SASSI Breakout Session

DOE NPH Conference

October 26, 2011

Agenda

Time	Item
8:30 - 9:00am	Overview of DOE path forward
9:00 - 9:15am	BREAK
9:15 - 10:30am	SASSI code module validation approach & discussion
10:30 - 11:45am	SASSI V&V problem approach & discussion
Noon - 1:00pm	LUNCH

Background
Subtraction Method Limitation

- Modern computational capacity has allowed for SSI analysis of larger embedded structures using the SASSI analysis methodology.
- Current guidance now requires higher frequencies of analysis (as high as 50 Hz depending on site conditions).
- The current computational capacity, along with the higher frequencies of analysis have identified situations where transfer functions derived with the SM produce anomalously high or low results at frequencies above the natural frequency of the excavated soil volume.

Chronology

- July 2010: LA-UR-10-05302, *Seismic Response of Embedded Facilities using the SASSI Subtraction Method* (Mertz et al.) identified conditions leading to the SM discrepancy and recommended caution.
- August 2010: CNS commissioned several SASSI experts to examine the SM issues.
- September 2010: *Supplemental Information to LA-UR-10-05302 and a Progress Report on Current Activities* (Mertz) introduced the MSM as an improvement over SM.
- Late 2010: DNFSB staff queried four sites/projects on SASSI SSQA practices.
- January 2011: Preliminary results were discussed with DNFSB staff.
- April 8, 2011: DNFSB letter to DOE.
- July 2011: *U.S. Department of Energy Soil-Structure Interaction Report* further documented SM discrepancies and MSM improvements. Recommended steps for reviewing past SM analyses and thorough V&V of any future MSM analyses.

Chronology (con't.)

- July 29, 2011: DOE Letter to DNFSB transmitting the SSI Report
- August 31, 2011: Presentation to DNFSB
- September 29, 2011: NNSA direction to develop and execute an integrated action plan to resolve SASSI issues for their projects
- October 17, 2011: Presentation to DNFSB of Proposed Action Plan for SASSI V&V and Path Forward

Proposed Action Plan

- Issues to resolve
  - Root cause analysis of SM anomaly
  - SASSI SQA
  - Use of outside experts in SASSI V&V path forward
  - Development of DOE-SSI guidance document

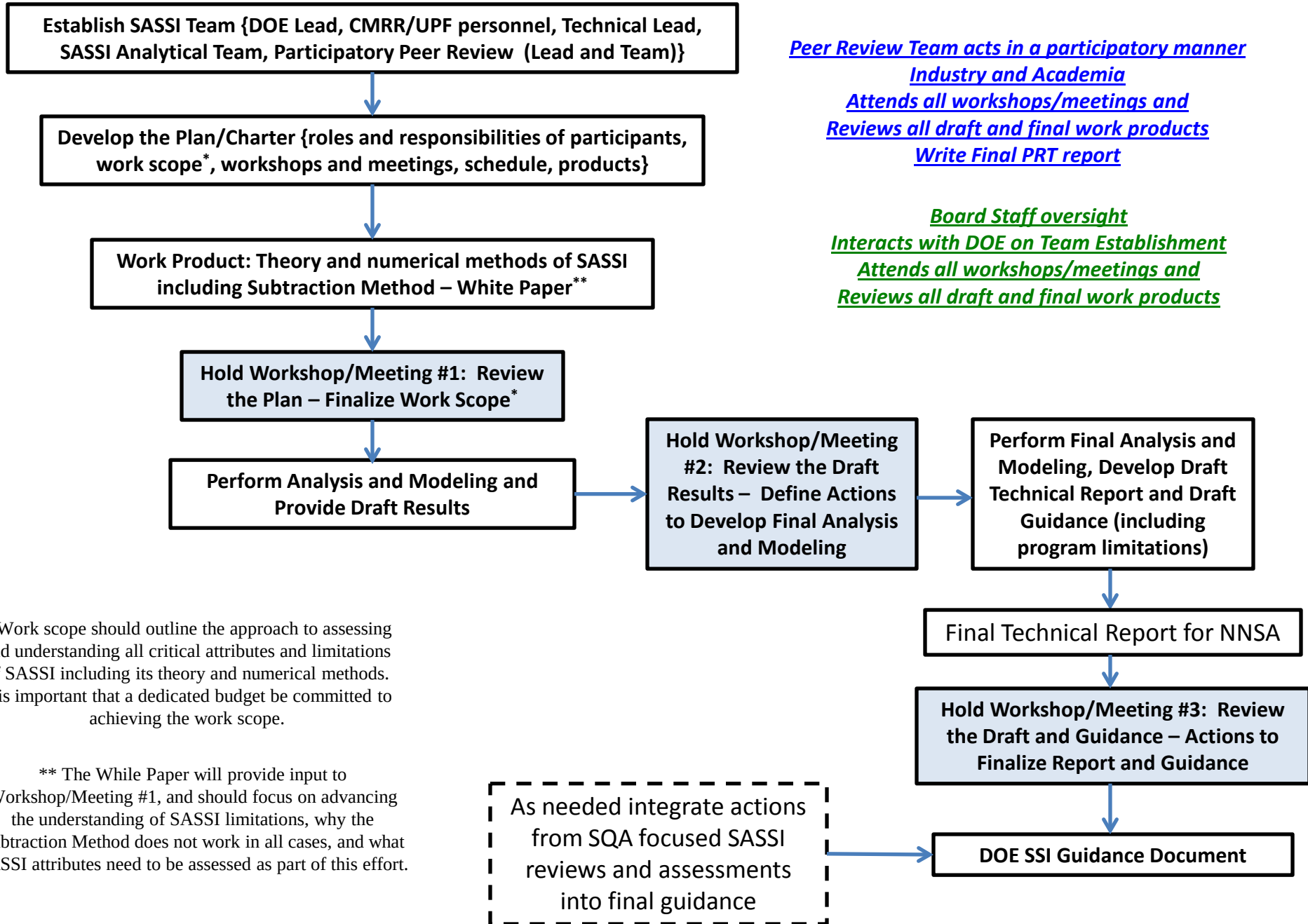
Elements of the SSHAC Process Appropriate for SASSI Validation Process

- Selection of SSHAC Study Level
- SSHAC 1 - Defines Technical Integrator (TI) who does everything. Peer Review performed at the end of the process. Not consistent with ASME V&V recommendations.
- SSHAC 2 - Defines TI and Evaluator Team. Participatory Peer Review to help guide the process. No workshops required. No Proponents needed. Consistent with ASME V&V.
- **SSHAC 3 - Same as SSHAC 2 but includes series of workshops to review various problems sets available, alternative methods of analyses and computer codes, higher level of documentation. Includes use of Observers who can interact with the TI**
- SSHAC 4 – Needs multiple Evaluators or Evaluator Teams. Not considered appropriate for this project

Elements of the SSHAC Process Appropriate for SASSI Validation Process

- Participatory Peer Review Panel (PPRT)
- Increases credibility of process and results
- Makes available broader range of experiences and expertise
- Satisfies ASME V&V recommendations to include a variety of stakeholders
- Participants of the PPRT should include personnel knowledgeable in the SSI field at both the consulting and academic levels, as well as knowledgeable in the applications of the SASSI approach to SSI.

Path Forward to Assess Technical Issues Related to SASSI



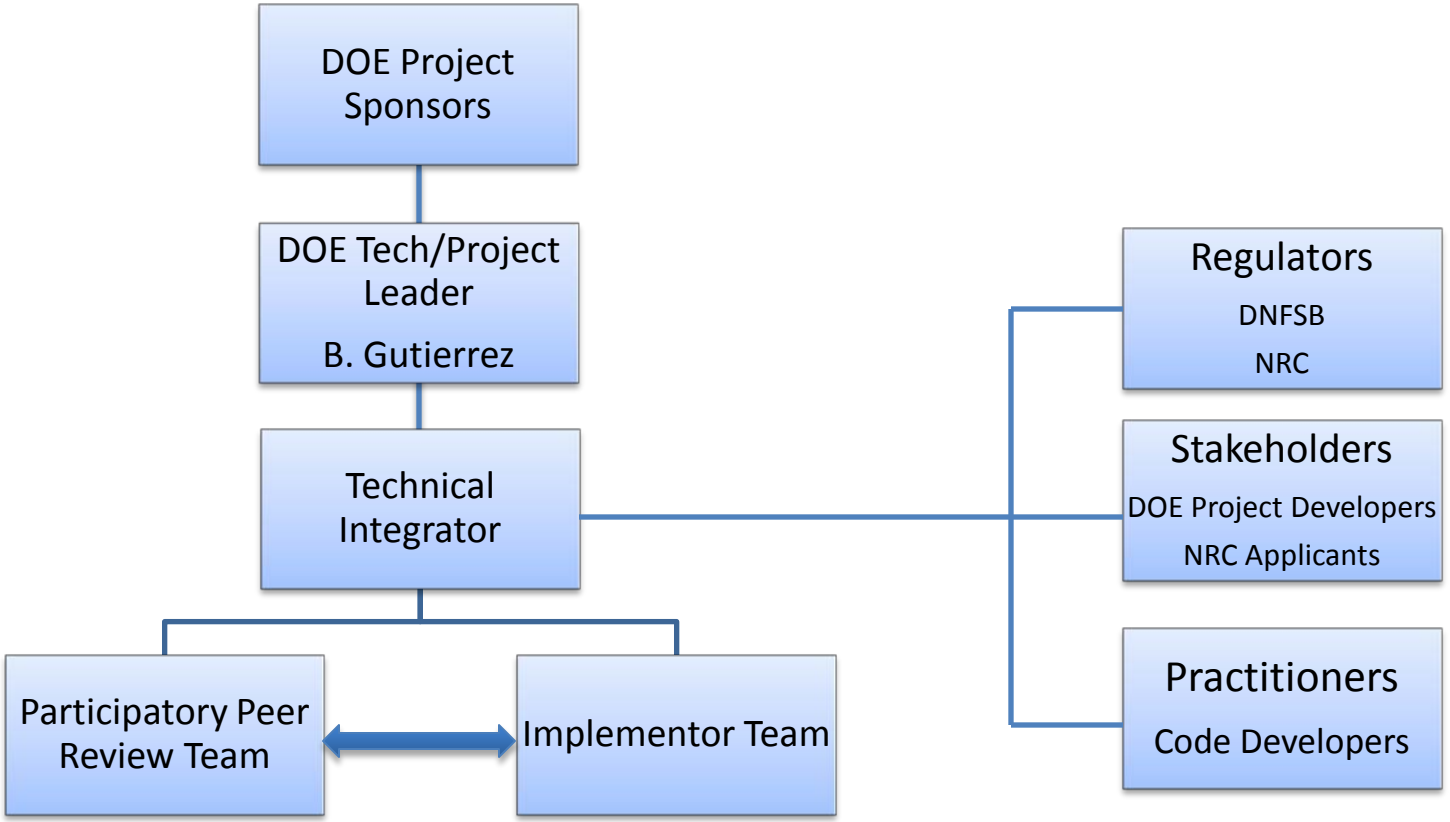
* Work scope should outline the approach to assessing and understanding all critical attributes and limitations of SASSI including its theory and numerical methods. It is important that a dedicated budget be committed to achieving the work scope.

** The While Paper will provide input to Workshop/Meeting #1, and should focus on advancing the understanding of SASSI limitations, why the Subtraction Method does not work in all cases, and what SASSI attributes need to be assessed as part of this effort.

Timeline


Oct 26, 2011
SASSI Breakout Session
Dec 2011
Est. & Meet w/ PPRT
January 2012
Workshop #1
Jan 2013
Resolution of SASSI issues for NNSA projects
Nov 30, 2011
SASSI Action Plan
Aug-Sep 2012
Workshop #2
Apr-May 2013
Workshop #3
Jul-Aug 2013
SSI Guidance Document

Project Organization



Elements of Proposed Action Plan

Action Plan for SASSI Validation Process

ASME V&V 10 “Guide for Verification and Validation in Computational Solid Mechanics“ will be used as a guide document in generating and implementing the action plan

- provides a template that will result in V&V consistent with NQA-1 requirements

V&V Definitions

Verification.

- The process of providing objective evidence that the software and its associated products:
  - conforms to requirements (e.g., for correctness, completeness, consistency, accuracy)
  - satisfies standards, practices, and conventions

Acceptance Testing.

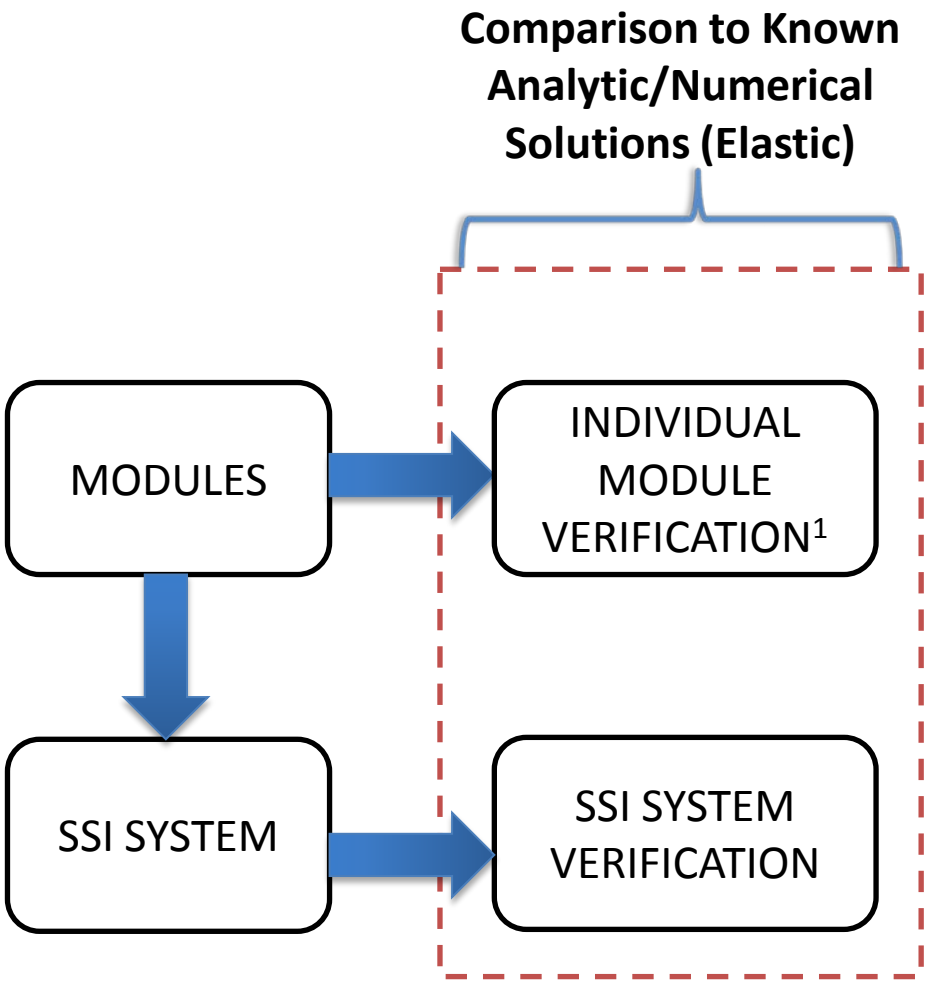
- The process of exercising or evaluating a system or system component to ensure that it satisfies the specified requirements and to identify differences between expected and actual results in the operating environment. (ASME NQA-1-2008 with the NQA-1a-2009 addenda)

V&V Definitions

Validation.

- The process of providing evidence that the software, and its associated products, satisfies system requirements allocated to software, solves the right problem (e.g., correctly models physical laws, uses the proper system assumptions), and satisfies the intended use and user needs. (IEEE Standard 1012-2004)

Proposed Technical Approach



1. Sensitivities for range of parameters

V&V Plan

- Planning will be done with the guidance from a team of experts (PPRT).
- Plan will be prepared prior to implementation of verification and validation activities
- Plan will include
  - Specification of the intended use of the code/model
  - A detailed description of the physical system to be solved
    - Behavior of the physical system solved by individual modules
    - Behavior of the physical system solved by the combination of modules
  - List of verification problems to be developed
    - Problem list may be expanded as a result of Workshops/Interaction with PPRT

Module Verification

- PPRT to guide development of problems and range of parameters
  - Problems to demonstrate system solved by individual modules
  - Establish sensitivity of module results to range of input parameters

System Verification

- PPRT to guide development of problems and range of parameters
  - Problems to demonstrate system solved by interacting (combinations of) modules
  - Evaluate sensitivity of system results to range of input parameters
    - Based on results from sensitivity of individual modules to input parameters and check problems for the full system analyses

DOE Order Compliance
DOE O 414.1D

- Action plan will incorporate interactions with DOE Software QA Expert(s)
  - Ensure consistency with DOE SQA requirements for V&V
  - Enable the use of the work product(s) by DOE contractors over the DOE complex