

Collaborative Systems Engineering in the Ascent Abort-2 Crew Module/Separation Ring Project

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Generally speaking, systems engineering (SE) tool-sets face a dilemma balancing power and accessibility. High-powered SE tools (MagicDraw, Cradle, Core, etc.) tend to be specialized and are available only to highly trained Systems Engineers, and/or through the use of a 'back room' developer team making the output products available to the broader team. On the other hand, highly accessible tools (MS Word, Excel, etc.) do not have the power to implement SE in a rigorous manner.

NASA has to test all aspects of the new human-rated Orion Multi-Purpose Crew Vehicle spacecraft prior to its first crewed mission. The test program includes uncrewed launch abort flight tests to demonstrate the capability to save the crew in the event that a launch failure occurs. Orion's second abort flight test will be a low-altitude flight test known as "Ascent Abort 2 (AA-2)." This test is currently scheduled to be carried out at Cape Canaveral Air Force Station's Space Launch Complex 46 (SLC-46) in Florida in 2019. NASA's in-house AA-2 Crew Module and Separation Ring (CSR) Team is producing the crew module and separation ring.

Operating jointly as both an Advanced Exploration Systems (AES) Project and an Orion Project, the CSR project charter includes development of innovative, streamlined and generally more efficient practices for creation of flight hardware and software. One result of this tasking has been development of a collaborative and data-centric systems engineering environment within the team's shared web environment (Microsoft SharePoint).

Through the use of built-in, 'out of the box capabilities' present in MS SharePoint, the CSR Systems Engineering team has created (with some limited developer support) a data-centric architecture for the project's SE implementation, including functional and interface analysis, requirements development and management, risk management, verification planning and management, test results, and end item management. Data elements are linked between data structures so as to define and control relationships between item types, link requirements to parents and children, and link tests to the requirements that they verify.

The overall project team integration is increased by also linking SE content to project management content over the project life cycle, including team communication, action items, configuration management, decisional and meeting materials, and life cycle

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reviews. This presentation will provide an overview of the collaborative SE environment, showing how it provides the power for a number of SE tasks while still providing the accessibility and transparency to allow the full project team to collaborate and succeed. Given the project phase, we'll be able to present a nearly full lifecycle discussion, from concept through verification and approaching delivery.

Reason for submission as a presentation (<100 words)

Our intent in sharing our SE approach is to provide a counterpoint to the 'nominal' expectation of a full featured MBSE environment with the correspondingly large schema and training needs. We believe that for the right projects, a collaborative approach that is more accessible, if less powerful and detailed, in fact provides a better overall solution as seen by the project's success. As such, this is truly a discussion as compared to a dissertation, and therefore well suited to this format.

Presenters

Jenny Devolites has been an aerospace engineer for 25 years at NASA's Johnson Space Center. After graduating from Texas A&M University with a Bachelor's Degree, she spent her early career working in the Guidance, Navigation and Control (GN&C) disciplines, with increasing project management responsibilities. Projects included the original Simplified Aid for EVA Rescue (SAFER), International Space Station GN&C, the Autonomous Extravehicular Robotic Camera (AERCam), X-38, and Orion GN&C. From 2010 to 2014, she served as the Systems Engineering and Integration (SE&I) Lead and Test Conductor for the Morpheus Lander project, and currently serves as the SE&I Lead for the Orion Ascent Abort 2 (AA-2) Crew Module and Separation Ring (CSR) Project, which will be used for a launch abort flight test in April 2019.

Tony Williams is the Chief Engineer, Systems Engineering and Integration, at Jacobs Engineering, developing flight systems for the International Space Station (ISS) and Orion. He also serves as Jacobs Engineering Project Manager for flight systems such as the Orion Ascent Abort-2 test. Tony is the INCOSE Director for the Americas Sector and an ESEP and Certification Application Reviewer.

Time Format Recommendation

30 minute format with 10 minute Q&A - The implementation approach, using Sharepoint as an SE environment, does require a bit more in depth discussion that might be well addressed in a shorter duration.