BAE Systems Upgrades
TMS Test Bed with Virtual HP1000

BAE SYSTEMS

About 20 years ago, BAE Systems developed a Thrust Management System (TMS) to automatically synchronize the output of jet engines on dual engine aircraft. The system is deployed on many twin-engine Boeing, Airbus, and Bombardier commercial aircraft. The platform used to test and certify TMS components was built around an HP1000 E-Series computer system running RTE-IV B.

The BAE TMS continues to be deployed in new and existing aircraft. The TMS test platform remains in use to check and certify TMS components. With the passage of time, the HP1000 controlling the test platform began to succumb to age-related issues, impacting reliability of the entire test bed.

Commercial aviation support

BAE engaged Migration Specialties to replace the HP1000 at the heart of the test platform without impacting its software or functionality. Migration Specialties was able to achieve this goal using the Strobe Data Kestrel, a real time virtual HP1000 replacement solution hosted on an integrated Windows server. The solution includes a specialized chassis that houses both the host server and an HP1000 compatible I/O backplane.

Over a period of three days, two Migration Specialties consultants worked onsite with BAE support personnel to install, test, and certify the Kestrel replacement system. The main project goals, successful replacement of the HP1000 and certification of the replacement solution, were completed in two days. The rapid implementation of the Kestrel solution allowed time to recover data from legacy HP1000 media and set up a file transfer process between the RTE environment and the Windows host environment.

Kestrel MEF rack mount chassis (6U)

During the replacement project, the following HP1000 system components were virtualized. The virtualization of these components is transparent to the HP1000 software.

- CPU
- Memory
- Boot ROMs (HP12992D, HP12992C, HP12992B)
- Time Based Generator
- Console controller (BACI-12966A)
- Console terminal
- Disk controller (MAC 13037A)
- Disk drives (MAC 2100)
- Line printer controllers (26099-60002)
- Line printers (2608A)

The legacy HP-IB card used to interface with a component on the test platform was replaced with a modern PCI GP-IB card. The replacement is transparent to the HP1000 software.

Several legacy I/O cards that interfaced with specialized equipment on the test platform were retained. The cards listed below were moved to the Kestrel's onboard HP1000 compatible backplane and continue to function exactly as they did in the legacy HP1000 system.

- BACI cards (BACI-12966A)
- Ground True In/Out cards
- Data Modem Transmit and Receive Sync cards

Porting to the Kestrel allowed BAE to eliminate two large 2608A line printers which freed up space in a somewhat cramped test area. The Kestrel provides options to print to local and network printers or to direct output to text or PDF files. BAE preferred electronic capture of print output as it makes comparison and distribution of test output much easier.

Upgrading to the Kestrel vastly improved local and remote backup operations. Virtual HP1000 disks are stored as container files on the Windows host server. These files can be backed up locally and across the network using BAE's standard Windows archive processes. Complete copies of the virtual HP1000 system were also burned to DVD for offsite storage.

BAE had a large archive of test applications and system software stored on a collection of 7906 disk platters and ARRAID flopticals disks. Taking advantage of the Kestrel's ability to interface with legacy controllers and its GetDisk Utility, procedures were created and tested that allow BAE personnel to generate image copies of the platters and flopticals.

Recovery of 9-track tape data using a legacy 7970E tape drive proved more challenging. Communications with the drive were established using the legacy controller card installed in the Kestrel HP1000 backplane. Data transfer to and from the drive was verified; however the drive was badly out of adjustment and generated too many read and write errors to successfully process a full tape. The drive will need to be cleaned or repaired before tape recover operations can be completed. Given the age of the equipment, this was not an unexpected result. Tape recovery with working tape hardware was proven feasible.

A final important benefit provided to BAE by the Kestrel system is the ability to transfer data between the Windows environment and the RTE environment. Utilizing HFCO, a file transfer utility provided with the Kestrel, two-way file transfer procedures were established for BAE.

This project allowed BAE to upgrade an important legacy system, recover data from old media, add new features, and improve operating efficiency in a very short period of time. BAE expects the virtual Kestrel to add another 10 – 20 years of operating life to the TMS test platform. In addition to upgrading HP1000 based systems, Migration Specialties offers similar solutions for PDP-11, VAX, and Alpha hardware.