Extending the trainer lifecycle through software and hardware concurrency upgrades.

The Customer

United States Air Force
C-5 MATS Program Office

The Situation

Trainer lacks concurrency with aircraft.

The Integrated Systems Trainer (IST) is comprised of a partially functional flight deck, flight engineer's station, circuit breaker panels and engine pod. The trainer gives the students the ability to start the engines and see the proper indications of all major systems on the flight engineer's instrumentation. The instructor has the ability to insert malfunctions at the Instructor Operating Station (IOS), enabling the students to troubleshoot the problems. Because the IST is utilized by students of all C-5 systems, it is among the most heavily used C-5 maintenance trainers.

The trainer was delivered to the USAF at Travis AFB without source code rights. The absence of these rights significantly limits the government's options for the procurement of concurrency or supportability updates. Also, its DEC host computer was nearing the end of its supportable lifetime and the cockpit configuration was not in concurrence with the aircraft.

- Reverse engineer the IST software to give the government unlimited source code rights.
- Replace the obsolete DEC host computer with a modern, supportable COTS computer.
- Update the cockpit configuration to be concurrent with the aircraft.
- Develop a documentation package for use in supporting the trainer.

The Solution

Nakuuruq implemented the following solutions:

Source Code—The current source code for the IST exists for both the host simulation and instructor station software and is written in both FORTRAN and C. Nakuuruq redeveloped the software in C, replaced all 36 host and nine instructor station modules, station modules, and transferred all data rights to the Air Force.

Host Computer System—Nakuuruq replaced the obsolete DEC computer with new and supportable PC COTS hardware. Replacing the current interface I/O systems and outdated High Speed Device (HSD) interface eliminate the cumbersome ribbon cable inter- connections between the trainer's major components. The computer runs a Linux OS and incorporate dual RAID hard drives, eliminating the need for an external drive array chassis. Since it is self-contained in its rack mounted enclosure, the host computer chassis was removed. Nakuuruq used open source compilers to build the software executables.

Aircraft Concurrency Modifications—The IST flight engineer's panel along with its circuit breakers had to be brought into concurrence with the aircraft. This included simulated versions of the trainer's fire detection and suppression systems. Nakuuruq incorporated hardware and software changes so that the students can carry out all operational checkouts. We also made upgrades to the fuel gauges and Tire Deflation Panel.

Documentation Package Upgrade—Most of the current IST documentation was missing, incomplete, inaccurate or in a paper, non-editable format. Nakuuruq replaced this existing documentation with an updated and the editable electronic O&M technical manual and completed and verified system diagrams and illustrated parts breakdown.

The Benefits

A fully concurrent, robust and sustainable Integrated Systems Trainer was accepted by the Air Force as Ready for Training (RFT) with zero discrepancies after the first ATP two weeks ahead of schedule. The Field Training Detachment now had a concurrent, integrated training device that six different aircraft maintenance specialties could accomplish training on a 3C level—a level that is equal to using the actual aircraft and in turn, eliminates the need for a dedicated aircraft to be fenced off for training purposes only.

The IST software, host computer, cockpit configuration and documentation concurrency upgrades were accepted Ready-for-Training with zero discrepancies after the first ATP two weeks ahead of schedule.