

SIMUL8 Returns NASA to the Moon

Science Applications International Corporation (SAIC) used SIMUL8 to develop an integrative and interactive approach to optimize the manufacturing process design for a test flight article.

SAIC is a leading provider of scientific, engineering, systems integration and technical services and products to all branches of the U.S. military, agencies of the U.S. Department of Defense (DoD), the intelligence community, the U.S. Department of Homeland Security (DHS) and other U.S. Government civil agencies.

Background to the Project

The purpose of the study was to simulate the manufacture of a test flight article, the Ares 1-X Upper Stage Simulator (USS), for the future Ares 1 launch vehicle as part of NASA's program to return to the moon.

The manufacturing concept was to divide the entire upper stage of the vehicle into a series of cylindrical segments (called tuna cans) that stack together. Primarily two facilities were to be used in manufacturing the USS at the Glenn Research Center (GRC). The critical point of interest was the attainment of the individual segment departures from the two manufacturing facilities and the GRC.



The project was highly complex and has various complications; fabrication and material handling floor space is limited; fabrication equipment and techniques that need to be created during the production of some segments must be integrated into the IPT plan; the pool of skilled staff is limited; and the engineering development tasks are being executed in a highly complex team structure, with the work spread across multiple design teams and contractors.

Project Objectives

- Optimize the design, fabrication, and test approach(es) to ensure that all of the USS segments for flight test article 1 are manifested for transport to KSC no later than March 2008
- Optimize the utilization of USS team resources (civil service and support service contractor staff, and facilities and equipment) to achieve the targeted segment departure dates within the baseline resource budget for the USS IPT.

The Approach

SIMUL8 was used to focus specifically on the challenging process of manufacturing and mating the tuna cans in Building 50 and to provide more detail on this part of the overall USS IPT. The most significant part to understand in the simulation was how the work flowed between these major portions of the overall process.

Process details required for the simulation were obtained from the process managers over repeated question-and-answer sessions as well as through weekly feedback sessions. This process helped mature the simulation, ignite process discussions among the process owners and ensure there would be confidence in any results provided.

The Results

The resultant recommendations were considered to be highly effective by the USS IPT team and as a result, the IPT has adopted the following changes:

- Adopt a mechanized welding approach to minimize weld defects and subsequent rework
- Shift design resources to finish the common segment design as quickly as possible
- Adopt a crew-based approach to maximize crew skill level
- Implement a schedule "dashboard" to increase visibility of segment manufacturing flow to the team and to the staff on the floor
- Implement flange storage recommendations
- Study moving the clock, mate and match drill and the secondary structure to Building 333.

While the results obtained were directly beneficial, the study also helped the build team to consider aspects of their manufacturing problem and address fundamentals solely as part of collecting data to build the model.

The Benefits

SIMUL8 was cited by the program manager as providing the concrete results to justify altering the manufacture process to allow the team to deliver on schedule, contribute to the timely flight test of the new launch vehicle and subsequently allow the continuation of manned space flight.

George Culver, Sr. Operations Research Analyst/Engineer at SAIC said , "We chose SIMUL8 as part of the study because it provides rapid model development, a high degree of control over entities within the simulation and superior graphical execution of the model that helps with troubleshooting and customer buy -in."

Future Projects

As the NASA process managers gain better understanding of the process, the SIMUL8 model can be updated to investigate more dynamic routing for the order of tuna cans and the assignment of which tuna can is assembled on which stand.