DASSAULT SYSTEMES

AEROSPACE & DEFENSE

BELL HELICOPTER

Accelerating Design Collaboration and Innovation with 3DS Solutions and ENOVIA

Bell Helicopter 505 Jet Ranger X was designed and manufactured with Dassault Systèmes' V6 technology, including ENOVIA, CATIA, DELMIA and 3DVIA.

Bell Helicopter
A Textron Company

Challenge:
As part of its Business Systems Modernization initiative, Bell Helicopter sought to establish one source of information that could be shared enterprise-wide and with its suppliers and partners.

Solution:
Bell chose to upgrade to ENOVIA V6R2013x to manage all of its aircraft and parts data, from contracts all the way down to capturing the delivered aircraft as a bill of material.

Benefits:
ENOVIA V6R2013x has provided a single, enterprise-wide solution with increased visibility to information, improved interoperability with CATIA V6 and enhanced stability that Bell's large assemblies require, improving productivity and quality between engineering and the shop floor.

Bell Helicopter, an icon in the aviation industry, was the first company to obtain certification for a commercial helicopter, and has been a mainstay of the US defense industry since World War II. Headquartered in Fort Worth, Texas, USA, Bell's mission is to "change the way the world flies with superior vertical lift that saves lives, preserves freedom and provides customers with exceptional value." Since 1935, the company has delivered more than 35,000 aircraft to its customers around the world.

To ensure Bell can continue to deliver on its customers' requirements with speed and reliability, the company launched its Business Systems Modernization (BSM) initiative in 2008. One main driver was to replace Bell's aging legacy systems, some of which had been in use as many as 35 years, with more modern, integrated solutions.

BUSINESS SYSTEMS MODERNIZATION

BSM aims to deliver more flexible and user-friendly innovation and collaboration systems not only to Bell's engineers, but across its entire organization, and for use in its interactions with suppliers and partners. "We needed to leave behind the technology of the 70s and move into the 21st century to be more responsive and lower our time to market with new products," says Charles Marsh, Chief of Design Tools and Standards at Bell Helicopter.

One key element of the BSM effort has been to establish one source of information that can be shared across the company. "We chose ENOVIA from Dassault Systèmes (3DS), not as an engineering tool or even just as a CAD data manager, but to manage all of our aircraft and product data, from contracts all the way down to capturing the delivered aircraft as a bill of material in ENOVIA," says Jeff Cloud, Manager of Systems Engineering and Engineering Operations for Bell.

To date, Marsh says, Bell has integrated four major systems: ENOVIA V6 (global collaboration), SAP for ERP (enterprise resource planning), CAMS (complex assembly and manufacturing system) and Primavera (scheduling and earned value information).

The first BSM GoLive, in 2011, included Dassault Systèmes' ENOVIA V6 and CATIA V6, with an implementation of CAMS interface. In 2013, it launched SAP with enhanced interface to ENOVIA. Bell also created a one-way integration between Primavera and ENOVIA.

"At Bell, we've been going through many cycles of system upgrades through the BSM journey," Marsh says. In the latest cycle of the continuing BSM effort, Bell chose to upgrade from ENOVIA V6R2011 to ENOVIA V6R2013x to capitalize on new functionality, he explains.

"V6R2013x brings improved interoperability between ENOVIA and CATIA V6 to Bell," says Marsh. "Behaviors in ENOVIA can now be replicated in CATIA, so that you have one platform."

The solution delivers the enhanced stability Bell's large assemblies require. "We have very large bill of materials and complex trees that are integrated between CATIA and ENOVIA – and that integration is bidirectional," Marsh explains. "V6R2011 simply could not perform all of the actions that were required to synchronize those bills of materials. CATIA BOM to ENOVIA BOM is a huge benefit."

The upgrade also positions Bell well for the future. "Our motivation to upgrade to V6R2013x definitely centered around the need to get on a more modern architecture so that we're on a go-forward path to upgrade to the **3D**EXPERIENCE platform at a later date," Cloud says.

"Because ENOVIA V6 is the primary for most of the product data and sends it to CAMS and SAP as the secondary systems, we are seeing an increase in the quality, with fewer errors created from data conversions or human input, of what is communicated from engineering to the shop floor."

– Jeff Cloud, Manager of Systems Engineering and Engineering Operations, Bell Helicopter

HIGH PERFORMANCE PLATFORM

Bell's need for a more modern architecture and high-performance solution are easy to understand when you consider the scope of its projects. "ENOVIA holds information for all of Bell's active products," says Marsh. "We currently have 11 active and three development programs all living on the V6 technology. We have more than 14 terabytes of data that we've captured and retain to document our parts and

products, so the 13x implementation was huge."

ENOVIA serves all of Bell's sites around the world. Workers from India and Singapore to Mexico, the United States and Canada all interact and consume or author information on the system.

"We have more than 6,500 ENOVIA users worldwide," Marsh explains. "And V6R2013x serves a broad range of different roles at Bell – from people writing contracts, design and manufacturing engineers, and quality engineers to authorities like the FAA (Federal Aviation Administration) and suppliers that provide us hardware and components for aircraft manufacturing. They all use ENOVIA to access our product information – whether it is CAD design, computer-aided manufacturing, planning instructions, certification documents or requirements – we carry the whole gamut of the company on ENOVIA."

Bell chose to migrate all of its legacy systems into ENOVIA. "All of our products, parts and documents have been migrated into ENOVIA V6," says Marsh. "This is true for legacy programs like CATIA V4 and new development programs that are being done in CATIA V6 – both types of product data coexist in ENOVIA. Legacy CAD data lives in the CAD platform it was developed in, but all of the parts data and documents merge together in ENOVIA."

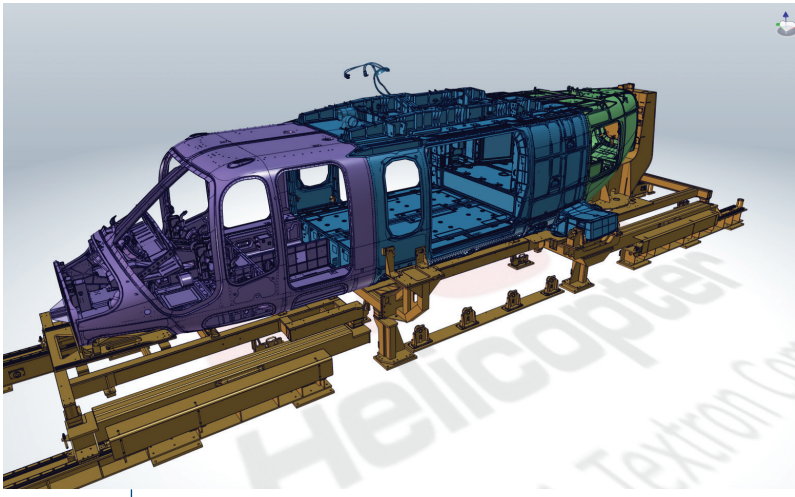
Marsh says that when it makes business sense to either create a new kit or a new product derivative of a CATIA V4 product, then Bell migrates that data to the CATIA V6 platform so it can leverage the downstream reduction in time to market that the CATIA V6 platform offers. "We're doing that, for example on the 412, but only in the areas that it makes sense," he says. "We won't do it wholesale, however, if there is no benefit for that non-recurring cost."

MOVING TOWARD ZERO FILES

Although Bell's primary users of ENOVIA are its engineers and manufacturing engineers, it truly is an enterprise-wide solution for the company. "The engineers are in there, and they're probably some of the more prolific users," says Cloud. "But we manage our aircraft and our product data from contracts to certification, so our contract organization all the way down to capturing the approved bill of material happens in ENOVIA – from the beginning to the end."

It is a ZERO files approach that is beginning to take hold at Bell. "All of our documents are now more like objects," Cloud explains. "We have them all in one place and all of the approvals are in ENOVIA. There is one place for everyone in the company to go to find information. They don't have to ask someone else to go find it…it's not locked in someone's drawer."

A large number of file types once juggled by the company's employees such as parts lists and bills of material have been moved to ENOVIA. "Those are now the engineering bill of material in ENOVIA, and the parts have metadata attached to them," Cloud says. "The notes are metadata. The usage is metadata. Where the part is built is metadata. So we pull information out of ENOVIA and feed it downstream to CAMS and SAP to execute and build parts in plants in Mexico, Canada and Texas."



Aft Fuse for joining and drilling with 3DVIA Composer

Fuselage Assembly with CATIA V6

Bell is moving away from a time when people asked their colleagues to send them a file or Excel spreadsheet of parts for the latest aircraft, Cloud says. "You don't have to do that now. It's in WIP and it's visible in ENOVIA for everybody in the company to see. So we're transitioning to a data-driven architecture at Bell."

But Cloud stresses that it is more than just visibility, he calls ENOVIA Bell's 'one source of the truth.' "Of course ENOVIA can be an engineering-only tool, but we have it for everyone. It's at the 'headwaters,' as we say, of product design. ENOVIA is where everything begins and it has provided an enterprise-wide ability to understand where information is and that it is the most up-to-date version. We can feel certain we're not working with outdated information."

CAPTURING REQUIREMENTS

Bell uses V6R2013x to manage all of its product data – from requirements and 3D models to documents and drawings. "Anything that is required to certify or manage an aircraft is housed or lives in ENOVIA," says Marsh.

Cloud says, for example, that Bell utilizes systems engineering to capture its requirements and stores those in ENOVIA. "We capture requirements from our customers, from regulatory agencies and from our own internal functions, including design and manufacturing engineering."

Cloud says Bell must capture the requirements, understand what they are, make them visible to the people who must design to those requirements and ensure the requirements will result in a quality product. "Capturing requirements drives the quality of the designs of the aircraft that we create, and helps Bell achieve first-time or near-first-time success on product deliveries that meet our customers' needs."

Bell's engineers use the features in ENOVIA's Variant Configuration Central application to break down the aircraft system by system, define each of those breakdowns with a feature, and decompose the features into subsystems all the way down to configuration items of self-contained assemblies, Cloud says. "At that time, we can tie requirements for the design to those configuration items. In this way, engineering has a system-wide, traceable view of what the aircraft must do."

Manufacturing engineers can then take that feature structure and 'remix ' it to match the build sequence of the aircraft using manufacturing features, Cloud explains. "So they consume all of the configuration items that were created by the engineers in the logical feature tree into a manufacturing feature tree that represents the build sequence of the aircraft. Then, that manufacturing sequence or structure is used to create the engineering bill of materials. The result is an engineering bill of material that, rather than being organized in a traditional way around system decomposition or functional architecture, is aligned around the way we're going to build the aircraft."

Bell also is capturing its options and kits in the feature definition. "We create inclusion rules that tell our marketing and sales teams working in SAP which options are compatible with others that are ordered by our customers," Cloud adds. "It really helps keep everyone on the same page."

TURNING PARTS INTO AIRCRAFT

ENOVIA's Engineering Central application allows Bell to include metadata to feed the downstream needs for the manufacturing of its aircraft.

"We start with the engineering bill of material (BOM) in Engineering Central. We have a planning BOM that consumes the engineering BOM and defines the manufacturing sequence and parts necessary to build certain assemblies specific to the plant where they will be built," Cloud says.

The planning BOM passes out of ENOVIA into CAMS and SAP, where it becomes the manufacturing bill of material or MBOM that will actually drive the execution of the assembly in the shop. The same kind of passing down of information happens with the work instructions.

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"So, planning and manufacturing consume the 3D data we have created on the engineering side," Cloud explains. "They create interactive work instructions (IWIs) from the data that shows the assemblers how to put the aircraft together or create certain assemblies, and those pictures or movies are incorporated into CAMS, so that as the operators are performing the operations, they have the list of steps they're executing. They also have a visible picture of what it should look like, or a movie that shows the steps to follow."

Bell uses 3DVIA Composer from 3DS to create IWIs from CATIA V6 data to allow its manufacturing teams and suppliers to visualize and inspect parts. "The 3DVIA file is, in essence, a drawing that is a rotatable, zoomable 3D view of the information with all the dimensions necessary to inspect the part," Cloud explains.

Bell's IWIs have replaced text-based assembly instructions and snapshots of 2D drawings. 3D instructions ease communications problems and eliminate language barriers with manufacturing plants in different locations around the world. "By eliminating text and using symbols to represent operations such as drilling, gluing, sealing and clamping," Cloud says, "we don't have to spend time translating our instructions into multiple languages."

To share IWIs and other information such as design data and

process and material specifications needed to build parts and components, Bell has set up portals for its suppliers to access ENOVIA. "They interact with what we call a technical data package that contains the information necessary for the part, and they extract that into their own systems," Cloud says.

UPGRADE EXPERTISE

The biggest challenge for Bell was to carry out the V6R2013x upgrade in such a way that it did not interrupt its business. "Having systems down, especially like ENOVIA that we rely on every day, is significant," Marsh stresses. "So, our first challenge was to reduce that down time."

Marsh said after a positive experience with Dassault Systèmes Industry Services (DSIS) for modernizing and customizing its systems with V6R2011, it made sense to partner with DSIS again when it came time to upgrade to the V6R2013x release. "They helped customize V6R2011 to meet Bell's needs, so who else would know better what those needs were when it came to upgrading to V6R2013x?" he said. "DSIS ensured that the enhancements we made to V6R2011 translated one-for-one into V6R2013x, so that we could continue to do business just as we were used to doing it."

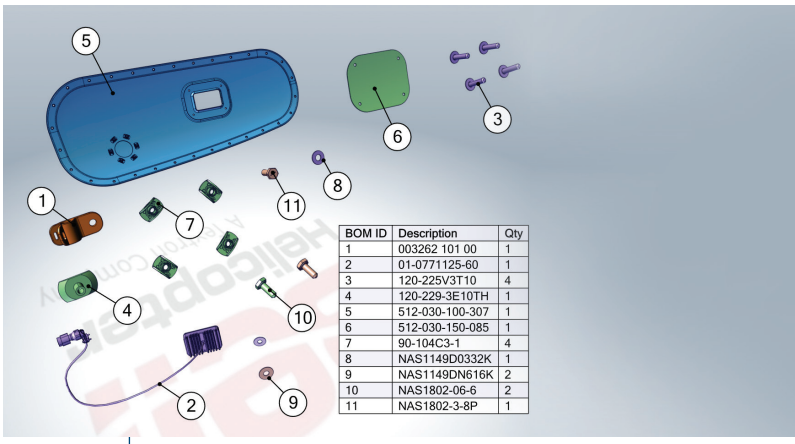
"Using V6R2013x out of the box works for startup companies that don't have existing data, but at Bell we have about 14 terabytes of data," said Marsh. "We've got a large investment in the aircraft that we're managing with ENOVIA, and we had to ensure that all of the product definition information migrated correctly and functioned properly."

Bell had a very lengthy migration path with more than 1,400 steps which DSIS helped to orchestrate. "DSIS provided beta testing and developmental code validation on the Dassault side," Marsh said. "We also brought it in-house onto our development server with Bell data, and they validated that code and that the fixes worked on our system prior to giving it to Bell to test in our test environment."

DSIS also sat on Bell's executive steering committee to help guide decisions made throughout the migration process. "They provided resources to mitigate problems that occurred during the migration and a direct pipeline to 3DS R&D to communicate our requirements and needs so those could be met with the solution delivered," Marsh says. "The DSIS involvement with the V6R2013x upgrade was critical to the success of the implementation. I personally believe without DSIS engaged, this implementation still would not have occurred. They reduced the time and ensured the functionality was in place and that the product delivered was high quality."

LESSONS LEARNED

Bell has learned a lot throughout its BSM journey about implementations. One major lesson, Marsh stressed is to build an environment for development and testing that is customer representative. "That means having customer data, customizations and the schema which those are built on, so that you can test and be confident that those behaviors will flow through into production," Marsh explains.



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6	512-030-150-085	1
7	90-104C3-1	4
8	NAS1149D0332K	1
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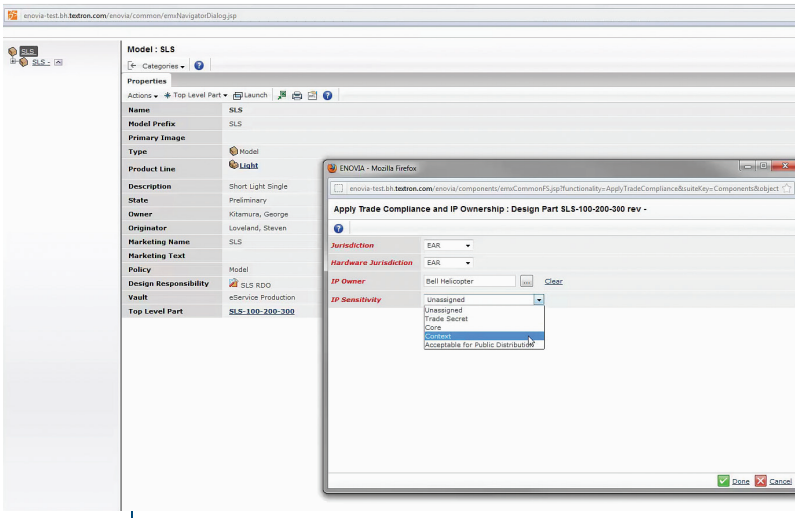
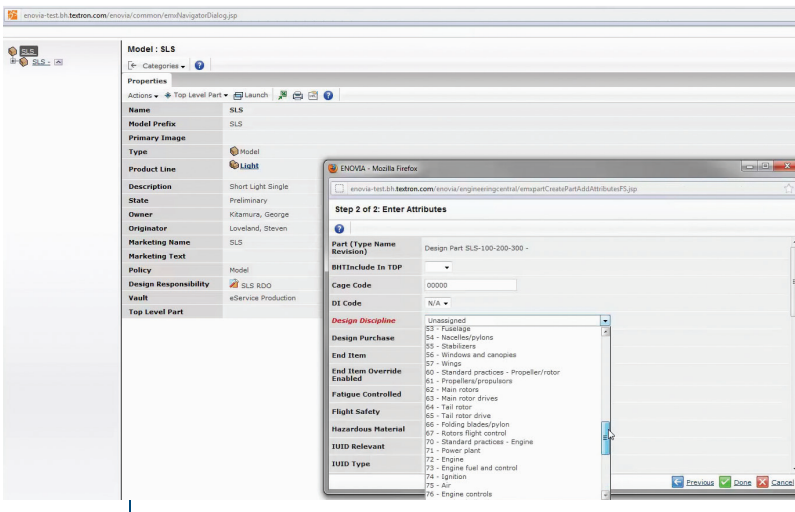
Interactive Work Instruction with 3DVIA Composer



Apply Trade Compliance and IP Ownership in ENOVIA



Entering attributes for Engineering Change Order in ENOVIA

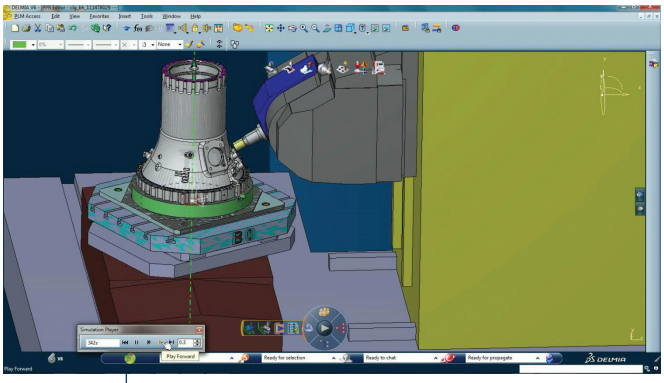
With upgrades every year or so, Marsh says change management is continual, and V6R2013x has been no exception. "Our objective was to inform our stakeholders what to expect well in advance. We established a very robust communication plan, which included an effort to encourage testing from the business," Marsh says.

Bell's implementation team communicated frequently, Marsh stressed, through many different avenues. They hosted 'lunch and learn' events, created websites and relied heavily on repeated email communication.

Training also was thorough and conducted well in advance of GoLive with users across the organization and among contractors and partners. "We reached out to all constituents – from engineers and contractors to manufacturing engineering, quality stakeholders, suppliers and even the FAA and our customers," Marsh stresses. "We ensured that they knew how to navigate to get the information they needed to support our business."

Marsh says the biggest lesson learned from the V6R2013x upgrade, however, is to make a very robust plan. "Plan for mistakes; plan for challenges; staff the plan; identify issues early and get risks mitigated," he advises. "Ensure that you've got engagement from all areas of the business validating that your business needs are still being met. And plan in such a way that your implementation can be event- or gate-driven, not date-driven. There's always a time factor, but you want to ensure you get the functionality required. You don't want to break things that are working."

Overall productivity of Bell's teams has improved noticeably with V6R2013x. "With ENOVIA for our entire enterprise, the information around the product or the aircraft is available and visible to everyone that needs the data, not only the engineers, which is the way it was in the past," Cloud says. "And because ENOVIA is the primary for most of the product data and sends it to CAMS and SAP as the secondary systems, we are seeing an increase in the quality, with fewer errors created from data conversions or human input, of what is communicated from engineering to the shop floor."



Starrag Heckert Simulation in DELMIA V6

Focus on Bell Helicopter

Products: Bell Helicopter, a wholly owned subsidiary of Textron Inc., is an industry-leading producer of commercial and military, manned and unmanned vertical-lift aircraft and the pioneer of the revolutionary tiltrotor aircraft.

Revenue: $4.3 Billion USD (2014)

Employees: 8,500+

Headquarters: Fort Worth, Texas, USA

For more information
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