The Joint Fire Science Program (JFSP) and the Interagency Fuels Treatment Decision Support System (IFTDSS)

John H. Cissel (JFSP)

M. Steven Palmquist PE (SEI)

Software Solutions Conference 2015

November 16–18, 2015

© 2015 Carnegie Mellon University

Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Copyright 2015 Carnegie Mellon University

This material is based upon work funded and supported by U.S. Department of the Interior, Bureau of Land Management under Contract No. FA8721-05-C-0003 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center sponsored by the United States Department of Defense.

References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by Carnegie Mellon University or its Software Engineering Institute.

NO WARRANTY. THIS CARNEGIE MELLON UNIVERSITY AND SOFTWARE ENGINEERING INSTITUTE MATERIAL IS FURNISHED ON AN “AS-IS” BASIS. CARNEGIE MELLON UNIVERSITY MAKES NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, AS TO ANY MATTER INCLUDING, BUT NOT LIMITED TO, WARRANTY OF FITNESS FOR PURPOSE OR MERCHANTABILITY, EXCLUSIVITY, OR RESULTS OBTAINED FROM USE OF THE MATERIAL. CARNEGIE MELLON UNIVERSITY DOES NOT MAKE ANY WARRANTY OF ANY KIND WITH RESPECT TO FREEDOM FROM PATENT, TRADEMARK, OR COPYRIGHT INFRINGEMENT.

This material has been approved for public release and unlimited distribution except as restricted below.

This material may be reproduced in its entirety, without modification, and freely distributed in written or electronic form without requesting formal permission. Permission is required for any other use. Requests for permission should be directed to the Software Engineering Institute at permission@sei.cmu.edu.

Architecture Tradeoff Analysis Method®, ATAM® and Carnegie Mellon® are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

DM-0002710.

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Agenda

What Is the Domain?

Who Are the Principal Stakeholders?

What Was the Problem?

How Did JFSP Approach the Solution?

What Changed in the Strategic Environment?

Was the Problem Resolved?

What Can Other Agencies Learn?

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Wildland Fire Fuels Treatment

Increasingly intense fire seasons and changes in the natural and man-made environment all increase the hazard that fires pose to communities, watersheds, and ecosystems

Fuel Managers plan and execute fuel treatments to proactively mitigate threats to firefighters & communities and to maintain/restore ecosystems; example treatments include:

Mechanized: Large equipment treatments such as thinning, pruning, lop and scatter, mowing, crushing, chipping, etc.

Prescribed Fires: A planned fire purposefully ignited (under pre-determined conditions) to reduce fuel and/or improve habitat

Wildland Fire: Managing naturally occurring fires (such as lightning ignitions) for resource benefits

Other: Chemical, biological, manual

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

The Wildland Fire Community

The federal **wildland fire community** *(the users as well as the researchers/developers of the tools)* consists of six agencies

- Agriculture (Forest Service)
- Interior (National Park Service, Fish & Wildlife Service, Geological Survey, Bureau of Land Management, Bureau of Indian Affairs)

The **Joint Fire Science Program** *(the program manager)* funds wildland fire management research and distributes results to policy makers, managers and practitioners to improve wildland fire management decision making

The Wildland Fire Management **Research, Development & Application** (RD&A) *(the follow-on transition agent)* is the liaison between research, planning & operations, and interagency IT as well as advises programs at the local, regional, & national levels

© 2015 Carnegie Mellon University

Distribution Statement A: Approved for Public Release; Distribution is Unlimited

The Wildland Fire Community (Early 2000's)

New Tools & Significant Capability Growth – But Also:

- *Confusion*: many fragmented and overlapping applications
- *Inefficiency*: many interfaces, time-consuming data transformations
- *High costs*: stove-piped, unconnected software development and maintenance practices
- *"Best" models*: lack of performance and comparison data

In the Fuels Treatment Community in particular:

- Inconsistent use of tools and analyses
- Fragmented guidance for model selection
- No risk assessment tools for non-experts
- No collaboration tools
- Tool-based training did not address the end-to-end problem

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Holistic Approach Involving Four Key Stakeholder Groups

The business or operational community owns the need for the system

The technical community designs/ builds the system and otherwise gets "*the system ready for the field*"

The transition community trains users and otherwise gets "*the field ready for the system*"

The governance/management community provides both enterprise governance and program-level management

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Software Tool and Systems (STS) Study

In 2007, JFSP in coordination with the *National Wildfire Coordinating Group (NWCG) Fuels Management Committee* initiated the Software Tools & Systems (STS) study

- **Phase I** (2007-08) studied the problem of "software chaos" that had been identified by the fire and fuels user community
- **Phase II** (2008-09) designed a collaborative system architecture and software lifecycle processes
- **Phase III** (2009-10) focused on proof-of-concept demonstrations of the *Interagency Fuels Treatment Decision Support System (IFTDSS)*
- **Phase IV** (2010-12) focused on gathering user feedback from a large body of test users on IFTDSS's growing functionality
- **Phase V** (2012-13) was a comprehensive IFTDSS assessment

The SEI performed the Phase I Study and the Phase V Assessment

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Software Tool and Systems (STS) Study

JFSP's Implementation of the Phase I Recommendations

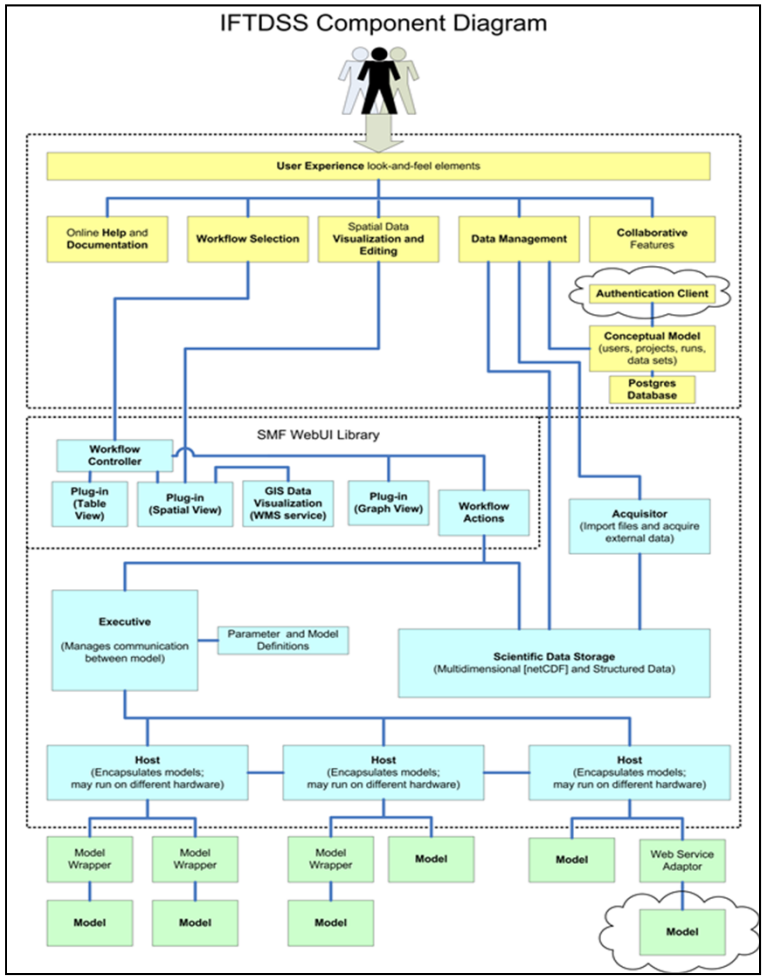
- Adopt centrally managed service integration frameworks
  - Separate models and data from interfaces
  - Consolidated, web-based interfaces
- Align business practices with service integration frameworks
  - Users, model developers, governance, IT
  - Lifecycle management, portfolio management
  - Analysis, performance measures, training, collaboration support

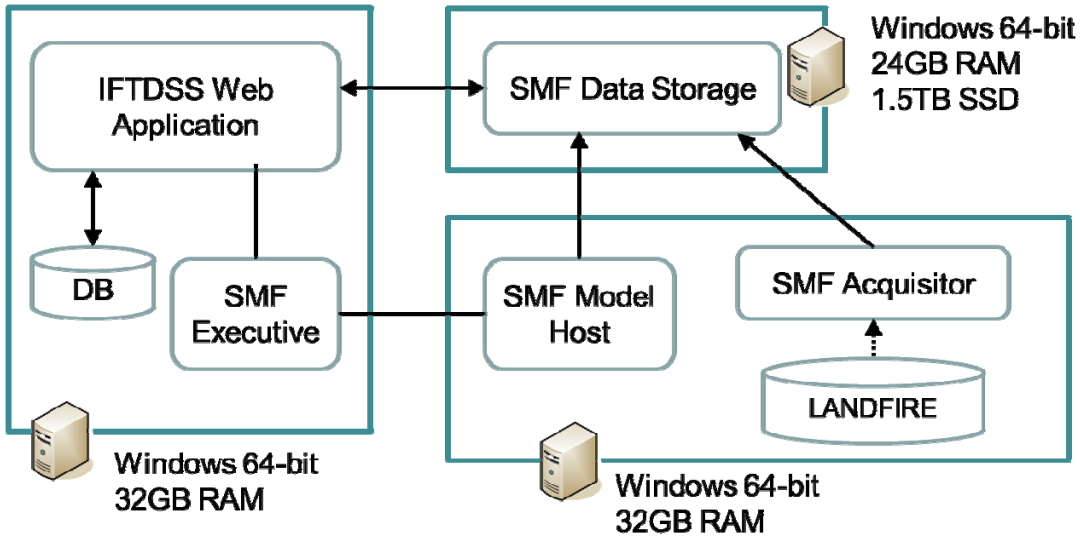
JFSP's Objectives for Phases II, III, and IV

- Demonstrate a service integration framework
  - Fuels treatment (workflows, risk assessments) and lifecycle management (realign lifecycle responsibilities)
- Future capabilities
  - System of record as well as process to deploy tools from research

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

IFTDSS (High Level)





© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Changes in the Strategic Environment

In 2008, USDA & DOI released the *Interagency Prescribed Fire Planning and Implementation Procedures Guide* (the *2008 Prescribed Fire Guide*)

In 2009, Congress passed *The Federal Land Assistance, Management, and Enhancement Act* (The FLAME Act)

In 2011, the Wildland Fire Leadership Council (WFLC) completed:

- *A National Cohesive Wildland Fire Management Strategy*
- *The Federal Land Assistance, Management and Enhancement Act of 2009 Report to Congress*

In 2012, the Department of the Interior and the USDA Forest Service signed the *Wildland Fire Information and Technology (WFI&T) Plan*

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Phase V: IFTDSS Evaluation Study

Requested by senior leadership to support deployment decision:

- How well IFTDSS met the WFI&T vision and strategy regarding an interconnected "system-of-systems" architecture
  - This also included recommendations for WFI&T updates to better support enterprise SOA-based systems such as IFTDSS
- How well IFTDSS met the business needs of improving the efficiency and quality of fuels treatment planning
- The potential for IFTDSS to improve software development and support processes for researcher-developed scientific models intended to be deployed for operational use
- The potential for IFTDSS to improve the fuels treatment planning training approach – in particular to enhance critical thinking and encourage end-to-end problem solving skills

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

SEI's Assessment Approach

General Approach For All Tasks

- Document review
- Interviews
- Demonstrations (as applicable)
- Research community and SEI body-of-knowledge (BOK)

Added For the IFTDSS Architecture Assessment

- Modified Architecture Tradeoff Analysis Method® (ATAM®)

Added For the Quality, Efficiency & Training Assessment(s)

- User workshops (extensive coordination and support from RD&A)
  - Pre-workshop webinars
  - Live workshops *(Portland, OR; Boise, ID; Sacramento, CA; Flagstaff, AZ; Rapid City, SD; Tallahassee, FL)*
  - Virtual workshops *(Alaska/Hawaii; Rocky Mountains; Lake States; Eastern US)*

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Assessment Findings

Interagency Fuels Treatment Decision Support System (IFTDSS)

Supports these strategic drivers

Addresses these user problems

- Systems do not support entire planning process
- Formatting & reformatting data is time consuming
- Multiple system interfaces impede use
- Collaboration is not supported
- Stove-piped, fragmented systems
- Processes not consistent across agencies
- Risk assessments too complex for most users
- System access limited by agency & location
- New science not readily integrated

FLAME Act

- "common analysis method…using common tools"
- risk assessments used to determine treatment areas

National Cohesive Wildland Fire Management Strategy

- "sound risk management is the foundation for all management activities"

Wildland Fire Information & Technology (WFI&T) Plan

- integrated, modular applications
- authoritative data
- available regardless of agency or location

Interagency Prescribed Fire Planning & Implementation Procedures Guide

- common planning workflow for all federal land management agencies

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Assessment Findings

- Overwhelmingly, users rated IFTDSS as “very satisfactory” and “satisfactory” in all categories of assessment
- From an architectural perspective, IFTDSS is sound and responds well to the key architectural drivers
- Enables standardized, risk-based fuels management planning for large numbers of users
- Provides a rich set of tutorial material going beyond mechanics into a knowledge management system for corporate intellectual capital
- Demonstrates a framework that could support end-to-end training
- Allows for improving the management of fuels treatment thru its data management and its incorporation of scientific models
- Offers the opportunity to make significant improvements in the science of fuels treatment

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

What Supported Success?

The SOA-based technical approach was critical, but the real success factors other programs could adopt were non-technical:

- As the sponsor, JFSP was committed, informed, and involved
- JFSP "looked up" to meet (or anticipate) strategic goals
- JFSP "looked out" to conform to (or anticipate) IT governance
- JFSP "listened everywhere" by actively soliciting user, trainer, and researcher/developer input and regularly exposed the product for feedback as capabilities grew
- The program had achievable scope/schedule and a development approach that matched the contractor's skill-set
- The government/contractor relationship was open and professional

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Current Status – RD&A Management

INFORMATION BULLETIN – April 2015

IFTDSS

Interagency Fuels Treatment Decision Support System

Iftdss.sonomatech.com

https://www.frames.gov/partner-sites/iftdss/iftdss-home/

Background: The Interagency Fuels Treatment Decision Support System (IFTDSS) is a web-based software and data integration framework that organizes previously existing fire and fuels software applications to make fuels treatment planning and analysis more efficient and effective. IFTDSS provides access to data and models, all in one place, through one user interface.

Current Status: ***IFTDSS version 2.0.1 Beta*** is currently available for use, testing and evaluation. IFTDSS will continue to be developed with input from Interagency partners and advisors over the next two years. It is expected that during 2017, the system will move from a Beta phase and will build upon the system integration efforts that started with the Joint Fire Science Program. Although development work is ongoing, users will find many features (listed below) that will enhance their fuels planning and operation efforts right now.

- ✓ ***Prescribed Burn Planning with 2014 Interagency Standards***
- ✓ ***Hazard Analysis using BEHAVE, FLAMMAP MTT and Flow paths,***
- ✓ ***Risk Assessment using RANDIG and portions of Fire Family Plus***
- ✓ ***Fire Effects Modeling with FOFEM, CONSUME, LANDFIRE (FCCS and FLM)***

© 2015 Carnegie Mellon University

Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Current Status

Future Project Enhancements:

- *Access to fire behavior models found in WFDSS (Near Term, Short Term, FSPro)*
- *Access to data layers available in WFDSS*
- *Potential Integration with Fuels Treatment Effectiveness Monitoring (FTEM) Database*
- *Potential Integration with NFPORS*
- *Potential official archive for federal fuels treatment planning and analysis*

Get Involved! All fire and resource management personnel are invited and encouraged to become an IFTDSS Beta user by requesting an account on the IFTDSS homepage at (http://iftdss.sonomatech.com/). Comments, suggestions, and any other input through the IFTDSS "Submit Feedback" link located on the homepage are encouraged and welcome.

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited

Authors

John H. Cissel is the Program Manager of the Joint Fire Science Program, Boise, ID. Prior to that, John was the:

- Research Coordinator, Oregon BLM
- HJ Andrews Experimental Forest Director, Oregon State Univ
- Systems Analyst and Forest Planning Group Leader, Ochoco and Willamette National Forests

M. Steven Palmquist is a Principal Engineer in the Civil Sector of the SEI's Client Technical Solutions Directorate. Steve is a:

- Licensed Professional Engineer (Electrical)
- Project Management Professional (PMP®)
- PMI Agile Certified Practitioner (PMI-ACP®)

Prior to joining the SEI, Steve served as a helicopter pilot, engineer, and program manager in the U.S. Coast Guard

© 2015 Carnegie Mellon University
Distribution Statement A: Approved for Public Release; Distribution is Unlimited