

Aerospace and defense

United Launch Alliance

Rocket scientists use Teamcenter to manage multi-step analysis chain and make faster, more informed decisions

Products

Teamcenter, NX

Business challenges

Hundreds of disconnected in-house and commercial analysis tools

Errors resulting from manual, brute-force analysis chain management

Terabytes of unmanaged simulation data

Need to accelerate launch times and achieve goal of 100 percent mission success

Keys to success

Deploying the Teamcenter simulation process management solution

Treating analysis as a product ULA delivers to its customers

Configuring the analysis chain to be self-aware of the input/output parameters in each analysis container

Results

New digital best practices fully embraced by company's engineers

Faster, more efficient analysis chain

Integrating simulation data from hundreds of tools, ULA can easily track the results from step-to-step and know when an analysis should be rerun

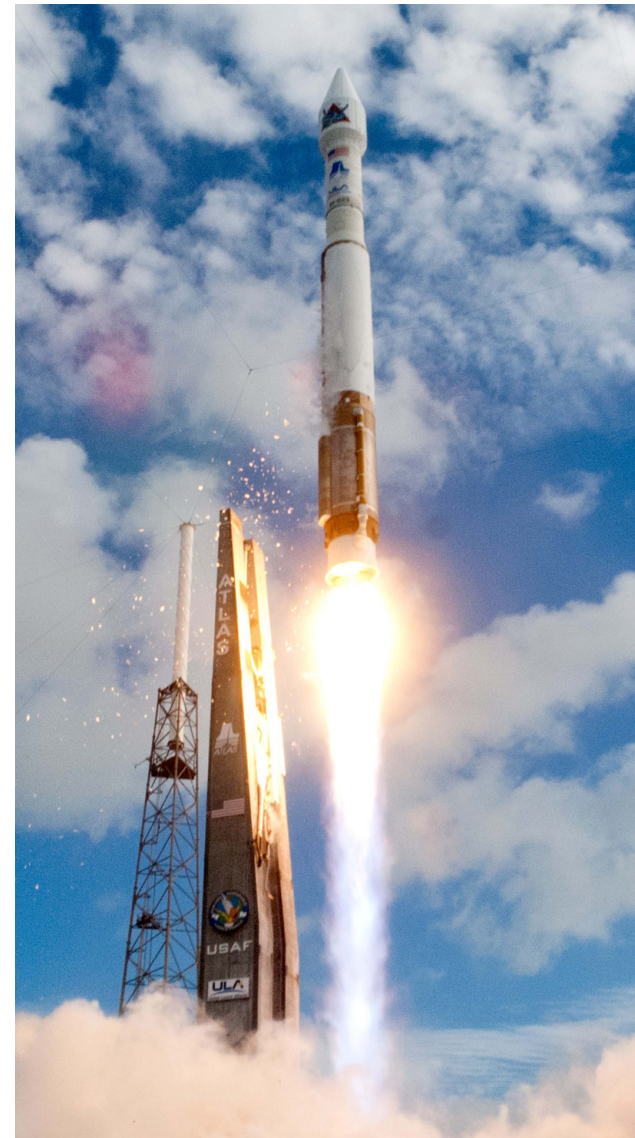
Relentless pursuit of success

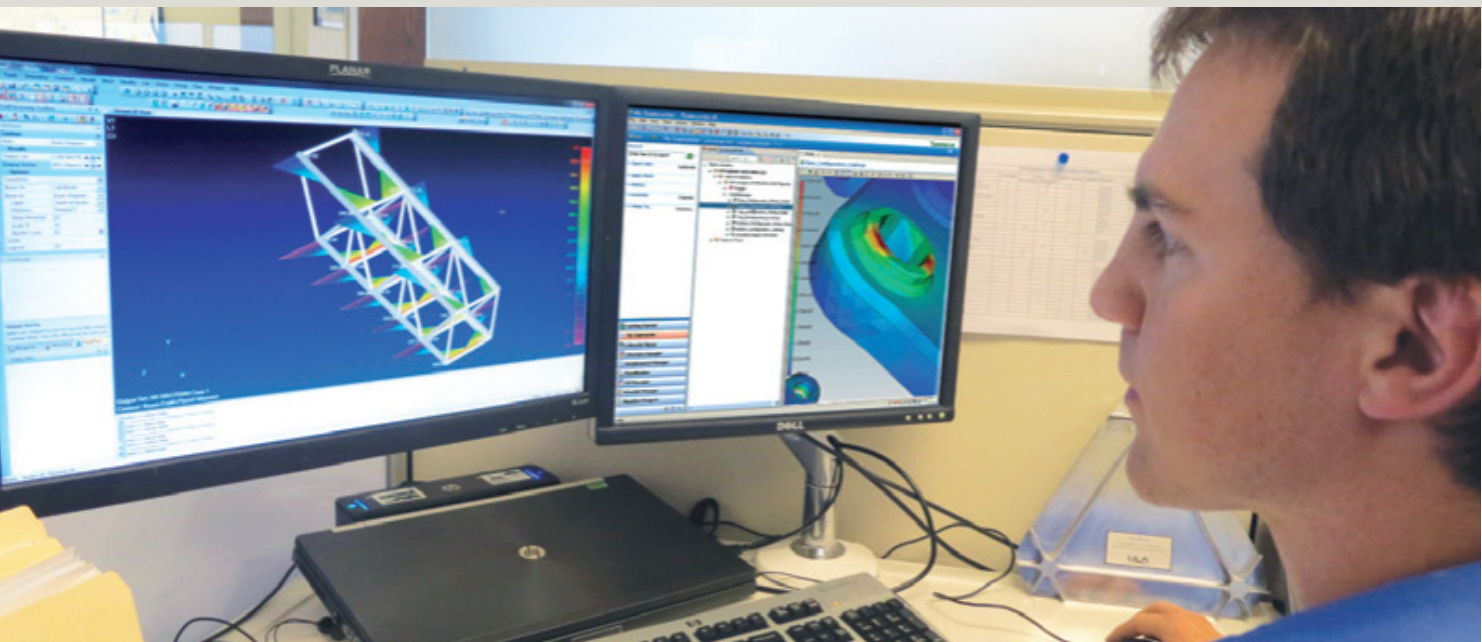
United Launch Alliance, LLC. (ULA) is a leader in designing and building reliable, cost-efficient vehicles to launch critical spacecraft for the United States Government, including the Department of Defense, NASA, the National Reconnaissance Office, and other commercial customers.

Headquartered in the US state of Colorado, ULA was formed as a 50-50 joint venture between Lockheed Martin and The Boeing Company in 2006. The formation of ULA brings together the Atlas and Delta lines of rocket systems, two of the most successful launch vehicles over the past 50 years.

Leveraging that tradition of success, the company continuously reviews and improves every process and product to meet and exceed the wants of its customers. ULA's employees share the organization's commitment to relentlessly pursue absolute success for each new mission.

However, there are always new challenges. With the science of rocket building becoming ever more sophisticated, the need for more complex, comprehensive





Results *(continued)*

Ability of engineers to trace analysis chain all the way back to the start

Ready understanding of how decisions were made, including the process, assumptions, analyses and results

Smarter decisions, improved deliverables

Expected reduction in overhead and documenting of analysis assumptions

simulation models is rapidly evolving. With this evolution comes a need to unify and integrate data from a wide range of sources and align it to mission objectives.

Mountains of simulation data

"The most important thing about what we do is mission success," says Marc Solomon, PLM chief engineer and engineering systems architect at ULA. "Our job is to take our customer's payload to a place in space without shaking it to death." What's interesting to note is that the rocket hardware design does not change very much for each launch. "We do not redesign our vehicle every single time," says Solomon. "What we re-engineer is our analysis. Our analysis is very important to us, and is a measure of our success, even as much as our design."

To successfully place a payload into space, ULA has come to rely on a vast array of simulation solutions, both off-the-shelf and homegrown. After 50 years of simulation and launch experience, the number of simulation tools has notably expanded because the company's engineers like to keep what's working while adding more tools as analysis needs evolve. Today, ULA uses hundreds of tools over a multistep analysis chain, where results from one step serve as input for the next step.

The result is an overwhelming mountain of simulation data that requires labor intensive, often highly redundant administration. In the past, integrating data from one analysis step to the next required physical meetings between engineers to share information, review data and make sure the applicable parameters were used.

ULA uses hundreds of analysis tools over a multistep chain. Using Teamcenter, ULA can easily track the results from step-to-step and know when an analysis should be rerun.

“Different generations of rocket scientists come and go. To retain valuable project insight, we have to be able to effectively capture and extend knowledge.”

Marc Solomon
PLM Chief Engineer and Engineering Systems Architect
ULA

While this method worked for ULA, any inefficiencies or waste would threaten ULA's competitiveness. To speed launch timeframes and help deliver mission success, ULA needed a better way to harness simulation data. Solomon points out, “We are the most successful rocket company on the planet. But we have to evolve to preserve it.”

Managing the analysis chain with Teamcenter

Solomon envisions a streamlined and automated process for progressing through the analysis chain. “The results from an analysis have to go from tool to tool, that is, flow in a digital, machine-readable fashion,” says Solomon. The simulation process management solution in the Teamcenter® portfolio was developed for exactly these types of challenges, and provides data, workflow and process management across departments and functions to streamline collaboration.

A longtime user of product lifecycle management (PLM) technology from Siemens PLM Software – including NX™ software for computer-aided engineering (CAE) and Teamcenter for PLM – ULA saw the potential of extending its use of Teamcenter to address simulation data management.

“We have done this with Teamcenter for simulation and the CAE model by using the analysis as a container with a configured relationship of the information coming in,” says Solomon. For example, each analysis has a set of inputs and set of outputs that serve as inputs to the next process, or “link,” in the chain. If a change in an assumption or an upstream process changes one of the inputs, then ULA's engineers know they need to rerun that particular analysis. If the output from that analysis ends up being different, then they know they also need to re-evaluate the second process, and possibly perform more downstream analyses. Using Teamcenter, ULA can easily track each input and output parameter and automatically flag the owners of each process when an input has changed and an analysis rerun is needed.

In the past, if an analysis assumption changed, they would typically re-evaluate the entire downstream analysis chain. However, by tracking and automating this process in Teamcenter, ULA can isolate the impact to an input change to just the affected links in the chain, saving valuable time and cost.



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“ULA uses thousands and thousands of one-dimensional equations, stick models and full dynamic models of the vehicle, authored in various tools ranging from MathWorks’ MATLAB environment to structural analyses to NX CAE, for example,” explains Solomon. “We use the Teamcenter simulation process management solution to close the loop with the tools that are used.”

Using the data model of the Teamcenter simulation process management solution allows each of the analysis parameters to be integrated and the corresponding tool needed for a particular analysis launched. With Teamcenter, each tool understands what inputs are needed and which outputs should be captured for the analysis.

Immediate benefits

Although ULA is only beginning to implement this new approach, the early results are already paying dividends. An immediate benefit is a reduction in the manual management of documenting analysis assumptions, processes and outputs. This means an engineer can easily trace the analysis chain all the way back to the beginning, which enables the engineer to confirm whether the original assumptions made are correct or should be challenged. Solomon notes, “The ability to quickly understand and compare changes in analysis inputs and results from mission to mission is enabling us to project months of improvement in process throughput.”

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Solutions/Services

Teamcenter Simulation
Process Management
www.siemens.com/teamcenter

NX
NX CAE
www.siemens.com/nx

Customer's primary business

United Launch Alliance is the leader in designing and building vehicles to launch critical spacecraft for the US Government, including the Department of Defense, NASA, the National Reconnaissance Office, and other commercial customers.
www.ulalaunch.com

Customer location

Centennial, Colorado
United States

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ULA

Siemens PLM Software

Americas +1 314 264 8499
Europe +44 (0) 1276 413200
Asia-Pacific +852 2230 3308

www.siemens.com/plm

Retaining analysis knowledge for the future

With a launch history that goes back 50 years, retaining all of the analysis experience gained over time has been a challenge. "Different generations of rocket scientists come and go," says Solomon. "To retain valuable project insight, we have to be able to effectively capture and extend knowledge." ULA's vision is quickly becoming reality. With the Teamcenter

solution, ULA's engineers now easily understand the assumptions, analysis processes and results and, ultimately, it's clear how decisions were made.

Solomon concludes, "Our society of rocket scientists is embracing this model, and we're looking forward to a lot of amazing changes."

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