



**Theorem Solutions**

World Leaders in Product Data Interoperability



## **BAE SYSTEMS NIMROD MRA4 PROJECT AVOIDS DUAL SYSTEM COSTS**

### **Unification of CAD data onto single system brings major benefits**

When CAD systems were first put into productive use in aerospace design in the early 1980s the best practice of the day was to install the CAD system considered best suited to the product that was to be designed. Differences in the way that CAD systems worked made it possible to see that some systems were better for some jobs than others. That meant that in these early days many design and manufacturing projects utilised more than one CAD system.

This trend was particularly apparent in very large scale projects such as aerospace design and manufacturing where 'best in class' products might be assigned to different aspects of an airplane. In these early days the productivity increases created by CAD outweighed the challenges of interoperability that are so much more apparent now and very considerable advances in aerospace design ensued from the use of these 'best in class' solutions.

As CAD technology has matured and as the scale of installations has increased and as the projects themselves have grown, many organisations have taken stock of their early investments and are considering the benefits to be gained by unifying their CAD processes onto a single CAD system.

These are the circumstances faced by BAE Systems with the Nimrod MRA4 project where originally CADDs had been selected for wing design and CATIA was being used elsewhere on the airframe. BAE Systems considered that it would be very worthwhile if it were possible to unify the MRA4 project onto a single CAD system and the conclusion was that a migration of CADDs data into CATIA would be highly desirable if it could be done effectively and economically.

There were many significant challenges to taking such a step. CADDs had been used effectively for wing design for a long time and BAE had built up a very large database of designs comprising over 120,000 models and drawings. These consisted of stand alone 2D drawings, 2D model data, 3D wire frame, 3D surface data, 3D solids and the various combinations. It very soon became clear that while standards based methods such as IGES or STEP would assist in the migration of some elements of this data they would not enable a full migration. Even a direct database CADDs to CATIA translator supplied by Theorem

Solutions although it would translate the 2D and 3D model files, was not at that time able to offer a solution for the whole 2D data set.

BAE Systems were also aware that a migration project is much more than a large series of translations. There already existed fully defined procedures for checking and validation of translations and these would need to be applied to migrated data to ensure that model and drawing integrity had not been compromised by the translation process. In addition the nature of the project meant that a detailed audit trail would need to be maintained and that every action taken in the process of the migration should be traceable.

This additional administrative overhead was so significant that it might prevent the whole project from going ahead. If everything was to be checked manually, for the project to be completed in anything like an acceptable time frame, a large number of checkers would need to be employed.

A similar issue was apparent in respect of auditability. If the audit data were to be created manually it would require significant additional manpower to such an extent that it would extend the timeframe to completion beyond acceptable limits. Furthermore the manual creation of an audit trail on such a large project would be error prone and would therefore be unable to satisfy one of the key project criteria of proving that the data was correct and consistent.

The implications of these challenges were that whilst the goal of the project was clear and the possible future benefits in efficiency and expenditure reduction were also clear the possible manual overhead needed to undertake the project would negate any benefits.

Nevertheless BAE Systems began to evaluate the possibility of overcoming these challenges and they asked Theorem Solutions to work with them to identify and propose acceptable ways of overcoming these issues.

The first task was to confirm to BAE that there was a workable solution to the translation of the whole data set from CADDs to CATIA. Theorem's standard CADDs to CATIA CADverter that was already in use on this project would translate 3D models and 2D geometry but not drawings. However Theorem had already developed drawing translation capabilities on other migration projects and the enhancement of this module to meet BAE's specific needs solved the problem. At an early stage in the process of identifying a solution, the requirement to translate the full data set was met.

BAE Systems and Theorem then together turned their attention to the challenge of automating the tasks that had previously been viewed as only achievable manually. It seemed

logical that since in any given translation the Theorem translation process had full knowledge of the source CADDs data and the destination CATIA data and that it would 'know' of any problems, that a comparison of the two data sets could take place at the time of translation. While this is theoretically true it was decided to make comparisons immediately after translation when the target CATIA file had been written to disc.

A translation process was developed that used Theorem's CADverter to translate all forms of CADDs geometry into CATIA format and then carry out three comparison operations on the source data and the resulting destination data.

1. For every translation the mass properties would be compared
2. Theorem's shape comparison module would be applied
3. Every entity in the source CAD file would be compared with its equivalent in the destination CATIA file.

It was shown that using these three different methods any discrepancy could be identified but the question of how to enable a manual checker to confirm this still remained. The data created by the three stage checking process automatically created very detailed reports and the prospect of manually trying to interpret such documents was not acceptable.

The solution to this difficult problem was Theorem Process Manager (TPM) a product that Theorem had developed for the management and control of translation processes. TPM provides the ability to be able to 'read' all the detailed comparison logs and build summary and exception reports including detail from other system messages during the process. Not only this, but TPM had the ability to compare the data in the summarised results with user defined 'range tables' and was therefore able to pinpoint any translations that included values outside acceptable ranges. This meant that TPM was able to create not just man readable summary information but specific exception reports directing manual checking to the translations that showed potential problems and avoiding the previous need to check the vast majority of translations 'just in case' there might be an error. TPM has automated the checking process and removed one of the most labour intensive and significant cost overheads and in so doing making the MRA4 migration project much more viable.

A natural by-product of applying TPM to the checking process has been that detailed audit trails are also automatically produced. This removes the other potential stumbling block of having to create and validate an audit trail manually and further reinforces the effectiveness of the migration process to a point where the effort is readily justifiable and the anticipated benefits can be achieved.

This successful migration project calls for simple file selection and 'drag and drop' operation. It has automated control of a number of processes and incorporates knowledge and skill that previously remained within key personnel. It carries out the migration of MRA4 project CADDs data into CATIA and enables very significant tangible savings including system and manpower costs that result from unifying the data set onto a single system.

As the CAD world evolves into the PLM world of design and interoperability many organisations, both large and small may find that their original decisions to install different CAD systems in different departments or sub-divisions are no longer applicable. Changing business patterns, business mergers and other factors also drive this requirement.

Migrations may look difficult and the solutions may look complex, requiring not just translation technology but sophisticated process control as well. BAE Systems have demonstrated that in selecting the right vendor and the right solutions CAD migration is not just possible but can also deliver tangible business benefits.