

Making the Virtual Real: Siemens PLM Software Goes Into Space, Again

CIMdata Commentary

Key takeaways:

- *All products produced, sold, used, and supported are a result of transforming the virtual into the physical*
- *Product lifecycle management software has proven its ability to enable aerospace companies around the world to meet complex and evolving challenges*
- *Siemens offers a broad portfolio of aerospace-specific capabilities, and a demonstrable track record of success in the industry*

At the end of the day there is nothing better than witnessing a rocket launch, at least that is how people in the space industry see it. The PLM market is full of designs, collaborative efforts, visualizations, concepts, plans, ideas, and other non-physical things, but ultimately these virtual definitions turn into something physical. As can be said of all products produced, sold, used, and supported, they are a result of transforming the virtual into the physical. The reality in a product is nothing but the physical outcome of its product definition information, and when that definition is of something unique, something not seen too often, not owned by the masses—the ability to see the result of all of that data is something special. Seeing a rocket launch certainly fits into the category of something special. CIMdata was recently provided an opportunity to do just that.

On Tuesday January 20, 2015 the United Launch Alliance (ULA), a joint venture of Lockheed Martin and Boeing formed in 2006, launched a United States Navy communication satellite, the third Mobile User Objective System satellite (MUOS-3), from Space Launch Complex-41 at Cape Canaveral Air Force Station, Florida (Cape Canaveral) using an Atlas V rocket. The night launch, scheduled for 7:43pm, proceeded at a little after 8:00pm EST after the launch team successfully addressed a reported high altitude wind condition and communication issue. The launch was the culmination of a full-day event hosted by Siemens PLM Software (Siemens)—one that included a visit to the launch pad early that morning, a presentation from a NASA astronaut, a panel discussion, and presentations from space agencies and key space industry participants. The full day agenda illustrated Siemens' commitment and influence in the global space industry, and how they support transforming the virtual into the physical.

The launch marked a milestone for ULA, the 200th mission of Atlas V, the most powerful version of the Atlas-Centaur rocket. Besides the Atlas V, ULA provides spacecraft launch services using two other expendable launch systems (the Delta II and Delta IV) to the US Department of Defense (DoD) and NASA. The Atlas V family of Evolved Expendable Launch Vehicles (EELV) first went into service in August 2002. Since that time Atlas V vehicles have achieved 100 percent mission success, and this launch was no different. According to ULA, having been built modularly with flight-proven elements, the Atlas V has followed a carefully executed program of incremental improvements resulting in this success rate. Overall, the Atlas program has logged more than 600 launches to date. Now to the day's event...

At T-12 hours (the approximate time before launch) two motor coaches with media from North America, Europe, Asia, and South America, and a select number of Siemens' employees,

customers, and a few special guests departed for the launch pad. Upon arrival at the main gate of the US Air Force's Cape Carnival sprawling (2.3 square miles) facility a few ULA employees joined the delegation upon which the media attendees were asked to stop filming until the launch pad was reached. Unlike the John F. Kennedy Space Center (KSC), which is run by NASA (a civil organization), Cape Canaveral is not just a secure site, but a highly restricted site that contains three active launch pads used to launch Falcon 9, Delta IV, and Atlas V missions. The center is also the site of over 30 inactive launch pads.

T-11 hours: As the buses approached, there it was, the 206-foot Atlas V rocket now on the pad awaiting its night launch. Not just another single-use, disposal product. Having rolled out of ULA's Vertical Integration Facility building a few days earlier, the ULA team is preparing the rocket through its launch day routine, before the real show starts. Checking systems, and checking them again, before fueling and final count down. A big effort in itself, even when considering the years of effort that went into the design of the rocket and its high-tech payload, and this isn't the first time ULA has accomplished this feat. Since 2006, ULA has in fact launched 91 successful missions. Like many other complex industrial endeavors, the challenges faced by ULA and other industry leaders include designing and delivering products that fulfill a rich and complex set of technical and performance requirements, at lower costs and quicker than ever before. As mentioned throughout the day by the presenters, product lifecycle management (PLM) software has proven its ability to enable aerospace companies around the world to meet these challenges, with solutions used throughout a product's complete lifecycle, from concept through retirement.

T-10 hours: After spending about 45 minutes outside the launch pad's security zone, the group headed over to the Kennedy Space Center Visitor Complex for presentations and discussions to gain additional insight on how Siemens is supporting the space industry with its comprehensive set of PLM-enabling solutions. Dr. Helmuth Ludwig, Executive Vice President of Digital Enterprise Realization and Chief Manufacturing Officer for Siemens PLM Software initiated the session. Dr. Ludwig outlined Siemens' vision for space systems manufacturing. Core to this vision is the integration of product and production, and their optimization—a drive to close the loop between the virtual worlds of product and production design and engineering with the physical world where those designs become reality.

Dr. Ludwig's presentation was followed by an inspiring presentation by Mr. Ed Morris, Vice President, National Center for Defense Manufacturing and Machining (NCDMM) and Director, America Makes—National Additive Manufacturing Innovation Institute. Operated by the NCDMM, America Makes serves as a nationally recognized additive manufacturing center of innovation excellence. Mr. Morris spoke on how the center is seeking to accelerate the adoption of additive manufacturing design and production technologies in the US by bridging the gap between basic research and technology development and deployment. The institute envisions a day where every school has a 3D printer. 3D printing and other additive manufacturing techniques are rapidly changing how companies transform their virtual designs into physical products. This could prove to be a breakthrough and even disruptive technology, not just on earth, but in space as well. Made In Space has already placed a 3D printer on the International Space Station. Made In Space's Zero-G Printer was the first 3D printer designed to operate in zero gravity. Launched into orbit on September 21, 2014, the printer was built under a joint partnership between NASA's Marshall Space Flight Center and Made In Space. This technology could dramatically reduce the amount of specific tools and spare parts that need to be stocked on the space station—why take up the storage space when you just need to print it when and if you need it? The evolution of 3D printing technologies in recent years has been astounding—from its roots in printing wax and thermoplastic to its ability to make

the hardened titanium parts vital in some A&D supply chains. One of the day's next speakers, Robert C. Springer, echoed this point.

Mr. Springer, the manager of Space Station Freedom's element integration for Boeing Aerospace and Electronics Division in Huntsville, Alabama, is a former NASA astronaut and a retired US Marine Corps Colonel. Mr. Springer spoke of his time as an astronaut where he logged more than 237 hours in space as a mission specialist during his two shuttle missions—STS-29 Discovery mission in 1989 and STS-38 Atlantis mission in 1990. Mr. Springer commented on the challenges often faced during a mission in space.

The final keynote speaker of the day was Mr. Matt Smith, VP, Engineering and Information Technology for ULA. In this role, Mr. Smith has enterprise-wide responsibility for engineering and IT personnel, processes, tools, products and services, as well as technical oversight and launch readiness certification activities. Mr. Smith spoke on the challenges ULA faces in today's highly complex and rapidly evolving space industry. He also touched on how Siemens' PLM software is helping ULA achieve success.

Mr. Smith was followed by Mr. John Roth, Vice President of Business Development for Sierra Nevada Corporation's Space Systems group. Mr. Roth commented on how Sierra Nevada (SNC) and others are supporting NASA's "Commercializing Space" initiative, which covers commercial cargo, commercial crew, and national laboratory components all designed to expand access to space while enabling the future of human space exploration. He also commented on how SNC uses Siemens' PLM software to support SNC's Dream Chaser program. By using engineering design and simulation tools like Siemens' NX software, SNC reported that they have been able to achieve a 20-22% time savings on development. Mr. Roth was followed by two space agency presentations that stressed the need to collaborate. Mr. Marco Caporicci from the European Space Agency (ESA), and Mr. Jurgen Drescher from the German Aerospace Center represented their organizations' views on how space exploration is a multi-national, complex, and collaborative endeavor. One well suited for a robust PLM approach from CIMdata's perspective.

Finally, this portion of the day wrapped up with a panel discussion moderated by Siemens and supported by most of the day's presenters. Here again, the complexity and challenges of the space industry were discussed and PLM's rightful place in supporting the industry was emphasized. As with the automotive industry, the aerospace and defense industry has been a leader in deploying and driving PLM enhancements.

T-3 hours: Next on the agenda—a somewhat unique opportunity to see space, or at least something that has gone into space many times. In the tradition of Disney World and other famous Florida theme parks, the Space Shuttle Atlantis Attraction at KSC is impressive, not just because it features the shuttle itself, but also because of the story the attraction tells. The majestic shuttle is right there; one can almost reach out and touch it. Atlantis, the second to last shuttle to be built by Rockwell International and delivered to NASA, flew to space and back 33 times over its 16 years in service. Like the Atlas V seen earlier in the day on the launch pad, the Atlantis, with its large cargo bay open to the public and all those thousands of ceramic tiles we heard so much about in plain sight, also represents the culmination of many thousands of hours of design, analysis, manufacturing, and service support. It is another great example of the physical result of the virtual world.

T-2 hours: At this point, the crowd migrated to the launch viewing area—the Apollo Saturn V (ASV) complex—for dinner and the main event. The ASV complex is impressive, with a full Saturn V laying on its side inside another well thought out KSC attraction. The Saturn V program, like much of the shuttle program, didn't have access to the sophisticated PLM-

enabling technologies available today. Drawing boards and slide rules were the tools of the day. Today's smart phones put to shame the compute power the US space pioneers had available back in the 1950s, 60s, and even 70s. Today's computer-aided design, simulation and analysis, visualization, data and process management, and other PLM-enabling software solutions are generations ahead. What ULA, SNC, and other leading space companies are doing today is impressive and is driving the industry rapidly forward, and Siemens is playing a critical role.



The Atlas V on the Launch Pad

According to Siemens, eighteen of the twenty largest companies in the aerospace industry rely on their solutions. Siemens offers a broad portfolio of aerospace-specific capabilities, and a demonstrable track record of success. As discussed by some of its customers during the day, many industry leaders rely on Siemens' solutions to optimize manufacturing processes that realize their products.

T-20 minutes. It's go time, time to witness the launch...I just wish that they had told us that there was a time delay in the audio broadcast to the crowd. From the lawn outside the ASV, a sizable number of people waited, along with hundreds more on viewing stands next door. In the distance, pad 41's massive floodlights could be easily seen. All we had to do now is wait for the count down. Loud speakers scattered throughout the viewing area provided on-going commentary about the rocket and its mission as well as answering questions coming in over a Twitter feed. The countdown ran longer than planned due to an identified high altitude wind issue and a communication glitch. Suddenly it was announced that the launch was a go and the countdown commenced but because the audio feed was delayed the Atlas V's engines lit and the rocket left the pad as the announcer began the 10-second count down. By the time the announcer said blast off the rocket was well into the air and the sound of its departure had reached the viewing area. Another Atlas V successfully had departed the east coast of Florida to place a satellite into geosynchronous orbit. Another powerful physical-world

demonstration of what the virtual world of PLM enabled...there's truly nothing better than witnessing a rocket launch.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM). CIMdata provides world-class knowledge, expertise, and best-practice methods on PLM. CIMdata also offers research, subscription services, publications, and education through international conferences. To learn more about CIMdata's services, visit our website at <http://www.CIMdata.com> or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48808, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.