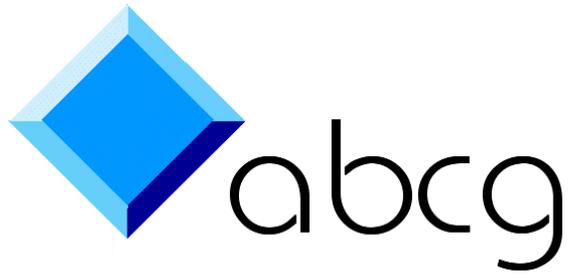


CATIA V6 – A User Perspective



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Executive Summary

The competitive imperative to innovate is driving more and more companies to specify, design, manufacture, market and support world-class products via international teams distributed throughout the world. Increasingly, it is no longer sufficient to simply check if parts “fit-together.” Optimal response to an on-demand market place requires that products must be designed, tested, produced, shared and experienced virtually in real-time.

Simultaneously, the Internet has evolved to Web 2.0, an environment where access to global information, on-line communities, and real-time interaction has become “child’s play” in a very real sense. The coming generation of engineers, designers, and consumers expect a level of information availability, community, interactivity, realism and response that would have been impossible only a few years ago. These trends are offering new opportunities and challenges in the PLM community. It is in this environment that Dassault Systèmes has announced V6 as PLM 2.0. At the strategic level, V6 is Dassault Systèmes’ vision or road-map for PLM addressing these trends. At the product level, V6 software is Dassault Systèmes’ new Global Platform for PLM. In this paper, Albert-Battaglin Consulting Group (ABCG) will describe how we see the software “reality” fitting with the “virtual” strategy in the initial releases of V6.

V6 is a global management and collaboration framework for PLM related intellectual property (IP.) 3D virtual representations of products and processes provide a common global language. Using 3D as a gateway into PLM, IP will allow companies to collaborate in beneficial new ways. ABCG was invited to Dassault Systèmes headquarters to review the new V6 platform. We took a CATIA user’s perspective in looking at what the V6 strategy would mean to V5 users in terms of improved capabilities. We also sought to investigate how easy the transition to V6 would be for current V5 users.

ABCG shares the Dassault Systèmes vision that PLM needs to inspire the coming generation of creative talent and that 3D needs to become the global language/medium for product IP to facilitate product innovation. ABCG found that V6 represents a good balance of integrating proven existing technology with important strategic architectural changes. ABCG also found that Dassault Systèmes has mounted an unprecedented effort to create a smooth path for moving from CATIA V4/V5 to V6. Dassault Systèmes is taking great care to minimize

disruption for current CATIA V5 users, making V6's increased capabilities available via a smooth transition process.

Converging Trends

Simply put, Dassault Systèmes' customers need to rapidly deliver products that meet market requirements in an increasingly global marketplace. This typically means constantly designing "best in world" products within a myriad of economic, regulatory, time and geographic constraints. Doing this requires enabling creative people to innovate as members of each organization's global (PLM) community. This is true of large, medium, and small companies alike. In the PLM space, innovation demands efficient use of resources wherever they are to create and utilize intellectual property. This phenomenon is rapidly increasing the quantity and types of IP being created and managed by PLM systems, as well as the number and types of organizations and individuals that need to access it.

In parallel, on-line portals, games and communities outside of the PLM space have created new expectations regarding how individuals interact with each other and their computers. Instant global searching, realistic 3D, and ad-hoc domain specific communities are the norm for today's educated, creative work force. For the on-line consumer, seeing and experiencing potential products on-line will ultimately be more compelling than reading about them.

These trends are pushing PLM vendors to deliver what Dassault Systèmes calls PLM 2.0, a platform for Global Online Collaboration. V6 was designed to be that platform.

Dassault Systèmes Solution – V6

The announcement of V6 represents the next big step for Dassault Systèmes and its customers toward realizing their global PLM vision. Many will ask what this transition will bring for Dassault Systèmes' customers and users. For this reason this paper augments a top down strategic view with a bottom up user perspective. The bottom up approach for V6 means CATIA. V6 impacts all Dassault Systèmes brands, but it is the 3D core of PLM that differentiates it from other IT technologies and CATIA is the core of Dassault Systèmes 3D. Consequently this paper will focus on the perspective of V6 from the CATIA viewpoint.

With V6, Dassault Systèmes has stated six strategic elements:

- Global Online Collaboration on V6 Platform
- Lifelike Experience
- Single PLM Platform for IP Management
- On-line Creation and Collaboration
- Ready to use Business Processes
- Lower Cost of Ownership

ABCG was invited to Dassault Systèmes headquarters to see the V6 technology first-hand. Over a period of several days, we spoke with various product managers and cut short long Power-Point presentations in favor of seeing what the software can do. We took a critical look at each of the six elements and have mapped what we saw against them in an attempt to bridge the gap between strategy and software.

ENOVIA - Global Online Collaboration on V6 Platform

3D as IP portal

With V6, ENOVIA 3DLive becomes the CATIA users' access point for all PLM data. This gives users better ability to find and load the parts that they must access for the design task at hand. All V6 applications include the PLM toolbar and PLM compass which are described later. The Search button on the PLM toolbar allows searching by name, and once projects are found, individual parts or assemblies can be accessed by using Dassault Systèmes' unique 3D turntable. Using 3D geometry as the "index" immediately makes one familiar with the product being designed as well as the spatial context in which parts of interest exist. This helps people accessing the data to gain a better understanding of the product, even while searching. In a concrete sense ENOVIA 3DLive causes the product rather than the part number to be the focus of attention.

ENOVIA 3DLive has many ways of locating parts including a proximity search that allows all parts near a desired part to be located as well as attribute searching which can be tailored to company specific requirements. For example, suppose that a certain Knowledgeware check should be run on various parts. Using attributes, it is possible to find out which parts the check is used in, whether it has been run, where the check has succeeded and where it has failed without opening or loading any parts or assemblies. Once a desired group of parts is

found, it is then possible to load just those parts into a V6 session for editing. Parts that are not required are not loaded, thus improving the engineer's performance.

Any search can be saved in a "Favorites" list just as in common web browsers. The Favorites list stores the search rather than the results, so that each time the search is run, the up-to-date results are displayed.

The first things a V5 user will notice about V6 are the PLM toolbar and the PLM Compass. These tools are the outward sign that V6 is a unique collaborative environment. The V6 collaborative environment encourages and will lead to improved, real-time collaborative work practices in PLM communities. When working on a part or assembly, the PLM Compass can be used to see who is responsible for a given part or sub-assembly, whether or not they are working on that object now, and whether they are on-line and available for real-time chat and/or collaboration. In Microsoft network environments, video conferencing is also available. The real-time, heads up nature of V6 will enable geographically dispersed teams to collaborate almost as if they were in the same room.

Using V6's Co-design capability users anywhere can brainstorm together to solve design problems in 3D. One good example is a typical space reservation problem. One user might be responsible for space reservation while another for detailed design. Using V6 Co-design, the space reservation feature can be pushed in real-time to the detailed designer. In his V6 session he is able to clearly see the design intent via a slider bar which essentially fades between the existing and new feature state. After refining the shape together, the detailed designer can accept the new feature into his or her detailed design. This represents a new way of real-time 3D collaboration. V6 allows multiple users to innovate together to solve problems as if they were standing next to each other sharing a single design session.

Lifelike Experience

An important V6 strategic goal is to enable "Lifelike experience." The idea is for the virtual representation of the project to appear and "behave" as realistically as possible in the given context. Naturally, appropriate realistic behavior may differ for various people accessing the representation. For the CATIA user, some key areas stand out where the drive for lifelike experience is evident.

UI Simplification –CATIA Live Shape

One important aspect of lifelike experience is easy, natural user interaction. Unleashing creativity and innovation requires allowing people to understand and modify their creations without wasting time and energy communicating with their design tool. V6 includes the first version of CATIA Live Shape. CATIA Live Shape is Dassault Systèmes' new history-free modeling technology. Using the 3D robot and only a few icons, it is possible to easily create and modify complex geometry. The 3D robot looks like a coordinate system and has various handles for changing its position and orientation. Once the robot is dropped onto (attached), to an object such as a body or face, it allows that object to be repositioned or altered accordingly. The CATIA Live Shape UI is intuitive because of extensive real-time feedback and highly context-(selection) driven operations. Changes occur in real-time so that you can “see what you mean.” Faces can be pushed and pulled to form bodies, cut-outs, or bosses in real-time. These features can be moved, copied, and arrayed using just a few clicks and key presses. More than just a “sketch pad,” exact values can be entered at any time. A ruler can be used to accurately position or measure relative to desired geometric features. Because CATIA Live Shape does not rely on a history tree, it can also be used on B-rep models from any other CAD system to allow fast, easy modification of non-native geometry. CATIA Live Shape does this by recognizing design features and likely topological constraints in real-time. The technology allows a user to reposition a hole, rib or boss for example, irrespective of the method or CAD system initially used to create it. ABCG hopes that CATIA Live Shape, like 3Dvia Shape, will soon be supported with video tutorials, which demonstrate concepts and techniques. This is a significant improvement as anyone who has tried to learn modeling techniques from a reference manual can attest. CATIA Live Shape demonstrates how V6 is making 3D modeling easier, more fun, more open, and more productive to use.

Realistic Rendering

V6 includes basic photo realistic rendering as a standard rendering option. The initial capabilities, which are a product of DS's newly formed Design Studio, includes three standard ambiances and a library of 209 standard materials include 73 which have effects such as glass, car paint, depth of field, etc., which are linked to the part material properties. The function allows any CATIA user the ability to make a very high quality image of their

design at any time in the design process. Lifelike images contribute to better communication and product understanding.

Single IP Database - Single PLM Platform for IP Management

ABCG believes that effective Knowledge and IP management and reuse strategies need to be a focus for all PLM implementations. Dassault Systèmes realized during the early planning stages of V6 that file-based PLM data management did not fully address the PLM 2.0 requirements. File-based PLM means that IP can only be controlled at the file level. This has typically meant that parts, drawings, assemblies and other documents were managed as “black-boxes” with special purpose editors used to author and access the IP within them. This meant that much of the IP contained in the PLM system could only be accessed by specialists using special tools. V6 essentially moves important IP out of black-box files and into a network-accessible PLM database. From here this IP can be managed and accessed outside of traditional authoring applications from anywhere with an Internet connection. Although the implications of this are extensive, in this paper ABCG focused on the impact for CATIA users.

In V6 many IP objects “live” outside of traditional part or product files. In the initial releases of V6 these objects include assembly constraints, features, operations and relations, knowledge rules including design tables, and some application-specific entities such as 3D FTA information. When using true database objects, V6 users can better determine the impact that changing this IP will have on other designs. For example, before changing a design table a user can see which parts and products use that table, and who is responsible for them. The Impact button on the 3D compass is intended to show the dependencies of a given IP object.

Knowledgware objects are an important example of objects that have been removed from the file only context. This allows KnowledgeWare to be used outside of CATIA, in all V6 applications including 3DLive. KnowledgeWare in ENOVIA V6 allows the creation of business process rules in addition to the design rules used previously.

Common Data Base for All Dassault Systèmes Brands

With V6 CATIA, DELMIA and SIMULIA all share the common V6 database. This means that data needs to be created and maintained once for reuse throughout the community.

CATIA part geometry for example can be accessed directly by DELMIA to check how a part modification might impact the assembly process. The new Engineering Connector means that assembly mating and positioning information created by CATIA can be reused and extended by SIMULIA in order to perform an assembly simulation or analysis. Through the common ENOVIA portal, users of any of these applications can clearly see the impacts and inter-relations of their work on the work of others.

IP Control Using People and Organization Solutions

The ENOVIA V6 database makes it possible to control access to IP at the object as opposed to the traditional file level. One example of the benefit of this is a CAE analysis of a part. With V6, the part geometry, meshing, load and constraint definitions and results are all separate IP objects with separate access permissions. This would enable control such that a CAE expert has access to set up a part analysis while the part designer might only be able to run this analysis against his part modifications and produce an updated results object. KnowledgeWare checks and rules are similarly controlled outside the part/assembly context allowing correct control of this important IP. The correct level of IP control will allow more people in the organization to safely access and use knowledge (IP) created and maintained by others in the community.

The better level of IP control offered by V6 will also create new opportunities for collaboration with suppliers. Depending on access permissions, different individuals are allowed to see only desired components within an assembly, for example. This extends to Co-share and Co-design sessions as well, so that it is not necessary to build special versions of assemblies in order to collaborate on the design of a component in a context where other proprietary components also exist. ABCG could see this concept being extended into the product representation so that, for example, some individuals could see a part as a B-rep while others could have access to individual features. The V6 architecture should allow this to take place without maintaining separate versions of a component.

Robust Relational Design

Knowledge, in the form of relation design, is a cornerstone for effective design automation. V6 technology allows for robust inter-part constraints and relations that will allow confident use of advanced relational design techniques to automate the design process. V6 includes several significant advances in assembly design including multiple design representations,

assembly features, and assembly operations, such as mirror, as well as improved inter-part constraints and relations. In V6, parts and drawings are managed as product representations, and each product can include an unlimited number of representations. The representation can be anything from a CATIA part to a photo to a model file from another CAD system. These representations can be associatively linked to sub-products or vice-versa. In this way sub-products can be driven by higher-level requirements, and different, but still associative, representations of the product can be maintained for various purposes (i.e., welding, assembly, or post-welding machining.)

Inter-part relations, sometimes called links, represent important company know-how and IP. With V6, inter-part relations and constraints are managed as true database objects. Because each link is managed separately, updates are faster since only changed links trigger updates, and it is not necessary to open and check part files in order to check links. Links as IP objects also allow dependencies to be better understood by everyone involved in the design process, not just the author, improving collaboration. V6 also incorporates a new automatic re-linker that allows parts and assemblies to be copied, switched and substituted while maintaining correct relationships. V6 assembly improvements will yield greater confidence to use powerful relational design techniques in order to deliver robust product morphing.

Concurrent Design

An important benefit of V6 is the ability for multiple users to work concurrently on the same assembly. This has not been possible with a file-based approach. In file-based assembly approaches, component positioning information is stored with the parent node of the assembly. File-based assembly management approaches essentially lock this parent node of the assembly tree, giving a single user write access to change the assembly. By managing the component positioning at the object level, V6 allows multiple users to manipulate components within the same assembly simultaneously in the database, enabling true concurrent design, thus reducing design time. In fact, two people can even simultaneously work on the same part using Co-design to share and trade modifications as desired.

Large Scale Design

V6 was designed to excel in large-scale projects. For individual users, V6 incorporates important memory management improvements over V5 that will allow assemblies with huge numbers of components to be designed, modified and documented interactively. V6's

memory management automatically loads and unloads parts from memory as required by the task being performed. This should lead to better performance for workstations with limited RAM.

Smart Drawings

Some of the V6 search capability has to be incorporated within the drawing generation capability of V6. Drawing views can be created based on saved searches. This means that a drawing could be made of parts within some distance of a given part, parts above a certain size, or parts containing a specified attribute. These views and drawings are then dynamically updated as the database changes.

On-line Creation and Collaboration

The on-line creation strategy appears to be in its infancy from ABCG's perspective. A typical CATIA user will not notice much on-line capability once he starts working on a part or assembly. Being on-line does mean that ENOVIA will notify users immediately if any part in their session is modified by someone else while they are working.

The strategy implies that various IP authoring applications or workbenches will either be downloadable or even server-based, but we saw no evidence of this to date. CATIA Live Shape is a stand-alone application and is relatively small compared to CATIA, but is still not available for download. Since some of V6's on-line collaboration capabilities were already discussed, we decided to highlight a couple of the newly available IP authoring capabilities available in V6.

Functional Modeling

One challenge for "history free" modeling approaches is that design intent is often lost for the sake of "rapid change." Design intent often represents a great deal of company know-how as well as a solid basis for design automation. V6 now includes functional modeling as a standard workbench. Functional modeling provides a method to replace or augment history-based features with smart features that capture true engineering design intent. Until V6, functional modeling had primarily been used for mold or casting design. With V6 other functional modeling domains such as "body in white" will be added. ABCG sees great potential in combining history-free, dynamic 3D design tools with engineering domain specific functional modeling capabilities to allow rapid, easy and most importantly, correct

3D designs which can correctly morph in response to changing requirements or design context.

Systems Engineering

V6 includes the first versions of the new Dassault Systèmes systems engineering capability. ABCG could have also included this topic under “Lifelike Experience” because we feel that Systems Engineering, Kinematics and Simulation lead to lifelike simulations of complete products. Systems Engineering capability brings together several recent Dassault Systèmes acquisitions on the V6 architecture. The software is designed around the Requirement Functional Logical Physical approach and is unique in the tight integration between each layer, leading to realistic 3D animations of the complete virtual product. We would also expect to see appropriate links to SIMULIA analysis in future releases. V6 Systems should allow companies to begin reducing the large number of disjoint Systems software solutions they are probably now using.

Looking forward, ABCG sees real potential in V6 bringing basic RFLP systems modeling techniques to non-systems engineers. At each level in the V6 Systems architecture, building blocks of company, domain, or industry specific know-how can be saved for reuse by mechanical designers. This capability will eventually broaden the appeal and usage of Systems engineering beyond its traditional Aerospace, automotive and mechatronics roots.

Ready to Use Business Processes

One of the challenges for the V4 to V5 transition was the lack of sufficient applications and functionality in the initial releases. With V6, the November release includes 80% of all existing Dassault Systèmes applications, including 100% of the popular HD2 and MD2 configurations. This means that the vast majority of users should be able to pick up their work processes immediately with the initial installation. With V6, Dassault Systèmes has also taken steps to simplify the product portfolio packaging by reducing the number of packages from 160 to 42.

Lower Cost of Ownership

ABCG did not look at V6 pricing for this paper. Ownership costs will, in any event, differ significantly from company to company. We also feel that the arguments we have heard regarding this, like lower IT support costs, are not as important to most customers as

transition costs, protection of existing investments in data, customizations and personnel training. Here we looked at how V6 will impact these issues.

First, V6 uses all of the same proven technologies now being used in production by Dassault Systèmes customers around the world. This includes the V5 math, user interface, geometry and annotation engines as well as the MatrixOne 10.8 core database and the 3DLive collaboration platform. V6 essentially integrates the best usage and implementation characteristics of these proven technologies into one ready-to-use package. Because of this, all V5 features, annotations, analysis elements and manufacturing elements are immediately available in V6 without translation. Tolerance or feature re-mapping and related geometry problems should not be an issue with V6. The use of these proven technologies means that applications can be rapidly transitioned from V5 to V6.

CATIA V6 uses essentially the same user interface as V5. Naturally V6 has new functions, especially those dealing with assemblies and for using the 3DLive collaboration capabilities, but V5 users will be immediately comfortable with V6. In fact, the V6 training course for V5 users is a one-day course that concentrates almost entirely on the new collaborative capabilities of V6.

Users should be expected to have at least one day of formal training on V6, plus additional training for company specific Best Practices. This training consists mainly of learning new collaborative techniques of V6.

V4/V5 Co-Existence

Dassault Systèmes understands that V4, V5 and V6 will co-exist within companies and supply chains for many years to come and have designed V6 with this in mind. In addition to importing V5 data into V6, it is also possible to write V5 parts (B-rep), product files and drawings from the V6 database. Dassault Systèmes has also developed several strategies for using V4, V5 and V6 together, targeted specifically at supplier/vendor relationships where the supplier has a full V6 implementation and the vendor is using V5 or other PLM solutions. With V6 it is possible for departments or suppliers to continue working on V4 and/or V5 in their existing VPM V4 environments while those designs are integrated in a larger V6 product context. V6 maintains this data in its native format, and although it is not possible to edit the data in V6, it is possible to do required positioning and even geometric linking from the native data. Changes to the data made in the appropriate authoring environment, be it V4,

V5 or VPM, can be updated in V6 automatically when desired. This is another benefit of V6's architecture.

For V4 users, V4 models can be pushed directly into the V6 database without translation, allowing users to browse, view and use it in context of V6 geometry creation.

Conclusions

The convergence of Web 2.0 and PLM offer new opportunities to utilize global community creativity and IP to virtually design, test, manufacture, share and experience products. Dassault Systèmes calls this convergence PLM 2.0. With V6, Dassault Systèmes has announced six key strategic elements for enabling PLM 2.0. These elements have driven the development of Dassault Systèmes V6. ABCG took a look at the latest version of V6 to see first hand how strategy is being turned into software.

Global Online Collaboration on V6 Platform

The ENOVIA V6 global IP database provides the foundation for understanding and accessing a company's PLM IP wherever it is physically located. Using 3D geometry rather than part numbers or text as the search index will build better understanding for products even as individuals search for the information they need.

Lifelike Experience

Enabling people to experience and interact with virtual products in a natural way is key in expanding the PLM community beyond traditional engineering users. For CATIA V6 users lifelike experience will be evident in a new focus on real-time, dynamic user interface techniques like those in CATIA Live Shape, which allow both experts and beginners to turn their innovative concepts into usable geometry.

Single PLM Platform for IP Management

V6 offers far better collaboration and IP management and assembly design capabilities than V5. Management should encourage the use of V6's remote 3D based collaboration techniques to improve their PLM processes. Companies should also re-visit their data access policies for internal, remote and 3rd party suppliers and partners to see how better and finer IP access will improve their product development process. V6's advanced assembly modeling paradigm will allow confident use of powerful inter-part modeling techniques. Previous

policies regarding the use of such techniques should be reviewed and tested against V6's capabilities. The biggest V6 benefits will initially come to those companies willing to enable the V6 ENOVIA infrastructure.

Online Creation and Collaboration

V6's new collaborative capabilities will enable easy real-time collaboration with co-contributors around the world. Functions like 3D search will improve design reuse and help minimize redundant design work. The multiple representations offered via V6's improved product data model, will allow better requirements-based design, as well as improved associativity for alternative representations in down stream processes.

Ready-to-Use PLM Business Processes

With V6 the November release includes 80% of all existing Dassault Systèmes applications, including all of the popular HD2 and MD2 configurations.

Lower Cost of Ownership

For end-users, working with V6 will be a natural extension of working with V5. Almost no re-training will be required to match V5 productivity levels. New V6 training will enable and encourage new collaboration Best Practices. Data import of clean V5 data should occur without problems.

V6 is a unique transition for Dassault Systèmes customers. It synthesizes the best technologies and practices of CATIA V5, ENOVIA and 3DLive into an environment that V5 users can readily accept and utilize to improve their PLM processes.