FPA. This layer could be a critical driver of the IRS and LFM reasoning processes.

5 ASSUMPTIONS, CONDITIONS AND LIMITATIONS

This external independent review of technical and business processes was mandated by the 2009 GAO Audit (WILDLAND FIRE MANAGEMENT Interagency Budget Tool Needs Further Development to Fully Meet Key Objectives, November 2008, page 12), and was defined by the 2010 FPA Charter "to guide further program management," amidst the second of three FPA phases defined as follows:

- Phase 1: Ongoing Learning and Calibration
- Phase 2: Establish Confidence
- Phase 3: Establish Ownership and Full Implementation.

5.1 Assumptions

The intent "to guide further program management" is best understood in the context of the other specified Phase 2 activities:

"*The Interagency Analysis Team will validate and report confidence in the results of fire planning unit analysis and again following the results of goal programming and tradeoff analysis. Ongoing feedback from the Interagency Analysis Team, the planned external science review, and the Phase 1 and 2 milestones will provide the opportunity for the Oversight Group to confirm confidence in the results and recommend status and course of the program*" (Fire Program Analysis Charter, October 2010).

FPA specified the scope of this independent review around the following focal areas, where program management insight will guide the transition from Phase 2 to Phase 3:

Business Process Review Focal Areas

- Fire Preparedness Budget Formulation
- Governance
- Performance Measures and Goal Programming
- Stakeholder Expectations Management

Technical Review Focal Areas

- Fire Ignition Generator (FIG) Module Reviews
- Initial Response Simulator (IRS) Module Reviews
- Large Fire Module (LFM) Module Reviews
- Goal Programming Module Reviews

The intent to yield programmatic insight around a selected scope of topics did not fit with the goals and scope of rigor for The Standard CMMI (Capability Maturity Model Integration) Appraisal Method for Process Improvement (SCAMPI). Rather, an informal review methodology was employed that fit the following criteria:

- Evidence-based (on documents and interview findings)
- Quantitatively measured, using maturity ratings that are based on CMMI ratings
- Based on multiple sources of best practices.
- Scoped by topics of interest, vs. scoped by topics measured by a certified CMMI audit or appraisal

5.2 Conditions

- Aspects of CMMI that were retained include: “CMMI is a process improvement approach that provides organizations with the essential elements of effective processes, which will improve their performance. CMMI-based process improvement includes identifying your organization’s process strengths and weaknesses and making process changes to turn weaknesses into strengths” (as viewed by the Booz Allen team on January 06, 2012 on http://www.sei.cmu.edu/cmmi/).
- Maturity level ratings: Six capability levels (CL 0-5) measure an organizations process-improvement achievement for each predefined process area, to align evidences to maturity ratings (that quantify both strengths and gaps), and map to recommendations for improvements, for selected topics.

5.3 Limitations

- Because this review is not a formal CMMI review, the scores are not representative of a certified CMMI appraisal or audit.

The topics selected for the independent review belong to multiple process and capability areas that would be found in a more formal appraisal or audit. Still, the independent review required that, to satisfy a capability level for a process area, FPA must satisfy the specific goals and level for that process area as well as the generic goals for that same process area. This enables FPA to characterize improvements relative to an individual process area (instead of a set of processes across an organization, scoped by CMMI Staged Representation requirements). While less formal than a CMMI appraisal, the methodology behind the independent review allows for comparisons within an organization based on a process area by process area basis and therefore, allows for flexibility within FPA to focus on the particular processes related to Phase 2 focuses, as specified in the 2010 FPA Charter.

6 CONCLUSION

Purpose

This external independent assessment responds to the 2009 GAO Audit and FPA's Charter request and identifies the many successes of the FPA program to date. The review also identifies areas where improvements are necessary to continue to derive value from the investments made to create an integrated, interagency tool to inform wildland fire budget requests.

Key Considerations for the Next Phase of FPA

FPA must consider the impacts that the transition to the operations and maintenance (O&M) phase will have on the governance structure because the roles and responsibilities must be explained at the project management level. These additional definitions of roles and responsibilities will help mid-level managers better understand the situations in which they have the authority to make decisions without OG validation. On the other hand, the major enhancements that still must be implemented, as identified in the 2010 Charter (i.e., gridded weather, improvements to fuels management, including more spatial data, and an improved WUI/HVR layer), do require OG involvement, along with planning and communications to manage stakeholder expectations and ensure all users understand the reasons for the enhancements and changes being made.

Stakeholder Expectations Management and Communications

Managing stakeholder expectations is a critical area for FPA to consider moving forward, as indicated by the different perceptions of the various stakeholders and by the various definitions of O&M. As fire management evolves and major enhancements are approved, all stakeholders must understand FPA's plan of action, roles and responsibilities, and have a tracking mechanism for measuring the progress of these enhancements.

- **Impact Analysis.** An impact analysis for the budget thresholds could help field personnel better understand the effects of budget scenarios (e.g., 5% increase versus 7% increase). These types of analyses, coupled with documentation and easy-to-understand explanations of goal programming (what it is, how outputs are used to inform budgets), would help re-engage stakeholders and re-build the trust related to the FPA outputs that are being generated to inform the budget requests.
- **FPA major capability enhancements are needed** to support fuels management, after adding more detailed geospatial data, and national impact of weather. These enhancements are currently being discussed by the OG, and are described in the 2010 FPA Charter.
- **Communications and training** will be needed to describe what FPA will and will not do as it progresses through phases associated with capability enhancements.
- **Mid-level Formalized Project Manager Governance** will be needed to describe the roles, responsibilities, and scope of authority for mid-level managers making project enhancement decisions that affect regional and local staff.

FPA Modules That Are Ready for O&M (with Steady State Enhancements)

FPA as a system of systems is ready to move its LFM and Goal Programming modules into O&M, as they deliver steady-state, repeatable services. Enhancements envisioned during O&M include improvements related to weather data, the level of geospatial detail for fuels, and the ability to handle updates to the WUI/HVR data layers and the Acres Burned performance measures.

Primary enhancements include the following:

- **Gridded Weather.** Gridded Weather will help fire planning by providing higher quality inputs for goal programming. Although the current outputs yield valid results at a high (national) level, gridded weather resolution will improve the modeling effort and result in higher caliber inputs to goal programming.
- **Spatial Fuels Treatments.** Improvements to Spatial Fuels Treatments, in conjunction with better data for the WUI/HVR layer, will improve the measurement of performance for fires that cross state, tribal, and other borders. Spatial fuels treatment information will greatly enhance the usefulness of FPA data. This effort will require coordinating agreements across the five bureaus on how to improve the WUI/HVR layer.

FPA Modules That Are Not Ready for O&M

- **IRS:** IRS may be moved to O&M to continue to support national-level coordination, with the understanding of the limitations of its known range of confidence to fire planning and handling of multiple objective fires. Primary enhancements to fuels and weather have been proposed and work is currently being done to develop a model that can handle suppression in the context of multiple fire management objectives. When these enhancements are ready, testing should occur on IRS outputs in a laboratory environment, to avoid the lessons learned of testing new outputs on users instead of scientists; scientists expect to discover and resolve problems, while end users expect a working product. Once testing of IRS refinements occurs, along with the identified enhancements, it is recommended that FPA evaluate whether to replace IRS or release the enhancements to end users.
- **Module-for-Allocation-Support:** The FPA module that supports allocation decision-making is not ready to go into O&M because it does not exist yet. Development of a User Dashboard is being discussed to help provide information to inform allocation and help with fire planning at the local and mid-levels. Consensus needs to be reached on whether this is the module that will inform allocation of fire-fighting resources.

IRS Development Needs

FPA should consider developing a new version of the IRS module that is based on sound scientific theory and that is tested using scientific principles such as sensitivity analyses and validation.

A key challenge of IRS is the current lack of ability to handle multiple fire objectives. FPA is based on a suppression model, and does not cope with fire management for objectives other than suppression. FPA is looking at ways of dealing with multiple fire objectives within a suppression model format. Further examination of multiple objectives is needed because fire is increasingly being managed for objectives other than suppression

The fact that the IRS module is opaque has been and will continue to be problematic. Transparency in the methodology of the module, and its relationship to other FPA modules, is essential for the FPA science team, and in turn the rest of the FPA community. FPA also should determine if IRS should be rebuilt or simply converted into a cost index lookup table for each FPU. FPA would benefit from better documentation on how IRS feeds into the Large Fire Module.

Allocation Support Needs

FPA is not an explicit allocation tool. Leadership must decide if/how FPA can contribute to a new way of formulating and allocating a unified federal wildland fire budget. FPA will either remain a national, strategic planning budget tool, or it will continue to evolve and eventually become useful as a regional (FPU) allocation tool. Resolving the specific functions of FPA in the out years and communicating these to the broader FPA stakeholder base should be a top priority, which will help respond to guidance from the Hubbard Report, OMB, and GAO.

Use of FPA Outputs

The use of FPA outputs needs further definition by the customers of FPA in the Bureaus and Departments, to clarify whether FPA outputs will inform stove-piped budgets vs. actually prompt funding movement among the stakeholders in the Bureaus and Departments. A structured framework around FPA, to include field-level planning tools, would help facilitate a discussion between FPA and local and mid-level staff to evaluate the pros and cons of integration vs. opportunities for separate development.

FPA information has been used by the National Cohesive Wildland Fire Management Strategy, referred to as the Cohesive Strategy, authored by the Wildland Fire Leadership Council (WFLC). The Cohesive Strategy is "a collaborative process with active involvement of all levels of government and non-governmental organizations, as well as the public, to seek national, all-lands solutions to wildland fire management issues. The Cohesive Strategy will address the nation's wildfire problems by focusing on three key areas: Restore and Maintain Landscapes, Fire Adapted Communities and Response to Fire" (http://www.forestsandrangelands.gov/strategy/overview.shtml). While the Cohesive Strategy leverages FPA outputs, it also involves systems that do not need further integration or relationship with FPA. Further documentation, communications and training on this topic will help clarify where gaps in functionality would best be served by enhancements to FPA vs. other systems such as LANDFIRE, EMDS, and HFPAS, to name examples.

Formalized Systems Engineering Process

One of our key conclusions is that the FPA development process would benefit from applying a more formal "systems engineering" process. Wildfire in the United States is socially relevant and expensive, and for FPA to continue to improve requires a more formal process to guide further management and development. Exactly how a better systems engineering process might be developed is beyond the scope of this review, but such an improved process would help on many fronts. Clearly, there is much to do to improve stakeholder expectations.

Performance Measures

FPA provides scientific modeling of the impact of agreed upon performance measures across national "what if" scenarios. The use of weights is important in the current FPA offering, as it determines the relative impact of performance measurement on the modeled outcomes. This improves the reliability of the budgetary estimates, in response to consensus achieved as the national discussion evolves over time.

Goal Programming

FPA offers cost effectiveness analysis, as required by the intent of the Hubbard Report and OMB guidance. This is achieved through the suppression cost performance metric, and the use of weights to measure agreed upon performance metrics. FPA leverages the time tested discipline of goal programming, along with its set of models and tools, when offering cost effectiveness analysis.

Science Team

Last, we again commend the FPA science team, as they are responsive and work collaboratively to overcome many challenges throughout the course of program development. Their development of the Large Fire Module in a relatively short period of time is a prime example of what can happen if science guides the evolution of FPA. Clearly, wildfire will remain an ever-present and important social and ecological issue in the years to come.

Summary of Conclusions

FPA engages at the national level fire-fighting organizations that have operated fairly independently for over 100 years. The move to integrate budget planning across the Bureaus and Departments is a significant effort and represents a significant cultural change. Although imperfect, FPA has made considerable strides in achieving the Congressional mandate to introduce a layer of coordination across separate agency and bureau efforts, as evidenced by the use of FPA information to support the 2013 budget with empirical "what if" analysis with a known range of confidence. FPA has a science team that has proven its ability to overcome many challenges, and has produced a valuable historical fire occurrence data set not available elsewhere in the government, NGOs, or commercial sectors. The LFM and Goal Programming modules work well. The IRS module has challenges to overcome As FPA is set to go into O&M, the community needs to understand what enhancements are allowed in O&M, such as improvements to the geospatial detail of fuels, an updated WUI/HVR data layer and Acres Burned performance measures, and Gridded Weather. FPA will need to carefully select the terminology used to describe allowable O&M enhancements, because the term Optimization, often used by other Agencies to refer to O&M enhancements, has a very different connotation within FPA surrounding the Optimization vs. Simulation debate that occurred during the development of FPA. FPA has been increasing its communications to stakeholders, as evidenced by quarterly newsletters. FPA has a governance mechanism that works well for achieving consensus across the Agencies, Bureaus and Departments, although additional formal governance for mid-level project management still needs to be developed. There is no alternative to FPA for national coordination of fire investments to reduce risk and control costs at the national level.

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APPENDIX B: ACRONYM LIST

Acronyms referenced in this report include:

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BoD	Board of Directors
DAA	Designated Approval Authority
DOI	Department of Interior
EFETAC	Eastern Forest Environmental Threat Assessment Center
EMDS	Ecosystem Management Decision Support
FFPDS	Fire Program Decision Support System
FIG	Fire Ignition Generator
FPA	Fire Program Analysis
FPU	Fire Planning Unit
FSim	Fire Simulator
FSPro	Fire Spread Probability
FY	Fiscal Year
USFWS	U.S. Fish and Wildlife Service
GA	Geographic Area
GAO	Government Accountability Office
GP	Goal Programming
HFPAS	Hazardous Fuel Prioritization and Allocation System
IAT	Interagency Analysis Team
IIAA	Interagency Initial Attack Assessment
IRS	Initial Response Simulator
IST	Interagency Science Team
LFM	Large Fire Module
MAT	Management Advisory Team
ME	Booz Allen's Mission Engineering methodology
MEL	Most Efficient Level
NFMAS	National Fire Management Analysis System
NPS	National Park Service
OG	Oversight Group
OIG	Office of the Inspector General
OMB	Office of Management and Budget
OWFC	Office of Wildland Fire Coordination
PDS	Wildland Fire Planning Data System
SWT	Support Working Group
USFS	United States Forest Service
USDA	United States Department of Agriculture
WFLC	Wildland Fire Leadership Council
WUI	Wildland Urban Interface

APPENDIX C: OVERVIEW OF SYSTEMS AND DOCUMENTS RELATED TO FPA

The National Cohesive Wildland Fire Management Strategy

The National Cohesive Wildland Fire Management Strategy (Cohesive Strategy), dated March 17, 2011 used the Fire Program Analysis (FPA), information to conduct wildfire risk analyses. The Cohesive Strategy conceptual identified four basic options for affecting risk:

- Invest to prevent human caused ignitions
- Invest in fuel treatments
- Invest to build capacity in wildfire response
- Invest to protect values exposed to risk

To understand how each option might play out, the Cohesive Strategy 1) establish a historical point of reference, 2) develop an analytical capacity to examine the relative effectiveness of each option, and 3) project conditions into the future.

The Cohesive Strategy select FPA is an interagency effort that focuses on investment effectiveness. The analytical system designed and built to support FPA models the effectiveness of fire prevention programs, investments in preparedness resources, and landscape fuel treatments. Effectiveness is evaluated by examining various performance measures tied to the probability and intensity of areas burning within the analysis area and the suppression costs associated with responding to wildfires.

Landscape Fire and Resource Management Planning

Landscape Fire and Resource Management Planning (LANDFIRE) supports and informs natural resource management, as well as applications such as the: Cohesive Strategy, Wildland Fire Decision Support System (WFDSS), FPA, and HFPAS. LANDFIRE is a cooperative program between DOI and USDA's Forest Service (LANDFIRE Article, *"Opportunity to Improve Decision Support"*. May 2011).

The LANDFIRE data products are being used by the Cohesive Strategy in the science analysis, FPA in budget formulation and Allocation, WFDSS in geospatial data for spread and probabilities, and HFPAS to coordinate hazardous fuel funding. LANDFIRE data products are also being used by state, local and private entities including research and educational institutions (Briefing Paper, Wildland Fire Leadership Council, *"LANDFIRE–National Interagency Vegetation/Ecosystem and Fire/Fuel Mapping Program"*, October 2011).

Fuels changes due to wildfires and other disturbances on the landscape are represented in each update of the LANDFIRE fuels data. FPA uses the most current version of LANDFIRE data available for each FPU. FPUs should develop fuels prescriptions based on the fuel types found in the corporate fuels layer that FPA is using to represent their FPU. FPA is currently using LANDFIRE Refresh 2008 for the conterminous U.S., Alaska, and Hawaii. The LFM begins the process of creating the "fuels prescription landscape" file by modifying the current condition, or standard landscape file created from LANDFIRE (Briefing Paper, FPA Project Team, *"Understanding How Fuels Treatments Are Used in Fire Program Analysis (FPA)"*, October 2011).

Hazardous Fuel Prioritization and Allocation System

The Hazardous Fuel Prioritization and Allocation System (HFPAS) is a system used to help prioritize areas for funding of fuel treatment for the DOI and FS. It is a complex GIS weighted attribute system that is customized for DOI and FS application. The tool was developed because Congress wanted to know how and why fuel treatment decisions were made. (Presentation to the NWCG Smoke Committee by Jim Menakis, Forest Service Research and Development on "*Hazardous Fuel Prioritization and Allocation System (HFPAS), May 2009)*

In February 2011, DOI established the HFPAS as a common, transparent, and systematic process. HFPAS ensures the Department's Hazardous Fuels Reduction (HFR) funds are allocated to high priority projects in high priority areas. HFR funds are provided to the bureaus to mitigate risks from wildfire to communities and valued landscapes. HFPAS builds on the foundation of the past with HFRA, the National Fire Plan and the 10-year Comprehensive Strategy and aligns for the future with the FLAME Act and the mandated work and opportunities in the development of the National Cohesive Wildland Fire Management Strategy.

The Congress, GAO and OMB have called on the Interior budget leadership to "continue to improve their processes for allocating fuel reduction funds and selecting fuel reduction projects." The Department has committed to having "in place an interagency process that assesses local and state priorities with nationally common criteria to determine the highest priority projects in the highest priority areas." The DOI HFPAS will be used to establish the allocation of HFR funding within the Department into the future. The process will be based on a 4-year program of work that mitigates risk to communities and the environment while providing economic opportunities. All projects are proposed by local managers as a result of collaboration with appropriate other federal, state, tribal and local wildland fire management partners. Selected projects will score high in meeting Congressional and Secretarial priorities and will effectively and efficiently reduce risk to communities and the environment.

HFPAS includes the following components:

- Programmatic Funding,
- Ecosystem Management Decision Support (EMDS),
- Project Priority System (PPS),
- Management Considerations,
- Four-Year Program of Work,
- Annual Allocation,
- Bureau Implementation, and
- Evaluation and Process Adjustments.

Land and Resource Management Plans, Fire Management Plans

Federal wildland fire policy requires that every area with burnable vegetation must have a fire management plan (FMP). Each plan will be based on the area's approved land management plan; in the absence of such a plan, the FMP may stand alone. Wildland fire management planning activities and program components (e.g., fuels management, initial response, etc.) for each agency will be coordinated across administrative boundaries.

The fire management planning process and requirements may differ among agencies. However, for the following federal agencies, Forest Service (FS), Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), and the National Park Service (NPS), a common purpose of a fire management plan is to provide decision support to aid managers in making informed decisions on the management of wildland fires.

In addition, for the DOI agencies (BIA, NPS, USFWS and BLM), the FMP contains strategic and operational elements that describe how to manage applicable fire program components such as: response to unplanned ignitions, hazardous fuels and vegetation management, burned area emergency stabilization and rehabilitation**,** prevention, community interactions and collaborative partnerships roles, and monitoring and evaluation programs. The Forest Service will have related information in separate fire management reference documents.

Each FMP will evolve over time as new information becomes available, conditions change on the ground and/or changes are made to land/resource management plans. (“*Interagency Fire Management Plan Template*” April 9, 2009).

The Ecosystem Management Decision Support

The Ecosystem Management Decision Support (EMDS) system is an application framework for knowledge-based decision support of ecological assessments at any geographic scale. The system integrates state-of-the-art geographic information system (GIS) as well as knowledge-based reasoning and decision modeling technologies in the Microsoft Windows environment to provide decision support for a substantial portion of the adaptive management process of ecosystem management