

The Impact of U3D on Product Lifecycle Management (PLM)

 **Hitachi Consulting**

 intel.

A Knowledge-Driven Consulting®
White Paper

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HITACHI
Inspire the Next

“Adobe is pleased to support U3D as a universal format for embedding 3D CAD data into PDF documents. We are excited about the opportunity that this presents for companies like Hitachi Consulting to provide new applications and solutions to downstream users for solving real business problems with a more effective means to communicate complex and compelling data in the PLM environment. Our vision is for 3D to become as commonplace as JPEGs are today for communicating ideas and concepts through U3D and establishing a “new” international language for business dialogue in an e-document environment.”

Adobe

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An Introduction to U3D

Interactive 3D graphics are a powerful medium for communication, education and entertainment. However, unlike digital audio, video, and photography – which are easily exchanged via the Internet and across computing applications – technical barriers have prevented the similar widespread use of interactive 3D content.

In recent years bandwidth and computing performance have increased dramatically, eliminating some of these technical obstacles. However, the lack of standards for sharing and experiencing 3D content has limited the reuse of valuable content produced by the engineering community.

Widespread use of 3D content could revolutionize how complex data sets are communicated. For example:

- Companies could repurpose 3D product designs to quickly (and easily) create powerful, cost-effective training tools based on interactive simulation.
- Electronic owner's manuals could provide 3D interactive guides for maintaining and repairing products throughout their life cycles.
- Online catalog customers could preview products by interacting with 3D models derived from 3D models used in product development.

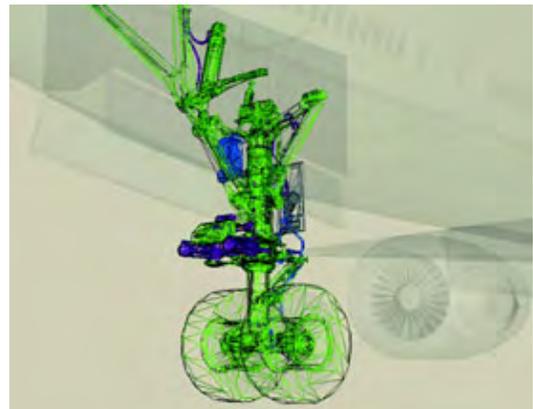
Recently, Intel, along with Ecma International, an industry standards group, and the 3D Industry Forum (3DIF), created an open and extensible format – Universal 3D (U3D) – for the sharing and visualization of 3D data in any mainstream application. Aimed at becoming the "JPEG" for 3D graphics, the U3D standard is already supported in a range of software products, including Adobe Acrobat.

More details on U3D can be found in the Intel White Paper **“Universal 3D (U3D) – Visualization & Simulation Graphics Standards”** available at www.intel.com/technology/systems/u3d/

Hitachi Consulting's Interest in U3D

As a leading consulting services provider in the areas of product lifecycle management (PLM) and customer-facing solutions, Hitachi Consulting has been particularly interested in the development and adoption of U3D. This white paper – jointly authored with Intel – provides an overview of the value and impact of U3D, with a special focus on PLM.

We believe that U3D will revolutionize PLM – taking 3D into areas that traditionally have not been previously considered and providing early adopters with a low-cost, low-risk competitive advantage offering high visibility. This advantage will not only provide bottom line savings, but will also lead to top line revenue growth.



Source 3D data provided by and used with permission of The Boeing Company

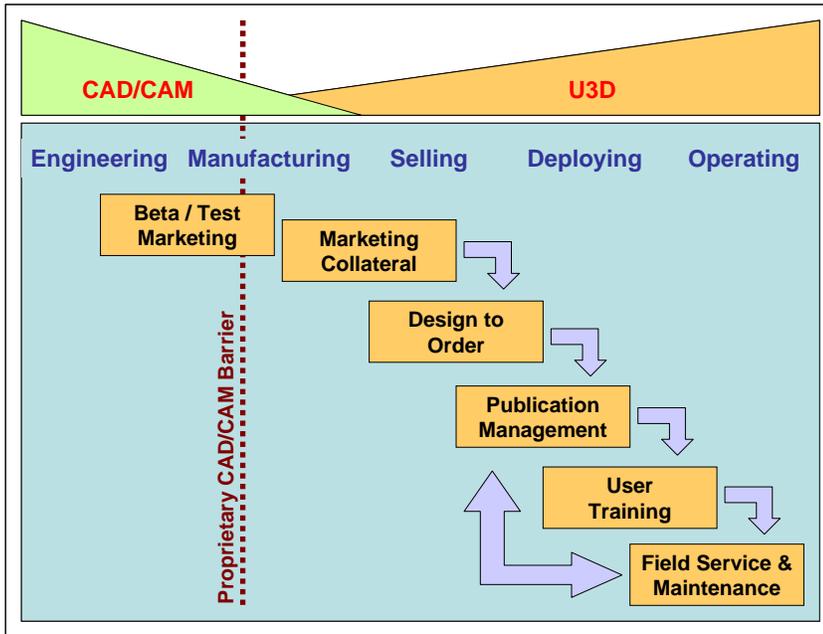
“U3D, and its support within mainstream software like Adobe Acrobat will revolutionize Product Lifecycle Management (PLM), taking 3D modeling outside of the traditional barriers imposed by proprietary CAD/CAM.”

Hitachi Consulting

The Value and Impact of U3D

U3D has the potential to impact many industries in a wide variety of ways. In this white paper, the focus is on understanding the impact of U3D on PLM.

RELATIVE VALUE AND AREAS OF USE ACROSS THE PRODUCT LIFECYCLE



For PLM, the primary benefit of U3D is that it allows CAD/CAM-sourced 3D diagrams and animations to be shared, displayed and utilized outside of the proprietary CAD/CAM software products. This breaking of the "proprietary CAD/CAM barrier" opens the door to the use of 3D graphics and animations in a host of areas much later in the typical product lifecycle.

The diagram to the left illustrates the relative value and possible usage areas of 3D within CAD/CAM and U3D-compatible software across a typical product lifecycle.

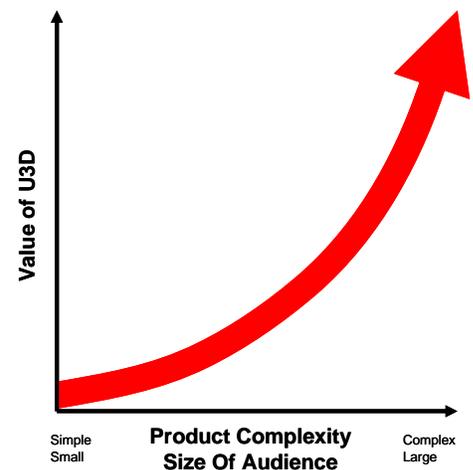
Within engineering and manufacturing, 3D will still be primarily used, shared and viewed within the proprietary CAD/CAM software tools. However, once a product has been manufactured, the bias of 3D use switches to U3D-compatible software like Adobe Acrobat. At this point, 3D graphics can be employed within a host of areas and activities.

For instance, U3D will enable the use of 3D graphics and animation in product beta and test marketing, marketing collateral and design-to-order sales processes (most likely online). U3D will also allow 3D to be shared and viewed with

markup capabilities within publications and training materials. And, perhaps most importantly, U3D will allow the inclusion of 3D product and component renderings within maintenance and support manuals and documentation.

Of course, the value of including 3D graphics in marketing, training and maintenance materials varies from product to product. 3D provides tremendous value for visualizing and comprehending complex products like airframes, engines, medical equipment and industrial machinery, but provides little additional value over 2D for simple products like food or apparel. Therefore, the value of U3D is directly proportional to the complexity of the product being marketed or maintained.

Equally, the size of the potential audience for the 3D graphics has a direct bearing on the value of providing them. If there is only a small audience, then the value and return on providing 3D graphics outside of proprietary CAD/CAM environments is relatively small, even for some complex products. However, if the audience is large, then the value of 3D, and therefore U3D, increases exponentially. U3D is therefore most valuable when selling, marketing or maintaining a complex product that sells to a mass consumer market.



"Boeing is investigating interactive 3D technologies to provide its employees and customers with enriched media that revolutionizes how complex product data is communicated. We are working to develop very efficient information delivery processes to produce more cost effective training and improved visualization methods."

The Boeing Company

Let's consider installed product maintenance and field service. Here the impact of using rich 3D product information increases exponentially with the increasing complexity of the product data and definition being referenced, the range of geographic locations at which the service needs to be performed, the global footprint of the service organization, and the skill level of the field service engineers.

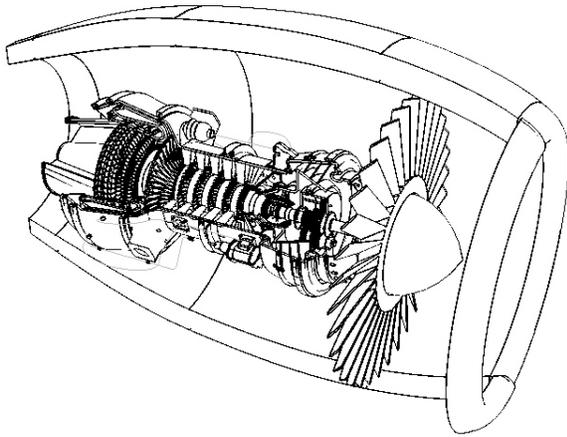


Figure 1:
Example of 2D field service instruction set

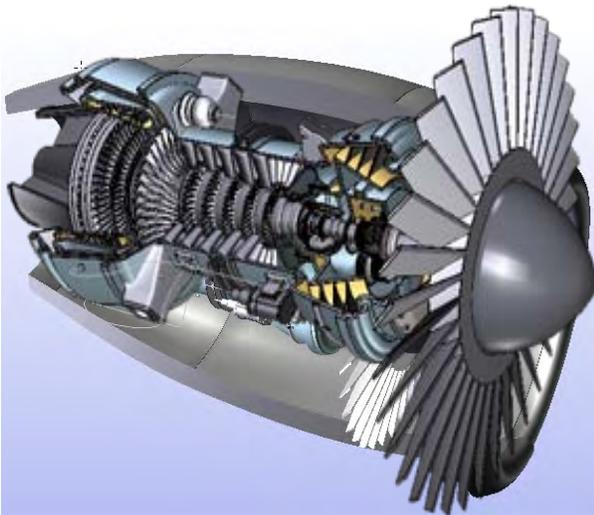


Figure 2:
Example of a U3D enabled 3D field service animation sequence

For example, imagine a semiconductor capital equipment field service engineer dispatched to correct a technical product issue at a chip manufacturing facility. Due to the high capital investment in the facility, there is a very high cost for each minute of downtime in the manufacturing line. Therefore, in cases such as this, it is critical that the field service engineer is able to rapidly diagnose the situation, search and retrieve the appropriate product information, review field service instructions, and then take the necessary steps to correct the problem.

The key issues to manage in this scenario are the extreme complexity of the equipment being serviced and the probability that it is highly configurable. Therefore, a PLM application that manages all the product information by individual customer configuration can allow the remote field service engineer to quickly search and retrieve the appropriate revision of the product field service instructions to reference the current corrective action.

In comparison to the current use of various 2D drawing formats and documents, a U3D-enabled 3D representation of field service instructions would be much more efficient and precise in communicating corrective action. The corrective action steps could be represented in the form of a 3D visual animation sequence.

The business impact of leveraging 3D-based product maintenance and field service methods is especially high in industries that involve products of high engineering complexity and rapidly changing technology, such as semiconductor and high technology, aerospace and defense, medical instrumentation and machinery, telecommunications and utilities, industrial machinery, energy exploration, shipbuilding and aircraft maintenance. Benefits could include reductions in equipment downtime, access to more accurate product information, increased customer satisfaction, collaborative product design improvements, improved content management of product information, better knowledge capture, and faster cycle times for all downstream functions leveraging 3D data.

Acrobat Reader 7 is required for interactive viewing.
Download the latest reader [here](#).

- Click image to activate interactive features
- Use toolbar buttons for navigation
- Click below for additional embedded features

| | | |
|--------------------|---------------|-------------|
| Exploded View | On | Off |
| Animation | On | Off |
| Graphical Elements | On | Off |
| Rendering Style | Shaded | Line |

Documentation Production

Document production is expensive for manufacturing companies. With many complex products requiring service and/or support, documentation has traditionally found its way into the hands of the targeted user via text and 2D drawings and schematics – all typically written in English (which may or may not be the end users' native language). The costs increase dramatically when multiple languages are added to the mix. What's more, changes and updates must be implemented quickly, often losing value if not timely in their receipt. Accuracy frequently suffers because of human error as the information is manually created, reviewed and then rewritten based on the level of feedback and validation.

“U3D is an important step in advancing productivity in the digital office. Unlocking rich, 3D content creates opportunities for new uses and new products based on intelligent documentation, such as interactive training simulations, product-life cycle management, electronic repair manuals, and workgroup collaboration.”

Intel

All industries are affected by their ability to communicate up-to-date and accurate information, especially when critical business processes are at stake. For instance, consider the importance of returning an airliner to the air. If the plane is grounded for service or maintenance, it can't generate revenue for the airline. Yet too often, maintenance workers are handcuffed by the extensive manuals required for complex maintenance and repair routines. The timeliness with which updates are communicated is also problematic, especially if the only means for distributing the information is via paper or drawings. Imagine the predicament where workers were last trained on a particular routine several years ago, English is their second language, and they're now faced with having to compare repair updates to what they originally learned. Performing the repair could be a daunting task, particularly when you add in the pressure for fast turnaround in the airline industry.

Now imagine that the worker has access on the shop floor to the latest information online through a laptop or tablet type of device. This information provides the most current procedure to follow, accompanied by schematics and drawings, plus 3D animations of the routines complete with recreations of the assemblies, product data, metadata, and the ability to provide comments back to the authors on the accuracy of the documented process.

With U3D and Adobe Acrobat, producing such documentation is possible today. Companies that use PDFs and have 3D CAD files in their data repositories can repurpose that 3D data through the U3D format and embed it inside a PDF document. Fully animated and interactive 3D images can be created from the original manufacturing data and then distributed to the work source that requires it. These 3D images will be directly imported into documents such as PDFs with a simple format translation process, protecting the integrity of the design as defined by the author and providing adequate data for a viewer to make appropriate comments and decisions on the image presented.

In essence, 3D provides a universal language that even transcends what pictures, schematics, drawings, blueprints and other 2D media can convey. With U3D, companies can develop documentation that is more robust, easier to distribute, up-to-date, more accurate, and transcends language barriers in ways unattainable in 2D or with text. The picture that is worth a thousand words is worth exponentially more in 3D.

Training

Employees are recognized worldwide as a company's most valuable asset. Nevertheless, no employee starts as the "complete deal." Consequently, training is required to maximize an employee's potential and contribution to the bottom line. Delivering this training to the employee at the right time and the right place can be particularly effective. For example, with the deployment of more troops overseas, the Department of Defense is looking for more effective ways to train and educate troops in the battlefield. Just as companies seek "competitive readiness" in their respective organizations, the military seeks "combat readiness" and wants to accelerate this readiness by delivering "just-in-time" training to the battlefield. Not only does this save time and money, but by bringing the training environment to the battlefield or manufacturing floor through online or computer-based applications, training is received when and where it's required without the abstraction and lack of context found in most training offerings.

The computer and Internet have made it easier and more cost-effective to deliver training to anyone anywhere, anytime. U3D takes this a step further by enabling companies to leverage CAD/CAM drawings to enrich training materials delivered in PDFs or other formats with interactive 3D animations.



These animations enable a person to learn an assembly or repair procedure right beside the actual device needing assembly or repair. Using the animation, a person can perform a procedure virtually before trying it on the device itself. Such virtual, on-the-spot training decreases training costs, improves training accuracy and effectiveness, makes it easier to reach larger audiences, and increases retention.

Consider an automobile mechanic. The complexity of modern cars and trucks, the sheer number of models, and the changes from year to year are nearly impossible to keep pace with – even for a single make, such as Ford or Toyota. Today's mechanics already use computers to diagnose problems. These same computers could deliver 3D animations on repair procedures for particular parts so mechanics learn new procedures as needed, right on the

job. Using the original CAD/CAM drawings and U3D, these 3D animations would be fast and easy for car manufacturers to create and post on technician web sites for access by authorized mechanics. The result would be a better relationship between manufacturers and service personnel and higher customer satisfaction through more accurate and timely repairs.

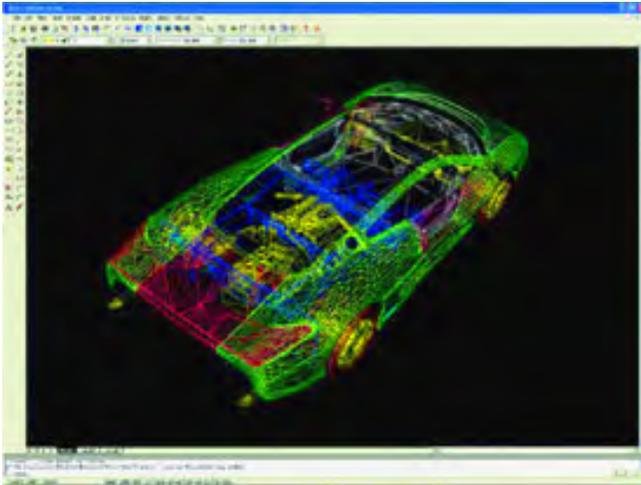
Such interactive 3D animations could have applications even for less skilled positions. Consider the coffee barista. The popularity of espresso coffee drinks has led to the need to train huge numbers of people in the art of operating and maintaining an espresso machine. A savvy espresso machine manufacturer could employ its 3D CAD drawings to create an interactive, animated tutorial on the use and maintenance of each of its models. These could be made available via CD-ROM or the Internet to customers seeking to train the constant influx of new employees to their stores. Such interactive, on-premises training would free managers from training duties and provide a competitive sales advantage for the espresso machine manufacturer and a new employee training advantage for the coffee shop company.

Many other industries could profit from leveraging 3D CAD assets with U3D for training and reference materials. For instance, call centers providing technical support could provide employees with PDFs providing 3D animations on repair procedures. Using these materials, call center employees train themselves on a repair procedure as they deal in real-time with a customer, taking the customer and themselves step-by-step through a repair procedure. Being able to view it in

3D, call center employees would be better able to visualize what customers are seeing and explain to these customers what they need to do.

Selling Complex Products

The sales cycle and costs involved in selling complex products like aerospace components, military equipment, industrial machinery and medical equipment is often long and substantial. Likewise, there is a convoluted and expensive sales cycle involved in selling products or services requiring up-front design and engineering or extensive product configuration. Requirements need to be gathered, designs completed, estimates produced, and then it all needs to be communicated back to the customer in a format and medium that they will quickly and readily understand.



The use of graphical representations of designs and even physical models of products and prototypes during the marketing, selling, design, and contracting of these types of products is not only common, it is essential. U3D literally adds a whole new dimension, allowing 3D CAD/CAM assets to be leveraged to inexpensively create accurate 3D representations. Even relatively simple-to-explain, but difficult-to-visualize products like furniture, consumer electronics, cars, trucks and ships could profit from U3D's ability to help people "picture it." The result would be shorter sales cycles, lower costs of sale, and greater customer satisfaction.

With U3D, it's easier and faster to create 3D representations of new products, prototypes, candidate designs and customer configurations early in the sales cycle. For some products, these 3D designs will help clarify the product capabilities and aesthetics. For other products, 3D representations will remove the need for physical models and prototypes. For yet other products, 3D imagery will simply make the client more comfortable with the price and purchase. In all cases though, they will help clients, customers and prospects understand and visualize your products far more readily and easily than before.



The U3D format makes it possible to share models of products with clients and prospects online, in kiosks in show rooms and at exhibitions, and in electronic sales and marketing collateral (such as CD-ROMs or USB drives) e-mailed to them. The U3D format can also be used in customer configuration software to allow people to use 3D to interactively design a kitchen, plan a home remodel, or outfit a truck.

Some benefits of U3D are obvious. Using it to create 3D models can help sell more products, more quickly, and with less effort. That will help increase revenues while reducing sales and marketing costs. There are other benefits though that, in the long term, are equally important. The use of U3D models during the sales cycle will help people design better products that more fully meet customers' needs. It will reduce prototyping and maybe even manufacturing costs. And it will help set more realistic customer expectations while improving

customer product fit and satisfaction, thereby reducing post-sales support, maintenance and return/ replace costs.

"Now that CAD/CAM-sourced 3D diagrams can be easily included and published in maintenance manuals, sales literature and user guides in a format that is easily accessible to over 500 million users, the use of 3D modeling will become common place, even in industries and applications that have never used, or even considered using CAD/CAM modeling before."

Hitachi Consulting

The Future Impact of U3D

As discussed in the section Value and Impact of U3D, eventually U3D may become as influential and pervasive a format as PDF, MP3 or JPG. As the price of computing power and memory continues to decline and more software products start supporting the display, manipulation and creation of U3D files, the use of 3D graphics will become as common as 2D graphics are today. Eventually it may even surpass the use of 2D.

In this new U3D world, every web site and electronic document will contain some U3D content. As electronic media replaces paper-based media as the primary source of information, all sales literature for both simple and complex products will include U3D representations of those products.

U3D representations of products will soon start showing up in computer games and computer-animated movies. Electronic product placement will become common. After all, why not provide studio or game developers with U3D files so that the main character in their latest animation or game drives your newest car, drinks your soft drink, or uses your latest mobile phone.

Free shareware libraries of U3D products may soon be created and shared so that people can insert and better visualize them in 3D models of their new house, their kitchen remodel, or their new car. People could also use them in their own animated shorts and games, and even include them in e-mails and school reports.

It won't be long before, creating the U3D model of your product will be as commonplace and normal as taking a photo of it is today. And if you don't create that U3D model, you just won't sell as many.

For More Information

For more information on Hitachi Consulting and the value and impact of U3D within product lifecycle management and customer-facing solutions, please visit: www.hitachiconsulting.com or contact:

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For more information on Intel's work on U3D please visit:
www.intel.com/technology/systems/u3d/

For more information on the 3D Industry Forum please visit:
www.3dif.org

For more information on Ecma's work on U3D please visit:
www.ecma-international.org/memento/TC43.htm

About Hitachi Consulting

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About Intel

Intel, the world's largest chip maker, is also a leading manufacturer of computer, networking and communications products. Additional information about Intel is available at www.intel.com/pressroom.

About Hitachi

Hitachi, Ltd. (NYSE: HIT), headquartered in Tokyo, Japan, is a leading global electronics company, with approximately 326,000 employees worldwide. Fiscal 2003 (ended March 31, 2004) consolidated sales totaled 8,632.4 billion yen (\$81.4 billion). The company offers a wide range of systems, products and services in market sectors including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's Web site at <http://www.hitachi.com>.

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