

# FSP Management Plan

## Path Forward



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**FSP PAC Meeting**  
**Princeton Plasma Physics Laboratory**  
**Princeton, NJ**  
**Sep 17-18, 2009**



**U.S. DEPARTMENT OF**  
**ENERGY**



# Outline

- **Philosophy**
- **Boundary conditions and constraints**
  - ◆ **DOE O's & G's, software process & SQA**
- **FSP management plan and strategy**
  - ◆ **What was proposed?**
- **Current planning status**
- **Next steps**

# Philosophy

- ❑ **FSP must have process and formality**
  - ◆ Adapt/adopt constraints from standards, regulations, best practices
- ❑ **FSP must accommodate, motivate, and facilitate applied R&D**
  - ◆ Simply re-factoring, re-designing, and re-implementing existing legacy software base won't cut it
- ❑ **FSP's principal product is quality predictive software and the answers and insight provided by that software**
  - ◆ Embrace Microsoft model: "release software early and often"
- ❑ **FSP must be open, inclusive, and embrace the fusion community to succeed**
  - ◆ What can be learned, e.g., from CCSM?
  - ◆ An active and open communication plan is needed
- ❑ **FSP must leverage existing and past programs as well as motivate new programs**
- ❑ **FSP must have focused deliverables and well-defined requirements to succeed**

# DOE O 413.3A Provides a Reference Point CD-1 and CD-2 Requirements

## CD-1

- ❑ Conceptual design report
- ❑ Acquisition strategy
- ❑ Preliminary PEP
- ❑ Federal Project Director
- ❑ Establish Integrated Project Team
- ❑ Conduct a design review of the conceptual design
- ❑ Project data sheet
- ❑ Environmental documents
- ❑ Security vulnerability assessment report
- ❑ Initial cyber security plan
- ❑ Preliminary hazard analysis report
- ❑ Quality assurance plan

## CD-2

- ❑ Preliminary design report and design review
- ❑ Establish performance baseline and conduct validation review
- ❑ Updated PEP
- ❑ Employ an EVMS
- ❑ Independent cost assessment and review
- ❑ Quality assurance plan
- ❑ Updated project data sheet
- ❑ Environmental documents
- ❑ Security vulnerability assessment report
- ❑ Updated cyber security plan

# Adapting the DOE 413.3A Process to FSP

- ❑ **Many of the CD-1 and CD-2 requirements can be constructively adopted for a R&D software project; others do not easily map**
  - ◆ **Tailor those requirements for a scientific software project during the FSP planning and definition phase**
  - ◆ **Draw upon proven and documented approaches such as those used in the CMMI (more later)**
  
- ❑ **Be aware of and prepared for “Lehman-like” review scrutiny**
  - ◆ **Basis of scope, cost schedule; funding profile & budget; critical path; risks and contingency management; basis of design and design review; IPT; technology readiness; contract readiness; project controls; quality controls & assurance; PEP, documentation of lessons learned**
  
- ❑ **Of particular importance: standing up and executing an IPT to maintain communication of progress, issues, and actions with key stakeholders (OFES/ASCR)**

# FSP Definition and Planning Products

## What was proposed? All elements (and more) of a PEP

- ❑ **Management Plan**
  - ◆ Q409 - initial draft; Q110 - final
- ❑ **Strategic Plan**
  - ◆ Q409 - initial draft; Q110 - final
- ❑ **Integration and Outreach Plan**
  - ◆ Q110 – initial draft; Q210 - final
- ❑ **Risk Management Plan**
  - ◆ Q210 – initial draft; Q310 - final
- ❑ **Requirements Management Plan**
  - ◆ Q310 – initial draft; Q410 - final
- ❑ **Program Tracking Plan**
  - ◆ Q410 – initial draft; Q111 - final
- ❑ **Change Management Plan**
  - ◆ Q111 – initial draft; Q211 – final
- ❑ **Quality Management Plan**
  - ◆ Q211 – initial draft; Q311 - final
- ❑ **Implementation Plan**
  - ◆ Q311 – initial draft; Q411 – final
- ❑ **Joint FES/ASCR MOU & “CD-O”**
- ❑ **Infrastructure Plan**
- ❑ **Project Execution Plan (PEP)**
  - ◆ Strategic Plan
  - ◆ Implementation Plan
  - ◆ Risk Management Plan
  - ◆ Quality Management Plan
  - ◆ Management Plan

# FSP Management Plan

- ❑ **Formal approved document that defines how FSP is executed, monitored, controlled**
  - ◆ **A condensed version of the PEP and the Implementation, Tracking, and Change Control Plans**
  - ◆ **Defines the approach used by the FSP team to deliver on products and milestones**
  - ◆ **Agreed upon and approved by the FSP team, participating institutions (PPPL, etc.) and DOE**
- ❑ **Typically covers the management of scope, schedule, finance, quality, resources, communications, change, risk, and procurement**
- ❑ **Focus on management organization and responsibilities**
- ❑ **Articulate the Integrated Product Team (IPT) role and responsibility**
  - ◆ **DOE Program Managers (OFES/ASCR), DOE Federal Project Director (PAO), FSP Director/Deputy Director, FSP Program Managers, appropriate institutional (PPPL) line management, other relevant program management (e.g., ITER)**
- ❑ **Basic philosophy: Manage the FSP as a collection of annual projects, with project scope and deliverables adequately covered by hierarchical milestones**

# FSP Strategic Plan

- ❑ Overall direction, policy, work areas in next 10-15 years
- ❑ Strategy and deliverables to accomplish stated objectives and goals
- ❑ Defines WBS and management team members and responsibilities
- ❑ Details principal program elements, their strategies, and performance indicators
- ❑ Include L1 milestones and top 10 risks
  - ◆ L1 milestone: 1-2 annually, FSP level
    - Ex: demonstrated simulation capability
  - ◆ L2 milestone: ~\$1-5M per milestone; FSP element level
    - Ex: formal FSP software release
  - ◆ L3 milestone: <\$1M per milestone; FSP sub-element level
    - Ex: document, report
- ❑ First draft in Sep, “final” in Dec 2009
  - ◆ FSP workshop forthcoming to vet proposed plan with larger community



# **FSP Strategic Plan**

## **Mission and Vision**

### **□ Mission (“reason for existence”)**

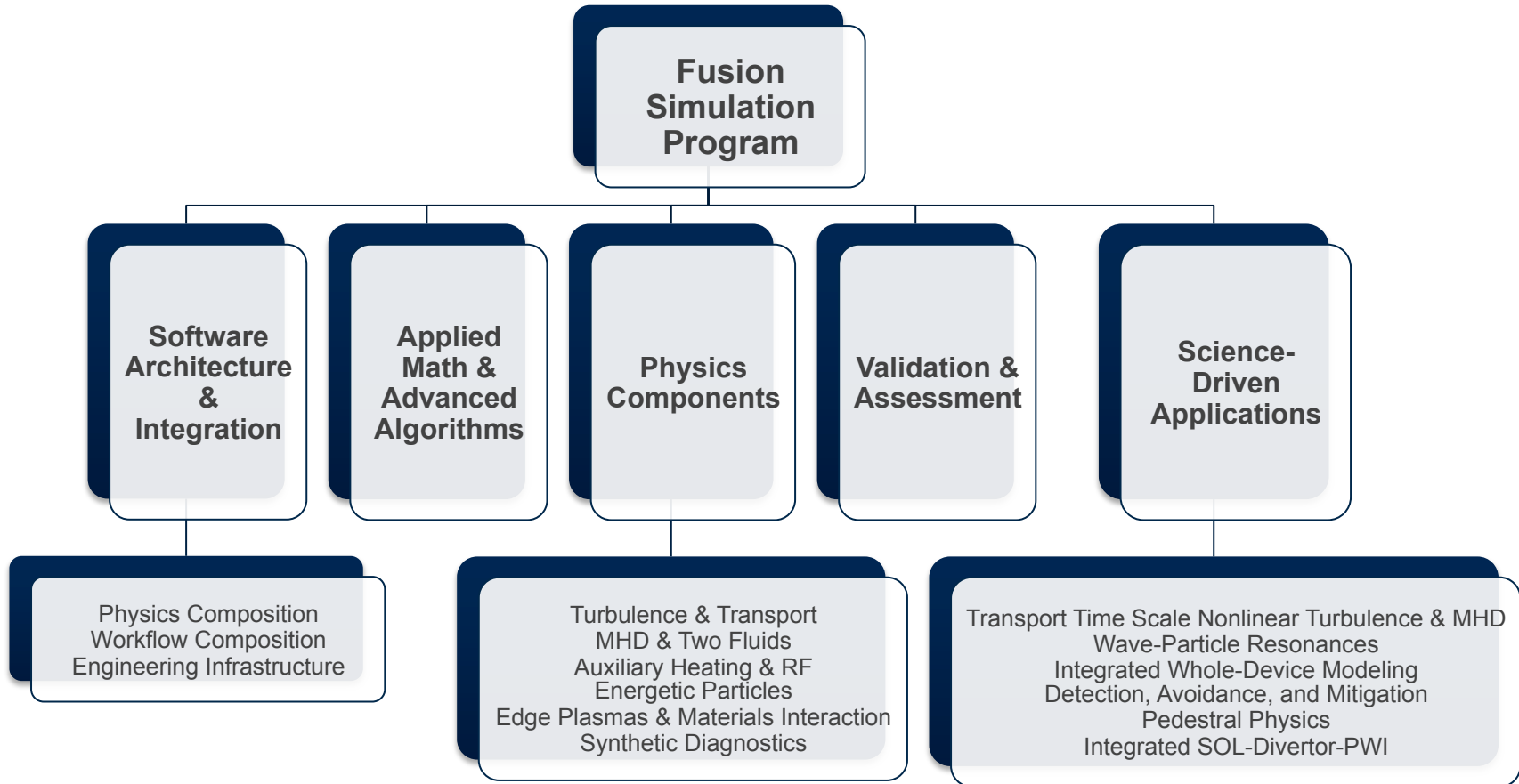
- ◆ Deliver an integrated simulation capability for magnetically-confined fusion plasmas that is properly validated against toroidal experiments in regimes relevant for producing practical fusion energy.**

### **□ Vision (“the goal; where FSP is headed”)**

- ◆ Confidently predict toroidal magnetic confinement fusion device behavior with comprehensive and targeted science-based simulations of nonlinear coupled plasma phenomena in the core, edge, and wall region on time and space scales required for fusion energy production.**

# FSP Strategic Plan

## A Draft Work Breakdown Structure (WBS)



The final and most appropriate WBS will likely evolve during the FSP definition and planning phase as a result of discussions with clients, customers, and users.

# FSP Strategic Plan

## Milestones

- ❑ **Philosophy: manage by milestones**
  - ◆ You only improve what you measure, so measure the right thing
- ❑ **Milestones associated with each WBS level**
  - ◆ **Level 1 (L1) WBS**
    - L1 milestones (reportable to DOE)
    - 1-2 annually
  - ◆ **Level 2 (L2) WBS**
    - L2 milestones (reportable to FSP Director, PAC, PPPL)
    - 1-2 annually
  - ◆ **Level 3 (L3) WBS**
    - L3 milestones (reportable to FSP Program Element Manager)
    - 1-5 annually
  - ◆ **A typical year**
    - 1 L1 milestone, 8 L2 milestones, 25 L3 milestones
- ❑ **All milestones are defined and documented >1 year from due date**
  - ◆ SMART: Specific, Measurable, Attainable, Relevant, and Timely
  - ◆ L1 milestone definitions and metrics are formally reviewed externally at least 1 year from due date
- ❑ **L1 and L2 milestones are formally reviewed**
  - ◆ L1 – external review committee (DOE + SMEs); L2 – FSP review committee (FSP + PAC)

# FSP Strategic Plan

## Milestones

### □ L1 (WBS Level 1)

- ◆ Ex: Demonstrated simulation capability
- ◆ FY12 - ??; FY13 - ??

### □ L2 (WBS Level 2)

#### ◆ Software Architecture & Integration

- Ex: Formal FSP software release

#### ◆ Validation & Assessment

- Ex: Documented assessment of latest FSP software release

#### ◆ Applied Math & Advanced Algorithms

- Ex: Solver library or application kernel release and integration

#### ◆ Physics Components

- Ex: Component release & integration; demonstrated simulation capability

#### ◆ Science-Driven Applications

- Ex: Application-specific (e.g., disruptions) component integration and demonstrated simulation capability

### □ L3 (WBS Level 3)

- ◆ Report, document, software commit to repository, simulation result, etc.

# FSP Strategic Plan

## Risks (Arbitrarily-Ordered Incomplete List)

1. Distributed team building too difficult
2. Insurmountable integrated code numerical and algorithmic issues not observed in prototypes
3. Components are inadequate in breadth and depth of required physical model
4. V&V and UQ for integrated computational models too difficult
5. Difficulty in recruiting, training, and retaining required staff
6. Inability to acquire appropriate and adequate validation data
7. Inability to balance short-term deliverables with longer-term exploratory R&D
8. Inadequate participation, buy-in, and collaboration from the fusion community
9. Inability to implement and execute appropriate project management practices
10. Inability to secure adequate HPC capacity and capability (leadership) resources
11. Balancing professional development of FSP staff against FSP deliverables
12. Ensuring FSP application developers retain “code ownership” and its associated visibility within a larger community software tool
13. Inability to evolve FSP software products into *the* fusion community software
14. Inability of DOE stakeholder program offices to agree upon and support a consistent and mutually-beneficial FSP scope and implementation
15. Inability to retain necessary FSP funds amid competing DOE missions and priorities
16. Inadequate participating institutional commitment to staff deployed on FSP
17. Inability to accurately estimate software development costs and schedule and maintain software scope
18. Development cannot maintain pace with time scale of changing requirements

# FSP Integration & Outreach Plan

- ❑ **Product delivery and responsiveness of FSP to key stakeholders**
- ❑ **How FSP integrates & coordinates with other US Programs**
- ❑ **Approach for interaction & coordination with integrated modeling efforts abroad as well as with international facilities**
- ❑ **Integration of program elements within FSP and synergy with OFES/SciDAC**
- ❑ **Whole team input; focused writeup**

# FSP Requirements Management Plan

- ❑ **Seek input from 3 sets of people**
  - ◆ Clients (pay for product development)
  - ◆ Customers (pay for product)
  - ◆ Users (use the product)
- ❑ **Requirements address 4 questions**
  - ◆ Why? (business requirement)
  - ◆ What? (functional requirement)
  - ◆ How? (design requirement)
  - ◆ How well? (quality requirement)
- ❑ **Process includes elicitation, analysis, specification, and validation**
- ❑ **Requirements must be unambiguous, testable, correct, in scope, modifiable, feasible, traceable, and *not* a solution**
- ❑ **Envision a hierarchy of documents in a “bulleted list” form (B.1, B.2, F.1, F.2, D.1, D.2, ...; Q.1, ...)**
  - ◆ Emulate existing useful and actionable documents
  - ◆ Start at the high (FSP) level
- ❑ **At least one requirements review annually**
- ❑ **Define set of clients/customers/users and questions and collect Q&A input over Q1 & Q2 FY10**

# FSP Software Lifecycle Model

Envisioned to follow a staged-evolutionary delivery model

- ❑ A model for software development with good risk management (Best Practice)
- ❑ Get the full application with basic capability into the users' hands quickly
  - ◆ Initial capability is simple and not full-featured
  - ◆ Follow-on delivery incrementally increases features
- ❑ Offers quick user feedback and exercises the full software framework quickly
- ❑ An ideal way to incorporate independent assessment and validation
  - ◆ Each release triggers a formal and documented assessment
    - Defines range of applicability for the FSP software and informs the next FSP software release with updated requirements, feature enhancement requests, and identification of bugs/issues
  - ◆ An effective best practice model used in the DOE NNSA ASC Program
- ❑ Success depends on a good component (object) decomposition



# Other FSP Plans

## □ Program Tracking Plan

- ◆ Process for tracking progress
- ◆ Define its performance measures (L1/2/3 milestones)
- ◆ Rollup process for conducting internal and external reviews

## □ Change Management Plan

- ◆ Formal process by which the approved baseline plan can be changed (scope, schedule, or budget)
- ◆ What changes constitute “large”, therefore requiring higher approval?

## □ Quality Management Plan

- ◆ Includes V&V and SQA plans
- ◆ How is the quality of FSP products assured and controlled
- ◆ Definition of explicit and measurable performance metrics for each FSP product

# SQA Constraints & Regulations

Used in certain DOE Programs: applicable to FSP?

- ❑ Various standards and guidelines exist – applicable?
  - ◆ 10 CFR 830: Nuclear Safety Management
  - ◆ DOE O 414.1C: Quality Assurance
  - ◆ Is there an OFES equivalent to the NNSA Weapon Quality Policy (QC-1)?
  - ◆ DNFSB Recommendation 2004-1
  - ◆ Others: ISO, IEC, IEEE, MIL, FIPS, NIST
- ❑ Software developed @ various DOE Labs
  - ◆ Are there institutional-specific requirements and regulations to be aware of (e.g., LANL “LIRs”)?
- ❑ Take away: FSP must have a quality management plan (including SQA) regardless of regulations (or lack thereof)
  - ◆ Software guiding “ITER shot decisions” must have SQA pedigree

# Software Process Improvement

## □ There is a business case

- ◆ Improved software requirements, efficiency and productivity of software teams, software reliability, management of software safety, and reduction of defects and rework

## □ Leverage existing knowledge/experience base

- ◆ PMBOK in the Project Management Institute ([www.pmi.org](http://www.pmi.org))
- ◆ Capability Maturity Model for Software (SW-CMM) (<http://www.sei.cmu.edu/cmm/>)
- ◆ Capability Maturity Model Integrated (CMMI) (<http://www.sei.cmu.edu/cmmi/>)
- ◆ Software Engineering Institute (<http://www.sei.cmu.edu/>)
- ◆ Construx (<http://www.construx.com>)

## □ Example CMMI Process Areas

- ◆ Project management assurance: project planning, project monitoring and control, supplier agreement management, risk management
- ◆ Engineering assurance: requirements development, technical solution, product integration, verification, validation
- ◆ Support assurance: configuration management, product and process quality assurance, measurement and analysis, decision analysis and reduction, organization environment for integration, causal analysis and resolution

# FSP Implementation Plan

- ❑ “Who does what when”
- ❑ The set of objectives that need to be accomplished along the way to achieve stated goals
- ❑ Product descriptions or all FSP program elements, sub-elements, projects
  - ◆ *Yearly* planned activities and deliverables for each product (L2/L3 milestones)
  - ◆ Decreasing fidelity in outyears
- ❑ Milestone co-dependencies are defined
- ❑ Explicit timelines and resources associated with each activity are defined
  - ◆ Probably need to use a PM tool like Primavera Enterprise (and a “PMP person”)
- ❑ The IP is the hardest and last deliverable
  - ◆ All FSP activities and efforts will have been articulated, planned, resource-loaded , and ready for execution

# Next Steps

- **Communication plan for FSP team members, fusion community, stakeholders**
  - ◆ Mailing lists, common repositories, telecon schedules, face-to-face meeting schedules
  - ◆ For broader community: web site (fsp.org), FAQ, bulletin board, blog, wiki?
- **Coordinate and schedule community involvement**
  - ◆ How many (and what) extended FSP workshops do we have?
- **Develop timeline and deliverables for each FSP program element during this planning phase**
  - ◆ Who does what when
  - ◆ Will find inconsistencies & overlaps that need to be worked out
  - ◆ Assess where contingency funds might be useful, needed