

JOVIAL to C++ TRW/U.S. Air Force MILSTAR Satellite

CLIENT
U.S. Air Force

SOFTWARE
MILSTAR Satellite

LANGUAGE PAIRING
JOVIAL to C++

COMPLETION TIME
1 month

HISTORY

The U.S. Air Force was ready to develop its next generation military communications satellite, MILSTAR. Lockheed Martin won the contract and brought in TRW to develop an advanced Extremely High Frequency (EHF) communications system for the new satellite.

For this system to operate successfully on the new hardware, and to implement a much higher data-rate mode than the older generation satellite, TRW had to first transform the legacy JOVIAL code to a modern language. TSRI was brought in to deliver the transformation of JOVIAL to C++ which would allow the system to achieve a much higher volume and speed of data transmission.

CHALLENGES

The MILSTAR satellite system was written in J3 JOVIAL, a software language widely used by the Air Force for high-performance, mission-critical embedded applications. In this case, the most effective way to enhance performance and reduce maintenance costs was to rewrite the JOVIAL legacy software language into modern, platform-independent C/C++. A rewrite could take advantage of new high-performance hardware and new software environments. A manual rewrite of the over 143,000 lines of JOVIAL code was estimated to take 12 months. TSRI's automated transformation process leveraging their JANUS Studio toolset could achieve the same goal in just one month, while also reducing technical risk.

Modernization of JOVIAL into C/C++ is a highly complex problem. Older Jovial systems often ran with a 60-bit word-length cyber hardware, which creates data field alignment problems during transformation. To save space, the Air Force's early programmers had used memory overlays to share memory and defined data field sizes to bit-sized lengths. In addition, JOVIAL has a powerful macro definition mechanism, but the mechanism is inconsistent with

HIGHLIGHTS



99.9X% Automation



Low Technical Risk



Completed Ahead of Schedule



Simplified Maintenance

TSRI's engineers successfully assessed and transformed the 143,000 lines of JOVIAL code. The project was implemented in three releases.

a C/C++ architecture. Finally, the 1750 hardware used 16-bit big-endian words. The target hardware was able to replace the 16-bit structure with 32-bit little endian words.

JOVIAL itself is a powerful language with highly complex data structure operations, dynamic program structuring, and effective error handling for real-time hardware interruptions. Transformation of JOVIAL requires perfect preservation of the semantics of operations, accuracy in the state of computation to the level of bits, and correct control flow in the presence of real-time interruptions.

RESULTS

TSRI's engineers successfully assessed and transformed over 143,000 lines of JOVIAL code. The project was implemented in three releases, successfully migrating the application's logic from a JOVIAL to a C++ environment. The MILSTAR transformation was completed in less than 30 days. Initial acceptance testing, for which the customer had budgeted eight weeks, was completed in a single day. By leveraging TSRI's automated modernization, TRW was able to begin software performance upgrades one year earlier than the original project schedule. The new and improved MILSTAR satellite system carrying the TRW/TSRI communications system provides enhanced communication abilities to the United States Armed Forces.

When failure is not an option, TSRI is here for you.

As a leading provider of software modernization services, TSRI enables technology readiness for the Cloud and other modern architecture environments. We bring software applications into the future quickly, accurately, and efficiently with low risk and minimal business disruption, accomplishing in months what would take years otherwise.

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