Carter Ground Fueling Pumps-Up Development Productivity With Telelogic' Rhapsody®

Carter Ground Fueling Ltd. (part of the Argo-Tech Corporation), based in Henley-On-Thames, UK, is the world's leading supplier of fuel delivery software and hardware to the Airline Industry. Their applications can be found at over 200 airports worldwide and on every continent. They recently brought to market a leading edge in-cab refuelling system whose timely development was only made possible by Telelogic' Rhapsody®.

Carter Ground Fueling's AvR2000 system consists of two separate major components; one, the Office Software component providing Fuel Accounting, Administration, Resource and Operations Management, and the other, a Vehicle Information System located on-board the deployed refuelling vehicles. The AvR2000 system has to achieve a number of business goals for Carter Ground Fueling's customers, including:

- Optimal usage of airport refuelling assets;
- Efficient and reliable control of refuelling operations to ensure there are no departure delays;
- Protection against environmental or commercial liabilities by providing highly accurate monitoring and accounting of fuelling operations.

Market Drives Need For New Product

During 2001, Carter Ground Fueling concluded there were pressing business and technical drivers to develop a replacement for the existing Vehicle Information System element of their offering, the RS4000ts. The RS4000ts consists of a microcontroller based Data Acquisition Module and a handheld computer used by the refuelling operator; data transfer to the handheld is via RS232. Subsequent data upload to the back office system is via an in-office cradle. As Vic Goddard, the then Development Manager explained, the replacement system had to meet a number of emerging market needs e.g.:

- Utilize modern wireless communications to enhance the timeliness and efficiency of data collection/transfer;
- Enable more efficient management of an airport's refuelling assets, including transmission of operational instructions directly to cab, and by incorporation of GPS tracking capability;
- Provide improved linkage between fuelling control and vehicle systems;
- Be more functional but cheaper than the existing system to enable penetration of the 2nd tier airport market;
- Be fully inter-operable with the existing Office Software component, enabling existing customers to upgrade vehicle systems incrementally and reducing acquisition costs.

To minimize unit cost & price, the replacement system – the AvR2057 – was to be a single integrated unit with a touch sensitive colour screen. For the first time they would use an embedded RTOS, WindowsCE .NET. In developing the software for the AvR2057 Vic Goddard and his team faced a number of significant technical and process challenges. The new system had to reproduce and extend the functionality of the existing product within the framework of an architecture which 'future proofed' the new system. However, Goddard explained a problem that they faced similar to many organizations, "The RS4000ts had been developed and upgraded over an extended period of time. The original developers were no longer with the company, design and requirements documentation were out of date, and it was being maintained at the code level only. The code base was clearly suffering from maintenance stress." Vic Goddard added, "In addition, the architecture and design did not lend itself to the modular extensible system we required."

Choosing The Right Solution

To ensure that the AvR2057 had a firm foundation, the decision was taken to develop it from scratch. To provide a solid architecture and the extensibility being sought, it was decided to adopt Object Oriented (OO) techniques and C++, even though the existing system was in C, and the team had relatively little experience in OO development. The team was therefore faced with considerable process as well as technical challenges. Vic Goddard was sure they should be using some form of design tool to aid the development. However, an encounter with Telelogic and Rhapsody convinced Goddard of the benefits of going further and adopting a full Model-Driven Development environment. For example the ability to generate the deployed application directly from the design, avoiding design/code dislocation, would solve many of the problems with the existing system. Rational RoseRT was also considered but was found to be overly complicated and less intuitive. Confronting process and experience issues, Goddard also sought a genuine Solutions Provider who would offer not only tools, but also quality training and mentoring during the early stages of the project. "My intuitive feel was that Telelogic and Rhapsody were the right choice; it's been great to see that I was right and they delivered," said Goddard.

Having selected Telelogic' solution and got project go ahead, the team went through Telelogic' initial Rhapsody training. The project was then kick started with a Development Consulting Workshop from Telelogic that focused on scoping the system, identifying an initial architecture and introducing appropriate design patterns.

This was later followed by a model review workshop. "This approach was very effective in bootstrapping ourselves and the project," said Tim Hughes, one of the engineers on the team. "It ensured that we started with a solid architectural base," he added.

Rhapsody Delivers Beyond Expectations

The AvR2057 was launched to market about 18 months after project approval. Rhapsody has been key to the success of the project and the product. "Without Rhapsody we would have a needed a larger team and would never have achieved the functionality and flexible product offering we now have," said Vic Goddard. Among the many benefits experienced by Carter Ground Fueling are:

- *Meeting Commercial and Market Needs:* A critical element to the commercial success of the AvR2057 is its flexibility, so that functional changes can be made quickly and cost effectively. This required a robust OO design and open architecture. "It would have been impossible to achieve and maintain such a strong design and architecture without the ability to express and share this visually through Rhapsody models" said Darren Hale, a project engineer.
- *Meeting Operational Needs:* Rhapsody's visual modelling has also played a key role in refining the requirements. The team worked with operators who would use the system out on the airport, using Sequence Diagrams to mutually explore operational scenarios. Similarly, Statecharts have been important in communicating and refining the required behaviour with operational experts.
- *Enhancing Quality & Productivity:* The software for the AvR2057 is 100% code generated from the Rhapsody model, including DirectX wrapper classes. Having the code synchronized with the model has been crucial to achieving a significant improvement in product quality, ensuring that the integrity of the design is maintained while the product is enhanced. Engineers are able to work at a higher level of abstraction; this improves communication and enables them to focus on requirements and design concepts where their expertise is most effectively utilized. "With Rhapsody we tend to work at the architectural and design level," explained Tim Hughes. The design abstractions provided by the Rhapsody framework also saved significant effort.
- *Reducing Program Risk:* Rhapsody significantly reduced development risk. The model animation and testing capabilities were used extensively for initial design proving. Its ability to seamlessly synthesize the application for different environments meant that the team could proceed with development and testing on the host for six months before prototypes of the new hardware became available. A full PC hosted system is still maintained for test purposes.

The ease with which new functionality can be introduced has led to unforeseen benefits. For example, the team decided to incorporate a real-time diagnostic logging capability; the quality of the design meant it could in turn easily link to any of the system's communications capabilities. This means that diagnostics down to the truck level can now be performed remotely whereas previously engineers would have to fly to site. This has reduced support costs as well as providing an enhanced level of customer service.

"When I joined the team I was very sceptical. I had read the marketing blurb but didn't believe Rhapsody could deliver," explained Tim Hughes. "The first time I made a major change to a state machine I was amazed at how easily it re-built. Now I'm just interested in the model view; it would be a chore to go back to writing code," he concluded. Darren Hale added, "It's very difficult to think of ever working on this type of development without Rhapsody again."

AvR2057 Fuels Sales Growth

The AvR2057 has not just been a developmental success, but has had a very successful launch to market. As planned, its enhanced functionality, extensibility and reduced cost has made it a winner. Carter Ground Fueling has acquired new customers and developed significant new business from existing customers. "Rhapsody has enabled us to achieve and exceed our goals, and gain a competitive advantage," concluded Vic Goddard. "We had a steep learning curve both in design methodology and in OO, but with the support of Rhapsody we have achieved a sophisticated, well-integrated and maintainable system."

About Telelogic

Founded in 1987, Telelogic is a leading provider of solutions for systems design through software development focused on real-time embedded applications. These solutions allow engineers to graphically model the behaviour and functionality of their embedded systems, analyze and validate the system, and automatically generate production quality code in a variety of languages. In 2002, Telelogic introduced iNotion®, an enterprise level Product Lifecycle Management Portal that enables users to easily manage the enormous amount of information generated during product design, development and marketing. Telelogic is headquartered in Andover Massachusetts and has sales and support centers throughout North America, Europe and the Far East. For more information about Telelogic, visit our website at www.ilogix.com