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To: Scott Hutchinson (1350)

From: Kevin Copps, Org. 1544, ASC L2 Milestone 5321 Committee Chair

Subject: Successful Completion of FY18/Q1 ASC L2 Milestone 6355:
Electrical Analysis Calibration Workflow Capability Demonstration

This memo serves as notification that the review committee has concluded that the Level 2 Milestone 6355 (due Quarter 1 in FY18) "Electrical Analysis Calibration Workflow Capability Demonstration" was successful and complete.

On November 9, 2017, Pete Sholander, milestone project lead and member of the Xyce development team, convened a meeting to present to the committee the final results. Attendees included the members of the committee: Kevin Copps (1544), Tim Wiseley (6616), Henok Abebe (9434), Tim Trucano (1400) and Dan Laney (LLNL), via VTC. Other attendees were Joseph Castro (1355), Robert Clay (8753), Ernest Friedman-Hill (8753), Matt Glickman (1463), Shahed Reza (1356), Jason Verley (1355), Brian Fox (1344) and Alan Mar (5443).

As a reminder, the text of the milestone read as follows:

Description:
The Sandia Analysis Workbench (SAW) project has developed and deployed a production capability for SIERRA computational mechanics analysis workflows. However, the electrical analysis workflow capability requirements have only been demonstrated in early prototype states, with no real capability deployed for analysts' use. This milestone aims to improve the electrical analysis workflow capability (via SAW and related tools) and deploy it for ongoing use.

We propose to focus on a QASPR electrical analysis calibration workflow use case. We will include a number of new capabilities (versus today's SAW), such as: 1) support for the XYCE code workflow component, 2) data management coupled to electrical workflow, 3) human-in-the-loop workflow capability, and 4) electrical analysis workflow capability deployed on the restricted (and possibly classified) network at Sandia. While far from the complete set of capabilities required for electrical analysis workflow over the long term, this is a substantial first step toward full production support for the electrical analysts.

Specific Deliverables:

1. Production deployment of the Xyce code component as part of electrical analysis workflows based on SAW on the SRN (and possibly SCN) network.
2. Electrical analysis distribution of SAW, including the simulation data management (SDM) modules (for data management).
3. Demonstration of "human-in-the-loop" as part of a Xyce calibration workflow.
4. Combined demonstration of at least one QASPR calibration workflow, leveraging the Xyce circuit-simulation tool, based on SAW.

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5. A report summarizing the results of the strengths and weaknesses of the QASPR calibration workflow capability, to inform future work to improve and extend this capability for electrical analysis.
6. A report summarizing the results of the effort.

During the final review, Pete Sholander presented work supporting successful completion of the milestone. The work for this L2 milestone included:

1. A workflow for calibrating the Junction Area (JA) model parameter for Heterojunction Bipolar Transistor (HBTs) for the hostile (radiation) environment. That workflow leveraged available production-quality versions of the Xyce and Dakota software codes previously developed for the ASC program. (Deliverables 1 and 4, listed above.)

2. The improvements to the Next Generation Workflow (NGW) capability in SAW required to support that calibration workflow. Those NGW improvements will be widely available in version 2.5 of SAW. (Deliverable 1, listed above.)

3. The demonstration of a SAW repository as a means of archiving and versioning the experimental data and scripts needed to run the calibration workflow. (Deliverable 2, listed above.)

4. Beta-testing and *Quality Assurance* (QA) testing by the end-users (Shahed Reza and Rachelle Thompson) of the calibration workflow in Organization 1356. That beta-testing assured that the SAW-based workflow gave the same results as 1356's existing script-based processes, and would also improve the shareability, repeatability and traceability of their calibration processes. Beta testing also ensured that the SAW-enabled work-flow would meet the "human-in-the-loop" requirements for capturing engineering notes on what Xyce and Dakota versions were used, and for example why some devices were excluded from a given calibration study. That testing also provided feedback on the analyst's ability to review and interpret the experimental data and calibration results during all the various phases of workflow execution. (Deliverable 3, listed above.) The QA testing in September 2017 then laid out the *future improvements* to that workflow suggested by the 1356 analysts. (Deliverable 5, listed above.)

5. A combined SAND Report was written following presentation of the final review, and will be included as documentation for the milestone (Deliverables 5 and 6, listed above).

Given the existing and potential capabilities of the delivered calibration workflow and workflow technology, the committee concurs with the conclusion of the project lead, Pete Sholander, that the milestone is complete and successful.

Kevin Copps, Chair, on behalf of the ASC L2 Milestone Committee