Summary: The pressure to develop products from multiple locations continues to grow. Computer technology isn't keeping pace with requirements. But there are techniques that managers can use to minimize problems and make the process leaner. In this second article in a series, Contributing Analyst L. Stephen Wolfe, P.E. examines the continuing problems associated with transferring 3D model data from one environment to another. (July 23, 2009)

Managing Distributed Product Development, Part 2: The Need for Simplified Product Model Data

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July 23, 2009—Engineers can collaborate well enough if they all use the same version of the same CAD software, and distances aren't too great. But when suppliers use different releases of a CAD program or, worse, different CAD systems, time and money are wasted.

Generally, attempts to translate boundary representations (b-rep data) between different CAD systems work reasonably well, provided that the recipient is simply going to manufacture the part. If both companies are going to collaborate on a design, the loss of design features makes b-rep translation impractical.

For more than a decade, companies have attempted to automate translation of design features. The consensus of participants at CIC was that such translation is impractical except in special cases, such as a migration of an old design to a new system to use as the basis for a new product. Generally speaking, CAD systems rebuild feature histories in subtly—and sometimes not so subtly—different ways.

Several companies have developed tools that enable people to view and correct errors caused by feature translation. However, these require considerable human effort for each transfer and are economically impractical for iterative collaboration.

When geometry becomes complex or sophisticated, even b-rep translation methods break down. In a frank CIC presentation, Donna Korfel, GM data administrator for Magna Decoma, showed the types of errors that occur when translating 3D models received from General Motors' NX system to IGES, the ANSI-standard format used by Magna's plants. Korfel's group of four "data administrators" processes between 3,000 and 4,000 models per month and serves 40 Magna manufacturing plants.

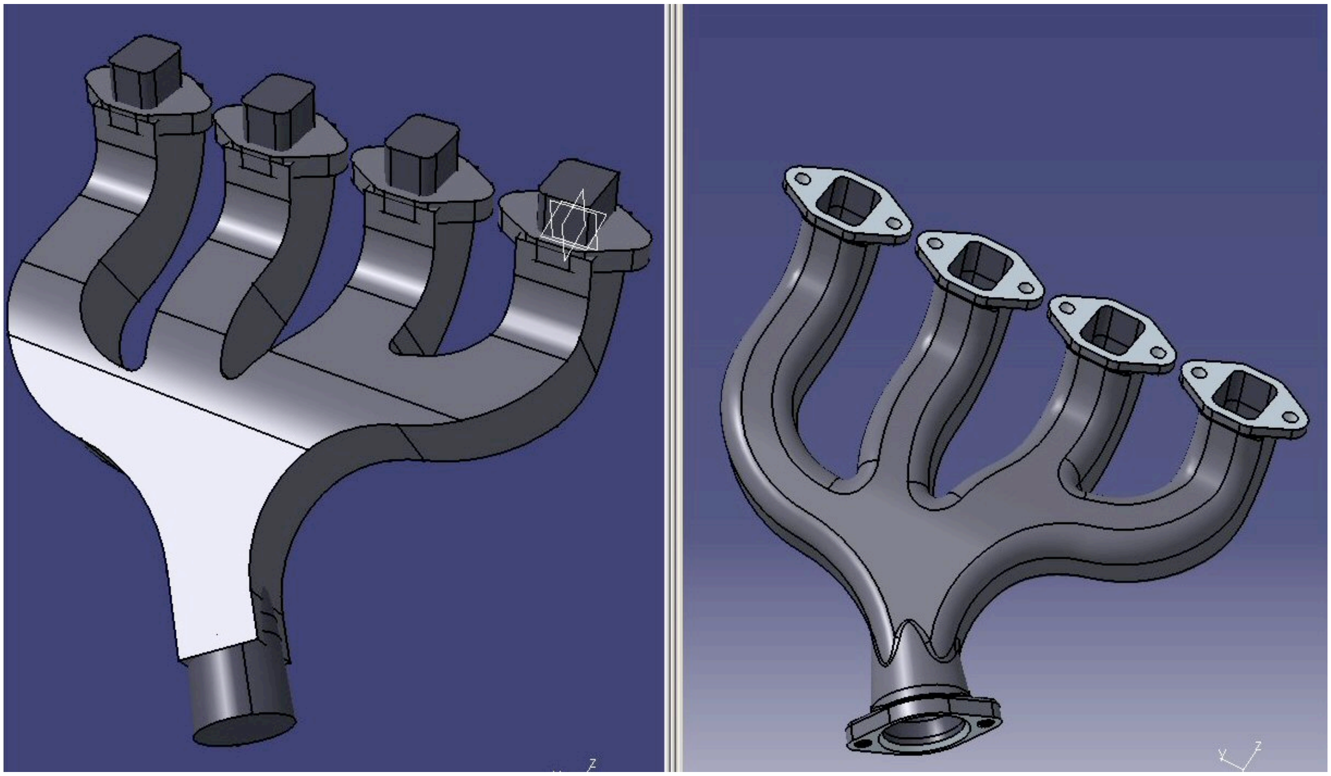

Figure 1—In this example, a feature translation from CATIA V4 to V5 (left) fails to recreate the geometric fidelity of a b-rep translation (right).

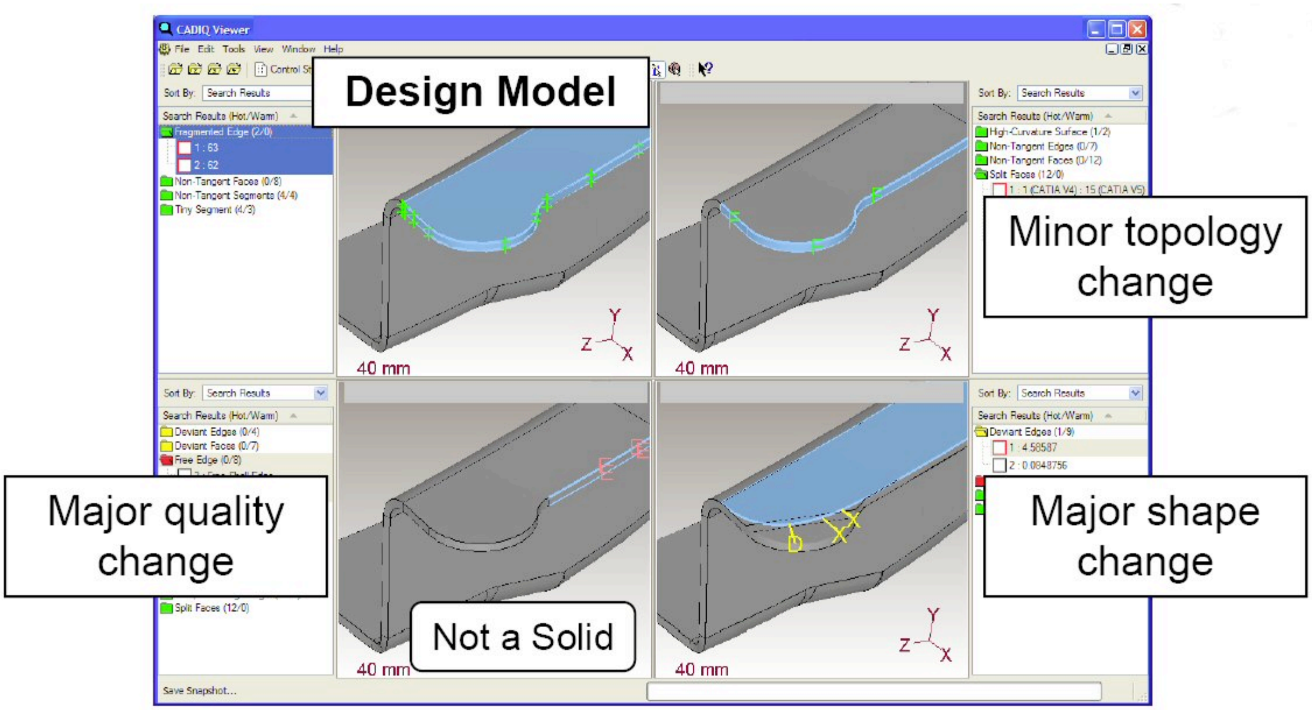

Figure 2—Examples of errors that occur translating CAD models. (Courtesy of ITI Transcendata and the Collaboration and Interoperability Conference)

Korfel found that the 3D Evolution software from a German company called CoreTechnologies, Inc. is effective at both translating models and repairing errors in them. CoreTechnologies' software finds and fixes errors such as free edges and missing faces that can cause errors when files are read back into another CAD system. Most of the errors are fixed automatically. Those that aren't can be fixed using interactive functions of the 3D Evolution software.

Before Magna began using the 3D Evolution software, designers had to fix errors in the receiving software system. Korfel estimates that labor savings to Magna from the software run as high as $245,000 for 3,000 files, the low-end of an average monthly work load. Yet even with good data-translation tools, some errors can't be fixed in the translation process and must be handled by highly skilled designers in the receiving system.

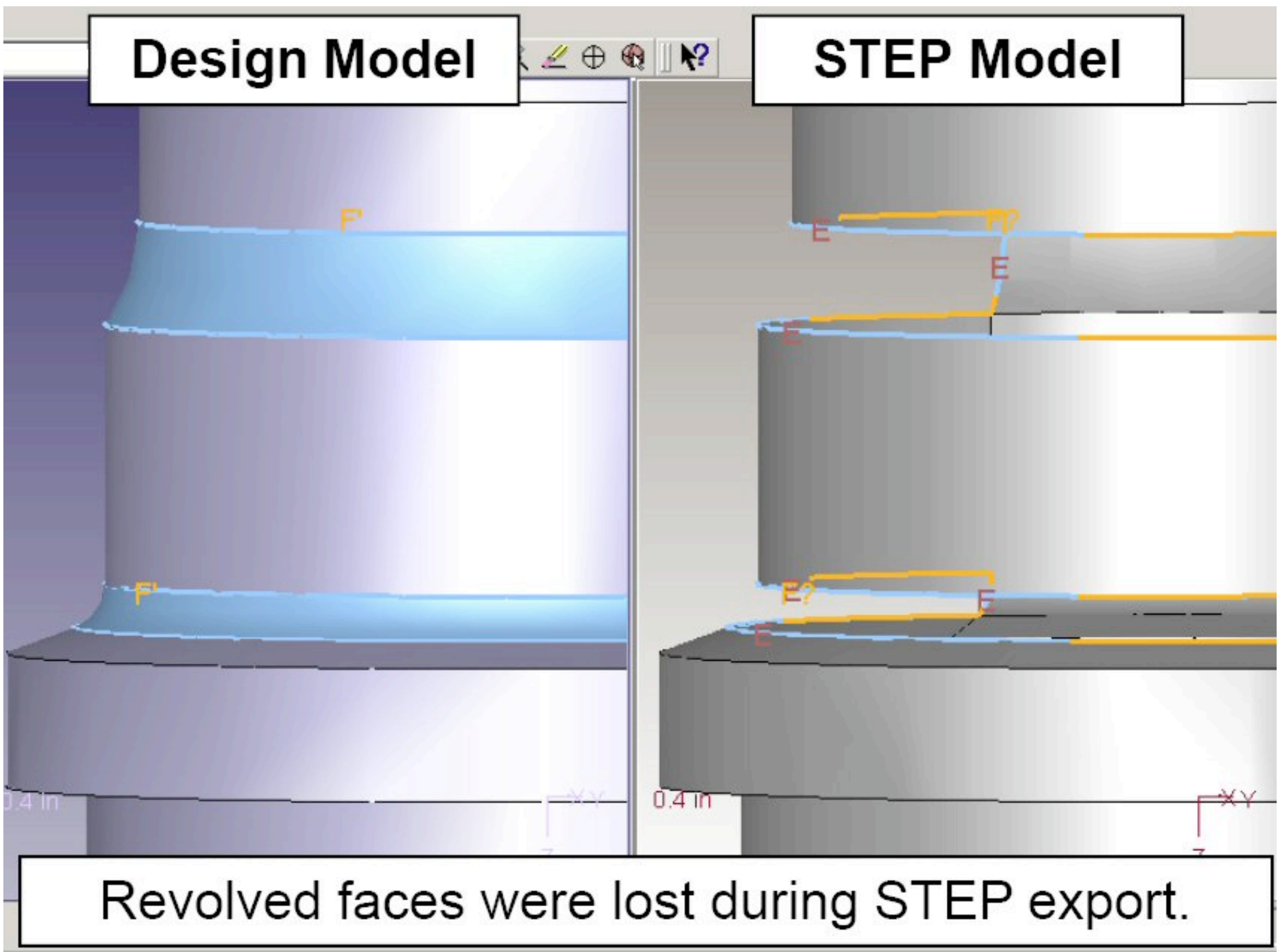

Figure 3—Revolved faces were lost during translation of this CAD model to ISO Standard 10303 format. (Courtesy of ITI Transcendata and the Collaboration and Interoperability Conference)

In an afternoon session on the last day of the CIC, Doug Cheney of ITI Transcendata elaborated further on CAD model translation errors and what can be done about them. ITI has been selling software for translating, checking, and repairing 3D CAD models since the mid-1990s. Cheney says many of the errors identified by data-translation software are caused by problems in the original CAD model. The reasons why such errors occur in CAD models vary, and Cheney didn't discuss them. But the important lesson for engineering managers is that 3D models must be checked in their native CAD system before releasing them as manufacturing masters.

This checking should take the form of visual and procedural checks, such as being sure that all feature dimensions have been specified and the buried and extraneous features have been removed. Checks should also be run by automated software to eliminate errors too small to see. Such defects can stall analytical or manufacturing applications that use the models. Clean models are more likely to pass through translation software without errors, an observation corroborated by Magna's Donna Korfel.

Checking by the firm that originates 3D models doesn't eliminate the need to check following translation. Translators make errors, so it's important to check and correct them before sending models to suppliers who may translate them again for use in other systems, such as NC milling or inspection programs. A disciplined procedure for checking models also helps manufacturers identify high fidelity translation software and eliminate software that's prone to error.

Protecting Confidential Data

Ships, aircraft, ground vehicles, and other complex products are themselves assembled from sophisticated subsystems such as motors, pumps, gearboxes, control systems, electronic devices, seats, and other fixtures. Suppliers generally risk their own capital developing such products and the tools and plants to make them. They don't want their technologies copied by competitors who could thereby avoid much development expense.

For this reason, suppliers of complex subsystems don't want to share their detailed CAD models with customers. They want to provide only the information that the customer needs to integrate the product into its system. Such information legitimately might include:

- 3D models of the exterior surfaces
- Location and physical details of mounting brackets and piping and electrical connections
- Functional specifications such as power consumption or production, flow rates, torque, frequency response, etc.
- Computer models of system performance
- Service procedures and diagrams, when applicable

Most 3D CAD systems permit customers to produce lightweight, exterior-surface models of product assemblies. Unfortunately, in many cases, keeping these package models coordinated with the original assembly is too much of a chore. Moreover, lightweight models often dumb down the entire assembly, failing to provide adequate details of mounting hardware and connection points. Lastly, simplified CAD assemblies remain in the proprietary formats of their respective CAD systems. OEMs must translate these models to their own systems if they want to incorporate them into a master mockup.

A number of software companies make lightweight formats and mockup software products that are vying to become de facto standards for digital mockups. The most widely used of these is Siemens JT, originally conceived by Engineering Animation in the 1980s. Other contenders have been developed by Adobe Systems, Right Hemisphere, and Lattice Technology.

In Part 3 of this series on managing distributed product development, Steve Wolfe summarizes the state of the art in collaborative product development. The article will appear next week.

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