



**Sonoma Technology, Inc.**  
*Air Quality Research and Innovative Solutions*

# **Project Management Plan**

Interagency Fuels Treatment Decision Support System

Prepared for

Joint Fire Science Program  
Boise, Idaho

October 2011

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# **Part 1: Software Functional Specifications and Project Work Plan**

## **Interagency Fuels Treatment Decision Support System**

STI-910901-3927

### **Prepared by**

Tami H. Funk  
H. Michael Rauscher  
Joan E. Larsen  
Stacy A Drury  
Paul W. Nuss  
Sonoma Technology, Inc.  
1455 N. McDowell Blvd., Suite D  
Petaluma, CA 94954-6503  
Ph 707.665.9900 | F 707.665.9800  
sonomatech.com

### **Prepared for**

Joint Fire Science Program  
3833 S. Development Ave.  
Boise, ID 83705

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Revision	Date	Who	Comments
Version 1.0	August 6, 2010	Tami Funk	
Version 2.0	January 14, 2011	Tami Funk	
Version 3.0	October 7, 2011	Mike Rauscher Tami Funk	



# 1. Overview of Project Scope

## 1.1 Introduction

Phase IV of the Software Tools and Systems Study began in June 2010. The goal of the first year's work in Phase IV was to complete Interagency Fuels Treatment Decision Support System (IFTDSS) version 1.0 by October 31, 2011. This project management plan describes the software functional specifications, work plan, and project management administration to complete Phase IV of the STS and the implementation of IFTDSS version 2.0 by October 2012.

This document describes the functional accomplishments that will expand IFTDSS version 1.0 to version 2.0. The IFTDSS development team plans to produce three versions of IFTDSS during this second year. They will be labeled versions 1.1, 1.2, and 2.0. This document has been organized to reflect the functional achievements for each of these versions. As the need arises, there may be more versions published before the final version 2.0. Versions 1.0, 1.1, and 1.2 will be hosted at STI's offices in Petaluma, California. The final version 2.0 will be transferred to a Government host agency computer system.<sup>1</sup>

Part 1 of this Project Management Plan describes the software functional specifications, and work plan to complete versions 1.1, 1.2, and 2.0 of IFTDSS. Part 2 addresses project administration.

### 1.1.1 Summary of IFTDSS Version 1.0

Version 1.0 of IFTDSS has been under development for the past year and four months and is scheduled for release in October 2011. Version 1.0 of IFTDSS will contain the following functionality:

- **Data Acquisition and Editing Work Flow:** a user can identify an area of interest, automatically acquire the corresponding LANDFIRE data for that area, and view and edit the data both spatially and non-spatially.
- **Prescribed Burn Planning Work Flow:** a user can choose from a broad range of options to model and analyze fire behavior and fire effects to plan a prescribed burn and then use that information to fill out the interagency prescribed burn template document leading to a publishable prescribed burn plan.
- **Hazard Assessment Work Flow:** a user can use the LANDFIRE data to perform a simple hazard assessment across the selected area of interest assuming constant weather and that every pixel will burn.

Version 1.0 of the IFTDSS will be released in two phases. In early November, version 1.0 will be released to the smaller group of test users and currently registered users. In January, after version 1.0 has passed the external quality control checks with the IFTDSS management team, it will be released to a broader group of potential new users (approximately 140 users).

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<sup>1</sup> The timing of the transfer of IFTDSS version 2.0 to a Government computer system is dependent on the time it will take to officially identify the agency. This is discussed further in Section 3.

### **1.1.2 Summary of Work Planned to Complete IFTDSS Version 2.0**

Following the release of IFTDSS version 1.0, we will focus on IFTDSS version 1.1, which will be released in January 2012. Version 1.1 will expand upon version 1.0 by including the first approximation risk assessment work flow and a work flow to allow users to assess different fuels treatment selections using the Fire and Environmental Research Applications (FERA) team's suite of tools, including the Fuels Characteristics and Classification System (FCCS). During the winter 2011/2012 time period, we will work with Janean Creighton of Oregon State University to conduct the impact study of IFTDSS version 1.0 and continue to collect user feedback regarding system functionality.

Following the release of IFTDSS version 1.1, we will focus on IFTDSS version 1.2, which will be released in June 2012. Version 1.2 will expand upon version 1.1 by enhancing the data acquisition and editing work flow to incorporate the use of treelist data and by updating the hazard analysis and risk assessment work flows to accommodate treelist data. In parallel with the software development effort, we will conduct, evaluate, and document the IFTDSS 1.0 user evaluation and impact study for the prescribed burn planning work flow. We will also develop the first complete draft of the software developer's guide, which will provide guidelines to scientific model developers for implementing models into IFTDSS.

Following the release of IFTDSS version 1.2, we will implement IFTDSS version 2.0, with the majority of software development effort focused on implementing the ability to simulate vegetation growth in the current condition landscape to simulate future conditions both with and without fuels treatments for a future growth scenario. This will involve implementing the Forest Vegetation Simulator (FVS) and three fuels treatment optimization models. In parallel with the software development we will conduct a user evaluation of the risk assessment work flow in IFTDSS 1.1 and will complete the online help system.

IFTDSS version 2.0 is scheduled for release and transfer to a Government host agency by October 2012. In order to meet the transfer deadline, a Government host agency will need to be identified by January 2012 (refer to Section 3.8 for more details).

## 2. Software Functional Specifications

This section describes the software functionality that will be implemented in versions 1.1, 1.2, and 2.0 of IFTDSS. It also describes the non-software development tasks that will be conducted in parallel with the software development. For a more complete and specific list of activities, refer to Appendix A at the end of this document.

### 2.1 IFTDSS Version 1.1

IFTDSS Version 1.1 will be released in January 2012. Version 1.1 will expand upon version 1.0 by including the first approximation risk assessment work flow and a work flow to allow users to assess different fuels treatment selections using the Fire and Environmental Research Applications (FERA) team's suite of tools including the Fuels Characteristics and Classification System (FCCS). Specifically, version 1.1 will include the following:

- **Risk Assessment Work Flow:** the risk due to fire as a disturbance agent will be calculated for the current vegetation conditions within an area of interest based on LANDFIRE data. Outputs will include ignition probabilities, the impact on values at risk (both positive and negative), the risk for each value identified separately, and a composite risk assessment output for all values at risk.
- **Fuels Treatment Selection:** the FCCS methodology will be used to develop a first version of a new work flow designed to assist the user in the selection of appropriate fuels treatments for their area of interest.

In parallel with the software development for version 1.1, we will develop and implement the IFTDSS 1.0 user release plan, which will require a user evaluation of version 1.0 (released in October 2011) and user feedback.

### 2.2 IFTDSS Version 1.2

IFTDSS Version 1.2 will be released in June 2012. Version 1.2 will expand upon version 1.1 by enhancing the data acquisition and editing work flow to incorporate the use of treelist data and by updating the hazard analysis and risk assessment work flows to accommodate treelist data. Specifically, version 1.2 will include the following:

- **Data Acquisition and Editing Work Flow:** the most significant new work to be accomplished in the data acquisition and editing workflow is to create the ability to upload, manage, and use Forest Vegetation Simulator (FVS) compatible treelist data. This new data in treelist format will come from two sources and will provide the following functionality:
  - NRIS FSVeg Spatial Data Analyzer software: ability to import data and maps in the format exported by the Forest Service fuels treatment specialists.
  - National Treelist Layer (NTLL) for the LANDFIRE data: ability to make this treelist data layer available to non-Forest Service IFTDSS users. Refer to Appendix B for more details regarding the implementation of the NTLL.

- **Hazard Analysis Work Flow:** update the hazard analysis work flow from version 1.1 so that users have the ability to use treelist data to perform the existing hazard analysis.
- **Risk Assessment Work Flow:** update the risk assessment analysis work flow from version 1.1 so that users have the ability to use treelist data to perform the current condition risk assessment.

In addition to the functional upgrades to the software, we will also complete the following tasks by June 2012:

- **Scientific Modeling Framework:** produce and publish a model developer's guide.
- **User Evaluation and Feedback:** conduct, evaluate, and document the IFTDSS 1.0 user evaluation and impact study for the prescribed burn planning work flow.

## 2.3 IFTDSS Version 2.0

The most significant expansion of functionality beyond IFTDSS 1.2 will be creating the ability to simulate vegetation growth in the current condition landscape to represent conditions with and without fuels treatments for the future scenario. Providing the users the ability to simulate current and future treatments allows for the evaluation of different management alternatives to reduce overall risk due to fire disturbance events. Specifically, version 2.0 will include the following:

- **Data Acquisition and Editing Work Flow:** allow users to edit the LANDFIRE national treelist layer with more representative local treelist data when available. Allow users access to weather data to support variable weather during hazard and risk analyses as well as gridded wind data to allow for more flexible simulation of winds over time. Allow users to identify fuel loadings using the digital photo series.
- **Spatially Explicit Fuels Treatment Assignment Work Flow:** allow users to simulate vegetation growth, simulate fuels treatments as manually placed by the user, and simulate fuels treatments as optimized by three different software modules to allow multiple comparisons of treatment locations.
- **Fuels Treatment Effectiveness Over Time Work Flow:** allow users to design a broad range of fuels treatments strategies and evaluate their effectiveness over time for the various vegetation/fuel conditions in which they might be applied. The results of this work flow will inform the user on which treatments might work best in the Spatially Explicit Fuels Treatment Assignment Work Flow above.
- **Hazard Analysis and Risk Assessment Work Flows:** allow users to simulate fire growth over a landscape with various ignition patterns in both the hazard and risk work flows. Allow users to integrate data from the spatially explicit fuels treatment assignment work flow to allow evaluation of treatment assignments, hazard, and risk. We will develop user interface tools to allow users to easily extract the significant messages from these multiple datasets.

In addition to the functional upgrades to version 2.0 of the software, we will also complete the following tasks:

- **Scientific Modeling Framework:** IFTDSS version 2.0 is to be deployed to a Government server. For this to happen, a sponsoring Government agency needs to be identified. The collaboration components of the modeling framework will be developed and will include:
  - the ability to publish, view, and copy other users' published projects into your own project area and the ability to identify other users working within your geographic area or working circle.
- **User Evaluation and Feedback:** We will conduct a user evaluation of the risk assessment work flow in IFTDSS 1.1 to determine what changes need to be made to make the work flow truly useful to field users. We will develop and implement an IFTDSS 2.0 user release plan; add the ability to review results of the risk assessment work flow evaluation; and determine what can be done within the scope of the project to improve this work flow further.
- **Online Help System:** The final (and significantly large) segment of work is to develop the Online Help system for IFTDSS version 2.0. This process is continuous and ongoing throughout the development year, and online help will be updated corresponding to the functionality implemented in each release. The necessary and appropriate material will be incorporated into the Online Help system by the time of release for each IFTDSS version (1.1, 1.2, and 2.0).

## 2.4 Data and Models

**Table 1** lists the fuels data and models that are targeted for implementation in the IFTDSS and the work flows that each support(s).

**Table 1.** Fuels data, models, and supported work flows expected to be implemented in IFTDSS. The X's indicate which data and software applications will support each work flow.

Data and Software Applications	Data Acquisition and Preparation	Hazard Analysis	Spatially Explicit Placement of Fuels Treatments	Fuels Treatment Effectiveness Over Time	Prescribed Burn Planning	Risk Assessment
LANDFIRE data	X	X	X	X		X
Treelist data (FSVeg, NTLL)	X	X	X	X		X
Fuelbed data (FCCS)	X			X	X	
Digital Photo Series (DPS)	X				X	
Stand Visualization System (SVS)	X		X	X		
Forest Vegetation Simulator (FVS)	X	X	X	X		X
FireFamily+	X	X			X	X
Wind Ninja	X	X			X	X
Fuel Characteristic Classification System (FCCS)		X			X	
FlamMap		X			X	X
FlamMap-Minimum Travel Time (FlamMap-MTT)		X				X
OptFuels			X	X		X
FlamMap-Treatment Optimization Model (FlamMap-TOM)			X	X		X
Fire and Fuels Extension to the Forest Vegetation Simulator (FFE-FVS)			X	X		X
Fire Behavior (SDK) modules as implemented in BehavePlus (IGNITE, SURFACE, SPOT, SIZE, SCORCH, SAFETY, CONTAIN)					X	
Consume					X	X
First Order <i>Fire</i> Effects Model (FOFEM)					X	X
Fire Emission Production Simulator (FEPS)					X	X
FARSITE		X				X
RANDIG-FlamMap		X				X

## 3. Project Work Plan

This work plan describes the work activities by task that will be undertaken to complete IFTDSS development for versions 1.1, 1.2, and 2.0. This phase of work begins with the development of IFTDSS version 1.1. As new versions of IFTDSS are released, we will continue to inform more and more stakeholders concerning the capabilities of IFTDSS and thereby expand the use, critical review, and opportunity to collect stakeholder feedback. The specific objectives of this project are to

- Document technical design specifications for the complete IFTDSS application, including the work flow scenarios and the service-oriented architecture (SOA).
- Maintain an evolving version of the IFTDSS beta-test application for use by the stakeholder community.
- Develop a version of the IFTDSS application for use by the fuels treatment community that supplies commonly used software models, data, and tools within an organizational structure that is capable of performing analyses for fuels treatment planning
- Assist in the deployment of the IFTDSS application at a Government agency yet to be identified.

This work will continue to be conducted in eight tasks:

Task 1 – Project management

Task 2 – Stakeholder community interaction and involvement

Task 3 – System analysis and design

Task 4 – System implementation

Task 5 – System acceptance test plan

Task 6 – Technical support

Task 7 – Documentation and training

Task 8 – Technology transfer

### 3.1 Task 1 – Project Management

This task includes overall planning, management, and progress reporting for the project. In addition to the information provided in the other sections of the IFTDSS Project Management Plan, this section describes plans for travel approval and management, biannual management review, progress reports and invoicing, and subcontractors.

### 3.1.1 Travel Approval and Management Plan

When project-related travel is required, the STI PM, Tami Funk, will send a travel request email to the BLM CO, Kathy Colson, and the FS COTR, Brad Harwood. The travel request will include the following information:

Name(s) of the person(s) requesting travel

Travel dates

Purpose of the travel

Estimated travel costs including per diem expenses

Brad Harwood will review and provide an approval recommendation to Kathy Colson, who will officially approve the travel. Kathy Colson will send an email back to STI with the official travel approval. STI may then book travel arrangements. Following the project travel, STI will submit travel expense receipts to Brad Harwood and Kathy Colson.

### 3.1.2 Biannual Management Review Plan

Biannual management reviews will be conducted approximately every six months during the last year of the project (October 2011 through October 2012). The purpose of the biannual management review meetings is to examine the project's progress approximately every six months and to update the project advisory board about the project status. The project advisory board will be given the opportunity to ask questions and to discuss any issues or other topics that warrant discussion and/or decision. The meetings will be conducted over two days in Boise, Idaho, and two members of STI's project team will attend. The approximate biannual management review schedule is shown in **Table 2**.

**Table 2.** Schedule for biannual management review meetings.

Meeting	Approximate Date(s)
Meeting 1	December 14-16, 2010
Meeting 2	September 13-14, 2011
Meeting 3	March 2012
Meeting 4	September 2012

### 3.1.3 Project Progress Reports and Invoicing Plan

STI will generate monthly invoices and project progress reports that will be sent to Kathy Colson and Brad Harwood, who will then forward them to John Cissel and Becky Jenison for review and payment. Each monthly progress report will contain a summary of

- Task status to date
- Work performed by task during the last work period

- Deliverables completed during the last work period
- Project budget status to date
- Work planned for the upcoming work period
- Travel completed during the last work period
- Expected travel for the upcoming work period
- Outstanding actions awaiting authorization
- Any issues encountered
- A project schedule and work status to date
- An updated work breakdown structure

### **3.1.4 Subcontractors**

STI is authorized by the Government to subcontract work if and when needed. For example, STI may need support from the science model developers who contribute data and/or tools to the IFTDSS. If STI requires assistance from individual(s), STI may establish a subcontract with the individual(s) to financially compensate them for their time. If the subcontractor is a Government employee, STI may not provide financial compensation, and the Government will handle any associated travel expenses.

## **3.2 Task 2 – Stakeholder Community Interaction and Involvement**

Six stakeholder groups were identified in prior phases of IFTDSS development: (1) the Governance Community, (2) the Scientific Model Development Community, (3) the Database Steward Community, (4) the Fire and Fuels Management Community, (5) the Information Technology and System Maintenance Community, and (6) the IFTDSS Coordination Team. STI will continue to interact with the IFTDSS stakeholder communities as directed in the IFTDSS communications and outreach strategy.

In August 2010, Mike Rauscher and Tim Swedberg revised the IFTDSS communications strategy and continued to give presentations and talk with various stakeholder communities. The current plan builds on what was learned in Phases I through III and provides a new strategy for interacting with the new JFSP-sponsored Regional Consortia. For the past several months, outreach for IFTDSS has slowed for two main reasons: (1) to allow time for a host agency to be identified, and (2) to allow the software to mature. In the coming weeks and months, Mike Rauscher and Tim Swedberg will revisit the communication strategy and determine how to proceed with the Governance community, the IT community, and the System of Systems (SoS) community. Stacy Drury will continue to lead outreach efforts with the model development community and the test user groups.

### **Governance Community**

- Mike Rauscher, Eric Christiansen, and Tim Swedberg will determine an approach for interacting with the Governance community.

### **Scientific Model Development Community/Database Steward Community**

- Interactions with specific science developers and database stewards will be shaped by the models that are needed for IFTDSS over the next two years.
- Stacy Drury and Mike Rauscher will continue to identify the data, applications, and processes to be included in IFTDSS, and that information will be used to develop a list of individuals to contact and a schedule of when the contacts should be made on an ongoing basis.
- Select members of the IFTDSS team will attend a meeting at the Missoula Fire Lab in early November 2011 to discuss the “Fire Bricks” concept paper drafted by Pat Andrews and to discuss future collaboration with model developers.
- Mike Rauscher has produced an initial draft of a Developer Guide in cooperation with STI software engineers that explains how a scientist/developer can successfully interact with the IFTDSS program. The draft will provide technical guidelines and best practices for building software modules that can be accessed by IFTDSS. We will be expanding upon this initial draft of the developer guide to produce a more complete guide by January 2012.

### **Test User Group/Fire and Fuels Management Community**

- Stacy Drury will work closely with the test user group to evaluate the new work flow implementations and to help manage feedback from the user community.
- Janean Creighton of Oregon State will conduct an impact study of IFTDSS version 1.0 beginning in the winter of 2011/2012. Mike Rauscher will assist Janean on the impact study.
- The following list outlines the outreach plan for the IFTDSS version 1.0 release (October 2011), immediately following the release of version 1.0:
  - An email will be sent to the broader registered user group (people who have set up accounts). The email will inform users that an updated version of IFTDSS is ready for viewing and will contain information about new features added to the system since version 0.4. The email will also inform users that there will be an upcoming demonstration webinar(s).
  - Following the 1.0, 1.1, 1.2, and 2.0 releases, we will periodically contact the larger group and invite people to provide feedback. Stacy will host webinars throughout the year to demonstrate new features as they are developed.
  - Stacy will follow up with people who show interest or who have been actively using IFTDSS.
  - A separate email will be sent to the smaller prescribed burn test user group to announce the release of version 1.0 and to discuss changes made to the system based on the feedback they provided. Stacy will follow up with each of them to confirm that the enhancements that have been made to the system are adequate for completing a burn plan. Stacy will then conduct a webinar(s) with the test user group

- to step through the prescribed burn planning process and note areas for possible future improvement.
- Stacy will reconnect the prescribed burn test user group with Janean Creighton following his initial interactions after the release of version 1.0.
  - Following the initial version 1.0 outreach campaign, Stacy will visit 5 or 6 people in the field to see how they are using the system and to collect feedback (similar to what was done to verify the prescribed burn plan work flow). This group could consist of new people or a mix of new and old. These onsite interviews would build on what was accomplished in the prescribed burn planning site interviews. Interviews will be conducted as new work flows are released to identify whether they were useful to land managers.
- The following list outlines the outreach plan for the IFTDSS version 2.0 release (October 2012):
    - We will follow the roll-out approach for version 1.0 for the broader group as described above (i.e., an email followed by a webinar).
    - We will identify a new, smaller test user group that we can interact with on a more detailed level to collect feedback on the new work flows added to IFTDSS.

### **Information Technology and System Maintenance Community**

- A new strategy for interacting with the IT community will be determined during the winter of 2011/2012.

### **System of Systems Cooperation**

- In March 2010, Mike Rauscher organized and conducted a meeting with the SoS stewards to discuss the technical issues that hinder the integration among these systems (e.g., WFDSS, BlueSky), ways to make the systems interact better, and the adoption of interoperability standards.
- Discussions have been ongoing with Sim Larkin to identify collaboration points between IFTDSS and BlueSky. These discussions will continue as the next generation of BlueSky is developed.
- Mike Rauscher and the SoS team will continue to discuss suggested standards and operating procedures with the National Wildfire Coordination Group (NWCG) governance group to acquire NWCG endorsement and facilitate the use of each system.

*Deliverables:* Community interactions and support

## **3.3 Task 3 – System Analysis and Design**

Task 3 involves (1) the development of an Information Technology (IT) Security Plan and (2) analysis and design work to continue to refine and design the work flow scenarios that will be implemented in IFTDSS. The existing conceptual and technical design specifications were developed in collaboration with the IFTDSS Application Steward, the Fire and Fuels

Management Community, and the Scientific Model Development Community. STI has used this existing documentation as the foundation to develop the design specifications for the work flows that will be incorporated into the fully implemented IFTDSS application. Collaboration between the COTR, the IFTDSS Business Steward, the IFTDSS Application Steward, and the stakeholder communities will continue throughout the development and implementation of IFTDSS.

### **3.3.1 IT Security Plan**

Brad Harwood and the STI software development team have developed an initial draft of the IT Security Plan, which will be used to roll out production version 2.0 of IFTDSS. Design changes may be required to allow IFTDSS to run on the Government-designated server system. STI will consider the technical architectures (hardware, operating systems, office software, networks, etc.) available at the designated Government computer center to ensure that IFTDSS can operate effectively within these constraints.

### **3.3.2 Design Specifications**

Stacy Drury will continue to work with Mike Rauscher and the software development team to refine and document the IFTDSS science design specifications for the decision support work flow scenarios (software design will be documented in other tasks). The specifications will include a set of well designed and tested use cases, which will be used during development, testing, and implementation of IFTDSS.

Conceptual and scientific designs will be developed for each new functional feature and work flow prior to software implementation of the features described in Section 2. While every feature added to IFTDSS requires design effort, the bulk of the effort in the upcoming year will be focused on acquiring the data and tools needed for each work flow enhancement, and on the design of the work flows described in Section 2.3.

## **Translation Process**

The process for translating the functional work flow designs into software design is as follows:

- Mike Rauscher and Stacy Drury will work with developers and users to refine work flow scenarios and requirements.
- The work flow scenarios and requirements will be sent to the FMC subcommittee and John Cissel.
- After review and approval, the work flow functional specifications will be given to Paul Nuss and the development team.
- The development team will design and implement work flows.
- The development team will release versions of IFTDSS for internal testing.
- After internal testing is complete, the software will be released to the test user group for feedback.

- The test user community will review the system and provide feedback.
- The feedback will be logged into JIRA and reviewed by STI.
- Feedback reports will be provided to Mike Rauscher and Brad Harwood, and feedback will be prioritized
- Brad Harwood will provide direction to STI regarding what feedback should be addressed – this will be documented as well.

### 3.3.3 System Test Plan

Stacy Drury will work with the STI development team and Brad Harwood to develop a system test plan that describes and governs the software testing to be performed by STI during the IFTDSS development process. This testing will focus on the science-based functionality of the system; for example, whether the model predicts fire behavior appropriately across the landscape. This should not be confused with the system acceptance testing discussed in Section 3.5.

*Deliverables:* IT Security Plan; Updated IFTDSS Design Specifications

## 3.4 Task 4 – System Implementation

STI will continue to develop the IFTDSS using an iterative, agile development methodology that produces a version of the software and work flow scenarios within a regular software development cycle referred to as a sprint. A period of user testing and feedback will follow the initial release of each scenario, followed by periods of rework and retesting. The entire development and review cycle will be approximately three to four months and will be focused on the functionality described in Section 2.

The software development team will develop recommendations and “best practices” guidelines for future software modules. We will work with the science/software developers at the Seattle and Missoula Fire Labs and the stewards of other large systems such as WFDSS and the BlueSky Framework to develop these recommendations and guidelines. A library of modules within IFTDSS will be documented and managed throughout the development process.

### 3.4.1 User Feedback

User feedback will be collected through face-to-face field interviews and through the email link within the IFTDSS GUI. The following general process will be used to manage user feedback:

- User feedback is submitted and logged into STI’s software tracking system, JIRA
- User feedback is personally acknowledged via email by Stacy Drury
- Feedback is periodically reviewed and assessed
- A report of user feedback is provided to Mike Rauscher and Brad Harwood quarterly
- Mike Rauscher and Brad Harwood determine how to address user feedback and provide direction to STI

- The FMC subcommittee reviews requests that lie outside the scope of this project and decide how to handle them

### 3.4.2 System Testing

STI has developed a test plan (Section 3.3.3) that describes procedures for software quality control (QC) and system testing. Use cases and test data sets are developed to aid in the testing process. STI will work with the developers of the software that will be implemented in IFTDSS to acquire test data sets when they are available. When they are not available, STI will develop test data sets for software unit testing and for scientific validation testing of the model outputs. Software code and unit testing will be performed concurrent with system development. See Section 3.5 for a discussion of user acceptance testing.

### 3.4.3 Technical Documentation

During the development of IFTDSS version 1.0, STI produced draft technical documentation for the system; the documentation is considered a work in progress and will be updated as needed throughout the development of version 2.0. The software installation documentation cannot be drafted until a Government host agency has been identified.

STI has developed a component listing for the system design to be included in the IFTDSS Design Specification. The purpose of the software component listing is to provide software developers with the information needed to maintain or make modifications or changes to the system. System design component documentation includes the following information:

- User/system interaction tables
- Data models
- Data dictionary consistent with the NWCG NWFEA standards to the extent possible, given the availability of the NWFEA standards at the time the work is performed
- Dataflow diagrams
- User interface specifications
- Data migration requirements and specifications
- Business rules to be deployed in the application

STI has written a Software Configuration Management Plan for IFTDSS, which includes

- A plan to ensure that all constituent software tools and databases are, and remain, the tools and databases of “record” and thus the official versions. If official versions of these tools and databases do not exist, STI will work closely with the IFTDSS project team to identify suitable versions to use.
- A change-control plan that includes information about the development, test, and production environments with appropriate isolation between these environments to ensure that production data and production schedules are not adversely affected by development and testing activities.
- A plan for code version management (note that STI will transfer the latest source code to the Government when needed) and document version management to ensure that

iterative versions of development, test, and production environment software and documentation can be tracked and retrieved as required.

Once a Government host agency has been identified, STI will write and maintain installation documentation for the production release 2.0 of IFTDSS to include a minimum of

- Documentation of the minimum network, system hardware, and operating system specifications required to support a multiuser environment for IFTDSS.
- Documentation of the process required to install new versions of software in development, test, and/or production environments.
- Documentation of the process required to “roll back” to a previous version of software in development, test, or production environments.

STI has drafted system development specifications to include standard software development practices and application consistency standards. The documentation will contain

- Variable naming conventions
- Commenting standards
- Code sharing standards
- Consistency standards

*Deliverables:*

- An SOA framework that supports IFTDSS
- IFTDSS releases 1.1 and 1.2 hosted by the STI website for use by the test user group
- IFTDSS release 2.0 to be deployed to a Government server
- Final design component documentation
- Final Software Configuration Management Plan
- Draft and final installation documentation
- Software Development Practices and Application Consistency Standards Document

### **3.5 Task 5 – System Acceptance Test Plan**

Mike Rauscher had developed the first draft of an acceptance test plan that will be updated as needed throughout the development of IFTDSS version 2.0. The acceptance test plan addresses the following:

- User acceptance of interface design and performance efficiency
- Validation of data and results generated by algorithms and work flow scenarios
- Acceptable system performance under multiuser loading, including network load distribution and response for different bandwidth connections
- Flexibility of the IFTDSS software architecture to link several new software base models into the system
- Verification of system security requirements

The purpose of the System Acceptance Test Plan is twofold. First, the plan lays out the process by which each new release of IFTDSS, beginning with version 1.0, will be delivered by STI to the Government. It is then the responsibility of the Government team to test, critique, and

finally accept the release as having met the contract obligations. The second purpose of the System Acceptance Test Plan is to provide a process by which the NWCG Fuels Management Committee (FMC) can certify that the fuels treatment work flows offered within IFTDSS provide a scientifically and managerially acceptable tool for agency fuels treatment planners and analysts to use in their formal and accountable work. In short, the FMC will certify that a particular work flow and the way it is implemented provide a scientifically credible and managerially acceptable fuels treatment analysis and planning process.

*Deliverable:* Final System Acceptance Test Plan

### 3.6 Task 6 – Technical Support

The technical support task is dependent on the identification of a Government host agency. Once an agency has been identified, STI will provide the Government with technical support, including a project conference phone and Internet connection, support for web-based joint application design (JAD) sessions, and system support for testing and training. Specifically, STI will

- Conduct webinars for the FMC following each IFTDSS software release
- Host JAD sessions with the NWCG IFTDSS subcommittee following each IFTDSS software release
- Conduct an in-person meeting with members of the test user group

The existing FRAMES STS Study website will be used to provide information to the IFTDSS stakeholder communities.

The Government will provide the project team, the Science Model Development Community, and the Science Community with access to a Help Desk, beginning with the initial beta system release and continuing until the end of the project.

STI will provide technical support to the Government during system deployment to validate that the system software is operational and functioning properly and to assist with problem resolution.

Support levels:

- First level: help desk
- Second level: system administrator
- Third level: contractor

*Deliverables:*

- Technical Support Plan
- Project phone and Internet support
- Support for joint application design sessions (similar to past development efforts)

### 3.7 Task 7 – Documentation and Training

This documentation and training task consists of three subtasks:

1. Develop marketing materials to advertise IFTDSS training opportunities;
2. Develop training material to populate the IFTDSS online help system, to train Help Desk staff and users; and
3. Conduct training through webinars, workshops, and other methods.

#### Develop Marketing Material

In this task, STI will develop marketing material to let potential users know about IFTDSS training opportunities. For example, STI will develop and provide content to Mike Rauscher to include in a monthly stakeholder project status report and/or conference/workshop promotional materials. The status report will provide a brief narrative about training accomplished during the month and training plans for the coming months. Promotional materials may include PowerPoint presentations, software demonstration materials, brochure content, and posters. Examples of content include a description of the IFTDSS (current and planned functionality); overview of current tools, models, and modeling capabilities in the IFTDSS; and the benefits of the IFTDSS to the user community.

We have assumed that up to one set of presentation materials, demonstration materials, or posters will be provided per month.

#### Develop Training Material

Prospective users will need training on how to use the IFTDSS (e.g., step-by-step instructions including installation and administration) and about the scientific thought process needed to most effectively use the models within the IFTDSS (i.e., technical content about the models). In demonstrations of the proof-of-concept IFTDSS, we found that walking through case studies was an effective training approach.

STI will develop training material to be used in training system users and the Government User Help Desk staff. Application training materials developed in this task will include a user-focused online help system, online training content (e.g., a tutorial posted to the web), and webinar content. Training material will be developed to assist the Help Desk staff in understanding how to use the IFTDSS. Technical documentation regarding the IFTDSS server and client hardware installation and system administration will be developed and supplied under a separate Task.

STI has been working with the FMC to support Government efforts to establish a standard fire-training module for IFTDSS. Several ideas have been discussed and proposed; however, at this time we are awaiting guidance from the FMC on how to proceed with training.

## Conduct Training

We will assist the FMC in IFTDSS training as directed by the FMC and within the scope of this contract. Training will be initially conducted in two ways: (1) in person at selected meetings, and (2) interactively via webinar. As the system is developed, we will work with the FMC to incorporate IFTDSS into other training forums. We have assumed up to five in-person training sessions during the two-year contract. These in-person training sessions will be based on one set of training materials. For in-person training, we assume attendees will have their own computers and an Internet connection. Class size will be limited to the number of computer workstations. A class size of less than 12 works best with one instructor, while a larger class requires two instructors. We will supply an agenda prior to training sessions. Handouts of lecture material (typically presentation slides) will be provided to attendees.

The Government will be responsible for the production of professional quality training manuals and materials.

### *Deliverables:*

- Final documentation and training plan and schedule
- Application marketing materials
- System administrator training
- Online help and corresponding documentation
- Assistance with the development of FMC training materials

## 3.8 Task 8 – Technology Transfer

Under the original contract initiated in June 2010, STI had proposed to implement the IFTDSS over a two-year period with two versions of IFTDSS that would be transferred to a Government host agency computer system. The first version, IFTDSS 1.0, was to be transferred to the Government in June 2011 and the second, IFTDSS 2.0, was to be transferred in June 2012. Under the recent contract modification, the delivery date for IFTDSS has shifted to October 2012. At this time, a Government host agency has not officially been identified. In order to meet the requirement that IFTDSS version 2.0 be transferred to a Government computer system, a Government host agency should be identified by January 2012 at the latest.

**Table 3** lists the tasks required to complete the technology transfer and an approximate timeline for completion. Note that this timeline is somewhat aggressive and assumes frequent interaction and responsiveness from the Government IT staff at the host agency. If a host agency is not identified by January 2012, it is unlikely that we will meet the October 2012 transfer deadline. Once a host agency has been identified, STI will develop and maintain a system implementation plan which describes a plan and process for transferring IFTDSS version 2.0 to the Government.

**Table 3.** List of tasks and estimated timeline to transfer IFTDSS version 2.0 to a Government host agency.

Tasks	Who	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Decision on Host Agency		■											
Gather Requirements on Security	Host Agency-STI		—■										
Incorporate security changes into IFTDSS	STI				—■								
Update IFTDSS Implementation and Migration plan	STI					■							
Prepare hardware and network infrastructure	Host Agency				—■								
Create release (V1.n) for Agency	STI						■						
Install release (V1.n) on Agency test system	Host Agency-STI							■					
Train Administrators	STI							■					
Test and gather feedback	Host Agency-STI							—■					
Incorporate feedback into final release	STI								—■				
Create V2.0 release for Agency	STI									—■			
Install release (V2.0) on Agency test system	Host Agency-STI										■		
Install release (V2.0) on Agency production system	Host Agency-STI											—■	
Package source code and documentation and turn over to Host Agency	STI										—■		■

Throughout the software development effort, STI will continue to make IFTDSS releases available to the test user group. STI will supply the hardware and software necessary to host IFTDSS in a multiuser environment through October 2012.

Once a Government host agency has been identified, STI will work with Government IT staff and the project COTR to provide system administration and support from the beginning of the transition process through the end of application development and final implementation of the production version. Assuming a Government host agency is identified by January 2012, we envision transferring a copy of IFTDSS version 1.0 to Government servers as a migration test case to identify any issues prior to transferring version 2.0.

In collaboration with the host agency IT staff and the project COTR, STI will produce an IFTDSS Software Migration and Implementation Plan that describes in technical detail how IFTDSS will be set up and configured on the Government server. This plan will be evaluated and approved by the IFTDSS Project Team and representatives of the Government server administration. STI will work with the Government to design and implement a migration plan that will provide the Government with the ability to independently operate IFTDSS.

*Deliverables:*

- Operational production version of IFTDSS (v 2.0) on the Government production environment
- System Migration and Implementation Plan
- Functionality to add base models to the SOA
- Functionality to communicate with other SOA systems

## Appendix A. Functional Task List for Year 2 of Phase IV Software Tools and Systems Study

Priority	Task Name
<i>Data Acquisition Work Flow</i>	
1	Ingest output from FSVeg Analyzer
1	Develop NTLL with LANDFIRE
2	Acquire and manage weather data (FireFamily+)
2	Create gridded wind file (WindNinja)
3	Ingest NTLL layer
4	Allow users to identify fuel loadings using digital photo series
<i>Hazard Analysis Work Flow</i>	
2	Convert treelist data to lcp style
3	Simulate fire growth (FARSITE or MTT)
<i>Risk Assessment Work Flow</i>	
2	Convert treelist data to lcp style
3	Simulate fire growth (FARSITE or MTT)
<i>Spatially Explicit Fuels Treatment Assignment and Simulation Work Flow</i>	
3	Simulate fuel treatments
3	Simulate veg growth over time
3	Treatment optimization (TOM, OptFuels, and LTD)
<i>Fuels Treatment Effectiveness Over Time</i>	
3	Simulate veg growth and treatment over time (FVS)
3	Visualization of veg stands (SVS)
<i>General Software Framework</i>	
2	Produce model developer's guide
4	Ability to publish, view, and copy other users' published work
4	Ability to find other users in your area of interest
4	Integration and deployment with the Host Agency
<i>User Evaluation and Feedback</i>	
3	Conduct V1.0 Risk Assessment work flow evaluation
4	Develop and implement V2.0 user release plan
<i>Online Help</i>	
	Update/enhance overview material
	Context sensitive help as appropriate
	Help desk information
	Work flow documentation for treatment placement and durability work flows
	Models and components
	Case studies (examples)
	Functional comparison of IFTDSS to other component systems



## Appendix B: Strategy for Bringing Treelist Data and the FVS Simulation Model into IFT-DSS

### FVS Compatible and Spatially Explicit Treelist Data Acquisition

We are now ready to bring FVS compatible and spatially explicit treelist data into the IFT-DSS. By “spatially explicit treelists” we mean stand exam data that are tied to a specific mapped polygon on the landscape. Forest Service fuels management specialists and their formal non-Forest Service partners have editing and download access to the Field Sampled Vegetation (FSVeg) database managed by Forest Service Natural Resource Information System (NRIS) team located at Ft. Collins, CO. The FSVeg database resides on a Forest Service server behind the FS firewall. Non-Forest Service fuels management specialists do not have direct editing and download access to FSVeg and will not have that access for the foreseeable future. We are therefore planning an alternative method for non-Forest Service fuels management specialists to acquire the FVS compatible and spatially explicit treelist data that can then be used by the Forest Vegetation Simulator (FVS) to forecast forest vegetation dynamics.

#### Pathway A: Forest Service Fuels Management Specialists

Forest Service fuels management specialists will use the suite of software tools developed and supported by NRIS to create FVS-ready, wall-to-wall treelist data sets with their accompanying polygon maplayer in ESRI format for input to IFT-DSS. This means that all data preparation, editing, and proofing will occur outside of IFT-DSS and result in one \*.loc file and one \*.mdb file for any given area of interest (AOI) to be analyzed in IFT-DSS. IFT-DSS will be provided with the ability to read the \*.loc and \*.mdb file.

NRIS provides three software tools:

- **FSVeg Dataset:** All Forest Service field sampled vegetation data is required to be placed into FSVeg which serves as the standard beginning point for this process. FSVeg is in Oracle running on a Forest Service web-server system in Kansas City. Local Forest Service employees have editing access to FSVeg through a password control system operating behind the FS firewall.
- **FSVeg Spatial:** FSVeg Spatial is the NRIS program that manages the polygon maplayer and the pointer system that links a mapped polygon to the appropriate FSVeg stand and plot data. Between 95 and 100 of the 105 National Forests will have map polygon layers completed for FSVeg Spatial by spring 2012. All acres of land within the boundaries of each national forest, regardless of ownership, have been assigned to one or another polygon.
- **FSVeg Spatial Data Analyzer:** The NRIS-developed and supported FSVeg Spatial Data Analyzer is used to identify an area of interest (AOI), automatically import the appropriate sampled vegetation data from FSVeg, automatically import the appropriate map polygons corresponding to an AOI, and place that data into a designated directory on the user’s own desktop computer. Once this step is accomplished, there is no further interaction with the FSVeg Database server. The Spatial Data Analyzer can then be

used to simulate growth of each plot to a common point in time using the FVS system and finally, use the data imputation tools provided in the FSVEG Spatial Data Analyzer to match empty polygons with available stand data. The user can then create the \*.loc and \*.mdb output files for input to IFT-DSS.

- Note that different national forests use different methods to create these imputed wall-to-wall coverages. It is particularly common for a national forest to have forest level specialists perform the imputation process for that forest to create a complete data set annually. To be clear, the FSVEG Spatial data is not being recreated annually. The FSVEG Spatial data along with satellite imagery are inputs to the imputation process that then result in a forest-wide set of data. This annually created imputed forest-wide dataset will then be used for all projects within the forest that entire year. In this case, the Spatial Data Analyzer just clips the project ready data from this common wall-to-wall coverage for the particular area of interest the user has designated.
- Note about imputation: The amount of stand exam data that exists on a given national forest varies. Although each forest using FSVEG Spatial will have a wall-to-wall set of vegetation polygons, that does not mean that they have stand exam data for all polygons, or even 20% of the polygons. Imputation generally works well on forests with modest amounts of stand exam data. There are a few forests with little or no stand exam data. In order to achieve viable imputation results (statistically meaningful), forests with limited data may need to collect additional stand exam data in order to effectively use imputation methods.
- Note also that by August 2011, the FSVEG Database will have been amended to offer support for storing and using FFI format data collected in the CSE protocol format.

#### Pathway B: Non-Forest Service Fuels Management Specialists

Non-FS fuels management specialists who do not have access to the FSVEG data will need an alternative data source to utilize the FVS pathway within IFT-DSS. We propose to use the list of field sampled tree attribute plots that are within the LANDFIRE Reference database to produce a LANDFIRE compatible layer of gridded treelists (NTLL) that could be used as input to the FVS within IFT-DSS for those users who do not have access to the FSVEG database. This is an approach that Stacy Drury has used in the past and has been published as Drury and Herynk, The National Tree-List Layer, Rocky Mountain Research Station, GTR RMRS-GTR-54, February 2011.

The NTLL is a seamless, spatially explicit GIS data layer that describes tree population variability by assigning each pixel a set of field-sampled tree attribute data called a "treelist." We will implement the NTLL as a data source to utilize the FVS pathway. Currently, within the LANDFIRE Reference database each set of plot data are associated with a suite of LANDFIRE map products such as the Existing Vegetation Type (EVT), the Biophysical Settings layer (BpS), and the Successional Class layer (SClass).

Previous work has been done to match treelist data from the LANDFIRE Reference database to the LANDFIRE Map products. To address areas where data were lacking or missing, the treelists were imputed to create a wall-to-wall map layer of tree population data

across landscapes. We will update and improve the methodology used to create the original NTLL for use in IFTDSS and will produce an improved treelist that incorporates new data added to the LANDFIRE Reference database since the original NTLL was created. We will then provide a methodology and tools for linking LANDFIRE base data (topography, etc.) with user-supplied, local field-sampled data from systems such as the FEAT/FIREMON Integrated (FFI) monitoring system. The resulting data layer can then be input to the FVS. This will allow users who do not have access to treelist data such as FSVeg to produce locally derived treelist data layers.

### **FVS Growth and Yield Simulation and Treatment Implementation**

Based on advice from Nick Crookston, the short term (1-5 years) solution is for us to use the Parallel Processing Extension of FVS with the Fire & Fuels Extension linked in. PPE can be set up to run several processes (1 process per CPU core on the system) which means that the landscape AOI can be split up into balanced number of polygons for each processor to run simultaneously. A controller will need to be written to handle this balancing automatically. Nick will help us set it up. The entire set of keywords that currently function within FVS are available for defining treatments. Dave Cawrse and the FVS support team in Ft. Collins are willing to work with us to define appropriate keyword sets for the treatment options we choose to make available pre-defined within IFT-DSS. Improvements in the execution speed of the FVS modules will automatically carry over into IFT-DSS through the PPE as these become available from the Forest Management Center in Ft. Collins.

1. Negotiate with Nick Crookston and form a plan, with his help, to bring the PPE system into IFT-DSS. The code is in Fortran and is all command line driven, so writing a wrapper for the PPE should not be too difficult. Mike will pave the way with Nick and then Paul, Daniel and other programmers will need to travel to Moscow, ID and work with Nick at his home place. Alternatively, he may be able to travel if funds are available from JFSP (travel funds are tight right now and may become tighter yet which is one reason we built a rather large travel fund into the STI contract).
2. A controller needs to be written to apportion up the AOI among all available CPU's in a balanced way to reduce processing time.
3. Pre-defined treatment sets of keywords need to be created and the user will need to be able to edit those keyword files to modify their definitions and add new treatments of their own design. Several software applications exist that allow this so we may be able to obtain some source code the study and modify to support this feature.
4. The controller will need to be able to control the number of years to run the simulation and the times for which output data should be saved.

### **Hazard and Risk Assessment Workflow Updating**

Once treelist data and their accompanying polygon maps are available, the hazard and risk assessment workflows will need to be modified to be able to function with either LANDFIRE or Treelist data types. The analysis leading to specifics for this task has not yet been accomplished.

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