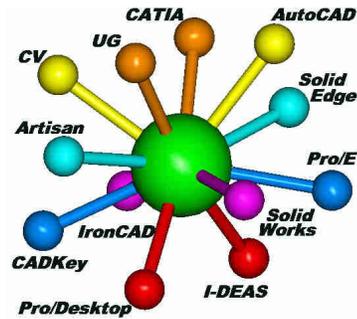


Imagine Digital Design



Are Companies On The Right Track With CAD?

Over the past few years many large companies have begun to leverage individual CAD companies. Their focus has been towards single source CAD vendors. Is this the direction the marketplace needs to go? It was not that long ago that the big buzzword relative to CAD was interoperability. Is effective interoperability between various CAD tools still needed? Many experts in the industry still think so. However, larger companies are addressing the interoperability issue by evading it through the use of single source CAD vendors. If every large company could get every supplier to use their CAD vendor the issue of interoperability is eliminated. The automotive companies are great examples of this direction. But is this best? These questions and others will be examined.

In a recent article, "Putting The Tools To Work", *Automotive Industries* magazine, September 1998, discussed the progress of Chrysler, Ford Motor Company, and General Motors in deploying single global CAD/CAE/CAM platform. "Each day saved in a vehicle's development cycle is generally worth \$1 million to the program's bottom line. ...the three automakers each want a single, integrated computing platform, deployed globally, to help cut costs and raise quality." In fact each of the automotive companies continue to leverage suppliers to embrace their system of choice. It is interesting that each of the companies chose different tools for different reasons, and all having their own merit.



Today's Focus

There is little doubt that if everyone used the same CAD tool many of the daily communication issues companies run into would be significantly reduced. Design requirements such as critical dimensions, notes, assembly sequences, inspection tolerances, and design variations could be easily captured. In fact many of us have seen the Chrysler ads voicing the development of a complete vehicle in a virtual or digital world. Ford Motor Company and General Motors also stress the importance of the virtual or digital environment. The virtual or digital world benefits are enormous. Minimizing costly prototypes and eliminating expensive testing are just a couple of reasons for this interest. What feeds the virtual or digital world is the company's single source CAD vendor. Larger companies, such as the automotive companies, continue to move along this line. This approach still eludes interoperability.

The effect of a single source CAD vendor focus is great at an individual company level. It provides Information Technology (IT) groups an easy path to develop processes and methodology to help the company. Data flow is improved merely by simplification at the individual company level. However, once a company looks outside for design, engineering, or manufacturing help, the individual company is open to potential interoperability issues. The reasons are simple. Every design, engineering, and manufacturing company will chose a CAD vendor or multiple CAD vendors that will help them achieve their business goals. Innovations and new technology in CAD requires companies to be nimble so they can continuously improve in the competitive marketplace. This can not be avoided in today's fast changing technology environment.

The single source focus has its down side. For example, while interviewing a supplier to an OEM the supplier stated "I told the company that having to design in (CAD tool A) will cost three times as much compared to designing in (CAD tool B)". The OEM was constrained because they could not operate outside of their single system. That additional cost gets passed on to the customer. The flaw in this process is the lack of interoperability.



"Digital Design" (A Way To Achieve Interoperability)

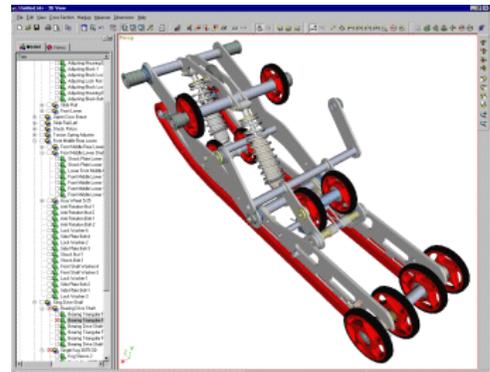
As mentioned earlier the automotive companies are moving to a focus on virtual or digital world. But how do those large companies achieve the virtual or digital world? The specifics for this may be somewhat vague however, there is a common thread. The common thread is the use of a newer technology. Let us call the new technology enabler Digital Design (DD). DD is focused on bringing together large or even small amounts of CAD data, including design, engineering, and manufacturing information, into an easy to use environment. Tying all of this information together is critical to the success of DD. The foundation for DD is and will continue to be interoperability.

Imagine for a minute that a large company, lets say a airplane manufacturer, is working to design a new engine for their next aircraft design. Internally the company uses CAD tool A but their key engine suppliers use CAD tool B and C. How do they bring it all together to produce a quality, cost effective product? Each of the suppliers have justified business reasons for their CAD tool selection but it differed from the airplane manufacturer. In the end all of the data has to come together. In the article "A STEP in the Right Direction", *Computer Graphics World*, September 1998, Boeing Commercial Airplane Group discussed this scenario. Essentially Boeing achieved successful DD using a neutral file format called STEP (STandard for the Exchange of Product model data).

The effort at Boeing should be commended but is STEP the key? The answer is it depends. The design and engineering community need to consider STEP an option. As stated before, the foundation for DD is interoperability. How interoperability is achieved is irrelevant as long as DD is the end result, regardless of the originating CAD tool.

Imagine for a minute that an engineering company in the U.S. is using Unigraphics as their main CAD tool and they are requesting design and manufacturing information from companies in Germany using CATIA, and in England using Pro/ENGINEER. Imagine that the companies could easily collaborate, by either using native or a neutral version of the CAD data. Imagine that the critical dimensions, notes, assembly sequences, inspection tolerances, and design variations were all being shared easily. Imagine Digital Design.

Technology today offers such capabilities. Neutral file formats for CAD tools exists today. Whether the file format is STEP, IGES, VRML, STL, JT, Fly or some sort of direct conversion, it can work. The only question is who will make it happen. One thing is certain, in the short term, it will not be the CAD vendors.



Actify's 3D View – Supports native CATIA and SolidWorks data as well as many other neutral file types



Catch 22 For CAD Vendors

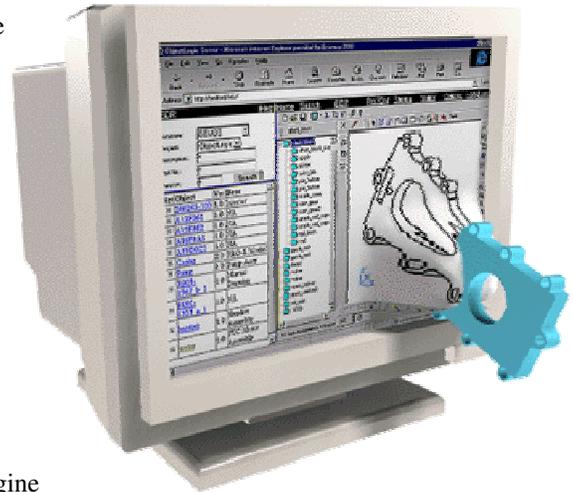
CAD vendors today differentiate themselves from other vendors through their technology innovations. Competition between the various CAD vendors is enormous. If R&D time and money was spent on interoperability then the vendor may begin to loose their edge. The CAD vendor's focus is on getting everyone in the world to use their CAD tool. If DD were the norm there would be some repercussions for the CAD vendors; first competition for CAD vendors would rise to the next level, second consolidation of CAD industry that we see today may also accelerate. For example, if a company using CAD tool A could collaborate with a company using CAD tool B there is no need for both companies to have the same tool. CAD vendor A has just potentially lost a client. The best case scenario for the CAD vendor is that they would have to spend resources and sales effort to get the other company to use their tool.

It is a difficult position for the CAD vendors. In fact, in the article, "Putting The Tools To Work", *Automotive Industries*, September 1998, Bill Carrelli, vice president of marketing at SDRC in Milford, Ohio said. "The problem is each one of us – (CAD vendors)... " "...reality there's going to be a limit to what can come in and go out of the system. We're all moving at different paces." This problem or limitation of the CAD vendors is based on survival and not the users need for interoperability.



Who Can Make Digital Design (DD) Happen?

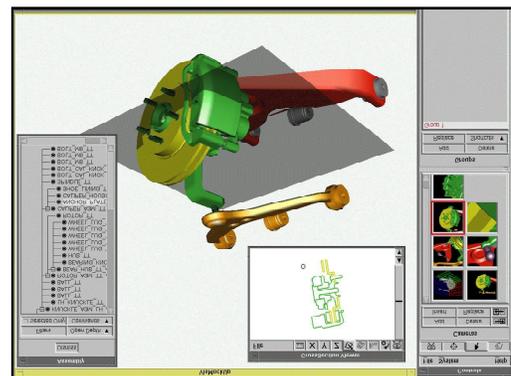
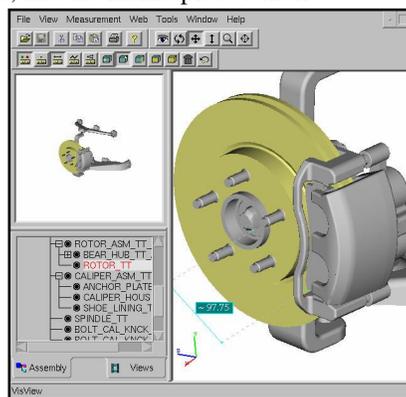
The marketplace is driving the development of DD. Large and small companies see the benefits of DD but many do not focus on interoperability. However many established non-CAD software companies as well as many new companies see the potential for DD and its foundation of interoperability. Many new products have now entered what could be described as the world of DD. Companies like EAI, ObjectLogic, CTAD, Resolution Technologies, Actify, Solid View, and others all offer products that touch on DD. These companies offer products that are, for the most part, CAD vendor independent. The capabilities of these products are all leaning towards the DD environment where interoperability is the foundation.



Imagine the ability of viewing, measuring, checking mass properties, doing motion studies, cutting sections on CAD models without the requirement that all of the data originate from one CAD source. Imagine the business benefits of such interoperability. Imagine DD. The savings to large and small companies could be colossal. Looking at the automotive companies for a moment, a supplier who chose CATIA for their business needs would not have to infer the cost of purchasing Unigraphics to do design and engineering work for General Motors. Not to mention the cost associated if the same supplier was to do similar design and engineering work for Ford Motor Company using I-DEAS. Cost in IT, hardware, training, and data transfer would decrease. Collaboration becomes the common thread when DD is the focus. How much would this be worth? A million dollars or more a day is easily imaginable. Many of the companies touching on the technology of DD either by developing the technology or using it see tremendous value. Ultimately the customer, users, and the marketplace benefit.

Object Logic's Engineering Data Client – Supports many of today's leading CAD vendors through what they call object adapters, allowing users access directly to the native CAD data without tessellation.

One of the fastest growing companies in the field of DD is Engineering Animation, Inc. (EAI). If we examine what EAI has done in the past as well as what they are doing today we'll have a better understanding how DD will happen. One of EAI's first products was called VisLAB. Essentially it was a high power animation and viewing tool. It provided engineers with an easy to use environment to view large amounts of data.



EAI's VisView & VisMockup - Allows design, engineering, and manufacturing groups simplified access to design data.

Seamless CAD interfaces (I-DEAS, Pro/ENGINEER, CATIA, Unigraphics) as well as support for many neutral file types (STEP, IGES, VRML, STL) helped the product to gain acceptance. EAI, and others, see the potential for the

DD environment and have expanded their business to include other aspects of design, engineering, and manufacturing. Today EAI offers a full suite of products that allow for the collaboration of designers, engineers, and manufacturing. EAI's suite of Vis Products (VisView, VisMockup, VisLab, VisFactory, and others) helps customers to reap the benefits of DD. Design requirements such as critical dimensions, notes, assembly sequences, inspection tolerances, and design variations are captured and communicated in an easy to use environment. Perhaps this technology should be viewed as a higher, yet simpler, level compared to the CAD level. EAI has moved many companies to this higher level while remaining relatively CAD vendor independent. EAI has established relationships with Ford Motor Company, General Motors, AlliedSignal, and others. It is important to understand the success is not necessarily dependent on a CAD source but the ability to collaborate design, engineering, and manufacturing.



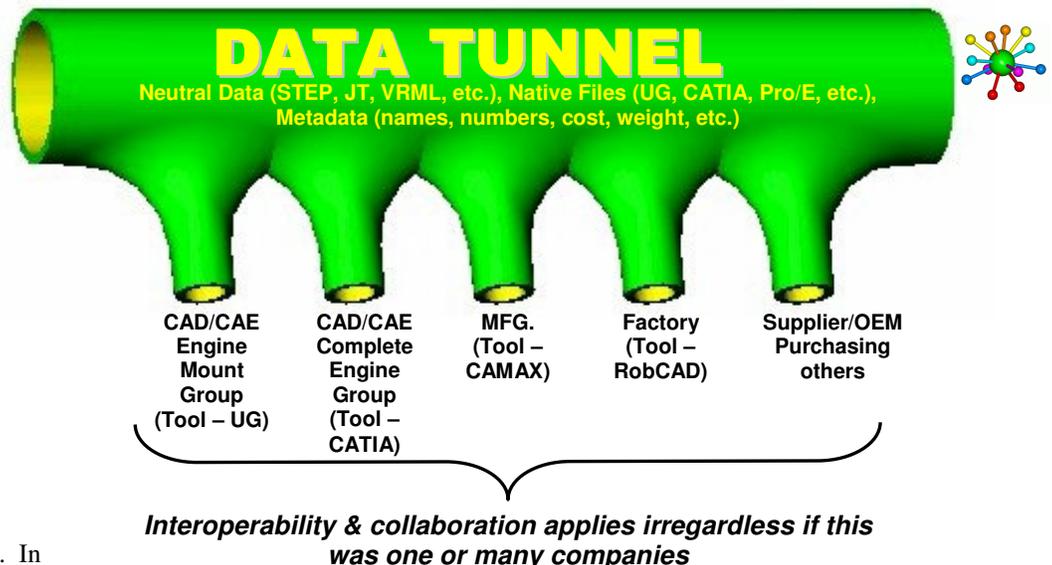
How Digital Design (DD) Comes Together

Companies must focus on a large amount of detail in any product development process. Whether the information is an aircraft engine or an automobile the fine detail of any project is important. However, the phrase "don't sweat the details" needs to be examined. Often, the view of engineering information is broken down into minute details, at every level of a project. The magnitude of this information then becomes a deterrent to collaboration. Imagine being able to extract only the information you needed, simplifying your given task. Imagine not having to gather a complete aircraft engine to design its engine mounts.

Until the advent of DD, the ability to share large amounts of information was virtually impossible. The amount of baggage associated with full CAD geometry is extensive. Today DD users have the option to use simplified versions of the data that outperform full CAD geometry by a huge factor. This type of information, typically tessellated, provides engineering with accuracy sufficient to complete many daily tasks. In fact, innovations in the accuracy of the digital data have helped DD to gain acceptance.

For Example: A DD engineer developing an aircraft's engine mount uses only the (needed) positional and simplified background information in the CAD tool to design the parts. They then verify the DD part (or assembly) using the virtual world. A manufacturing engineer uses DD to develop jigs and fixtures based on the virtual product, independent of the originating CAD tool. An engineer who develops assembly processes (plant layout) uses virtual robots and virtual tools to establish the most efficient approach to the assembly process independent of its origination. The only details that are "sweated" are the details critical to feed the success of the project. In a virtual world where DD's interoperability is the foundation a different viewpoint can be taken. Design, engineering, manufacturing, and others will only need to get information that increases their ability to improve the projects success. What it comes down to is that each activity or group can give and get what they need without carrying or supplying extra baggage.

In order to keep it simple and not sweat the details, the process will depend largely on the ability to give and get only what you need. Extracting the necessary details needs to involve Product Data Management or Product Information Management (PDM or PIM). In



order to implement DD and move towards interoperability, companies must begin to look at how today and tomorrow's PDM technology can lend itself to the virtual world. Imagine for a minute a data tunnel. The data tunnel is your PDM system. This data tunnel carries with it information such as a neutral file (tessellated), native CAD geometry, and metadata (mass, center of gravity, part number, part name, cost, etc.). The data tunnel would provide each activity with the ability to give and get, exactly what is needed. This would allow each piece of a project (engineering related or not) to focus on their details without having to carry other activities details. DD's foundation of interoperability should be considered a strategic weapon in today's competitive environment.



Where To Next?

Digital Design (DD) is here. Where the marketplace takes DD is an open question today. It is clear that companies large and small would benefit greatly from the foundation of DD (interoperability). Just a few years ago even the thought of DD would have been considered non-sense. The decision for many companies to move to single source CAD vendors had merit then. However, the competitive marketplace, timing, quality, and cost are driving us to DD today. The fact the automotive and airplane manufactures continue to pursue DD is encouraging. However, the foundation of DD, being interoperability, must become a key part of everyone's pursuit. All companies large and small need to continue to investigate and leverage the technology of DD. In either case the benefits can not be ignored.

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