

Taking hands on maintenance training from the aircraft to the classroom.

C-5 Galaxy Fuel Tank Pressurization System

- Enable complex system training in safe environment
- Train without taking aircraft out of service
- Train multiple students concurrently
- Achieve 360° instruction view with trainer walk around
- Optimize use of training personnel

The Customer

United States Air Force C-5 MATS Program Office

The Problem

Virtually no hands on training possible.

All training on the C-5 Fuel Tank Pressurization System (Dewar) had to be performed on the aircraft itself, thus removing the aircraft from operational service for limited fuel system maintenance training purposes. Instructors relied on teaching troubleshooting objectives with illustrations and diagrams, so most maintenance technicians were unable to diagnose and repair the Dewar system due to lack of hands-on experience.

Two 800 liter Dewar storage tanks pressurize the C-5 Galaxy's fuel tanks and are located on each side of the aircraft between the main wing and the fuselage. This confined space allows for only one technician in the work area. A full body safety harness must be worn along with protective coverings from head to toe. It is difficult to maintain certain components without damaging others. Some fuel tank pressurization operations can create environmental hazards.

The Opportunity

Two Dewar systems were available and could be converted to C-5 Fuel System Maintenance Training Devices (MTD) for classroom, hands on training purposes.

In 2010, instructors from the Maintenance Qualification Training Program (MQTP) delivered the following five training objectives for the proposed C-5 Fuel System Maintenance Trainers:

- Operational checkout of the Vent Valve
- Operational Service checkout of Service Panel switches & system components
- Operational checkout of Primary/Secondary Pressure Regulators
- Operational checkout of the Nitrogen Fire Suppression Panel & system components
- Operational check of Liquid Level Sensor Conditioner



The trainer provides a full 360-degree view with walk-around access to all components. Instructors can teach hands on Remove and Replace procedures to a classroom of students in a fraction of the time it would take on an aircraft and without the potential for damage to otherwise operational flight-line equipment.

The Opportunity *-continued-*

Utilizing the available Dewar systems, Nakuuruq Solutions will design and develop two C-5 Fuel System Training Panel 2 units, one to be located at Travis Air Force Base and the other at Dover Air Force Base. These two Maintenance Training Devices (MTD) will enable an instructor to teach the C-5 Fuel Tank Pressurization System and Nitrogen Fire Protection Suppression System in a classroom environment.

The Response

At every critical point across the Acquisition Life Cycle

Nakuuruq's electrical, mechanical and software engineers began collaboration with the Government Subject Matter Experts (SME) for the system design during System Requirements Review (SRR). Design, engineering, prototyping and assembly of the trainers would be done at our Broken Arrow Oklahoma facility with support from Nakuuruq's Training System Support Center (TSSC) at Travis Air Force Base, California. Collaboration between Nakuuruq and the government SMEs continued at the Preliminary Design Review (PDR), the Critical Design Review (CDR) and through Customer Acceptance, delivery and post-delivery operations and maintenance.

Each trainer consists of a C-5 Dewar assembly and associated plumbing as well as a cabinet with Instructor Station, Nitrogen Service Panel, Nitrogen Fire Suppression Panel and Liquid Level Sensor Single Conditioner. The cabinet also houses the electronic components and board computer to control the simulation. A wooden base on casters supports the Dewar assembly and cabinet.

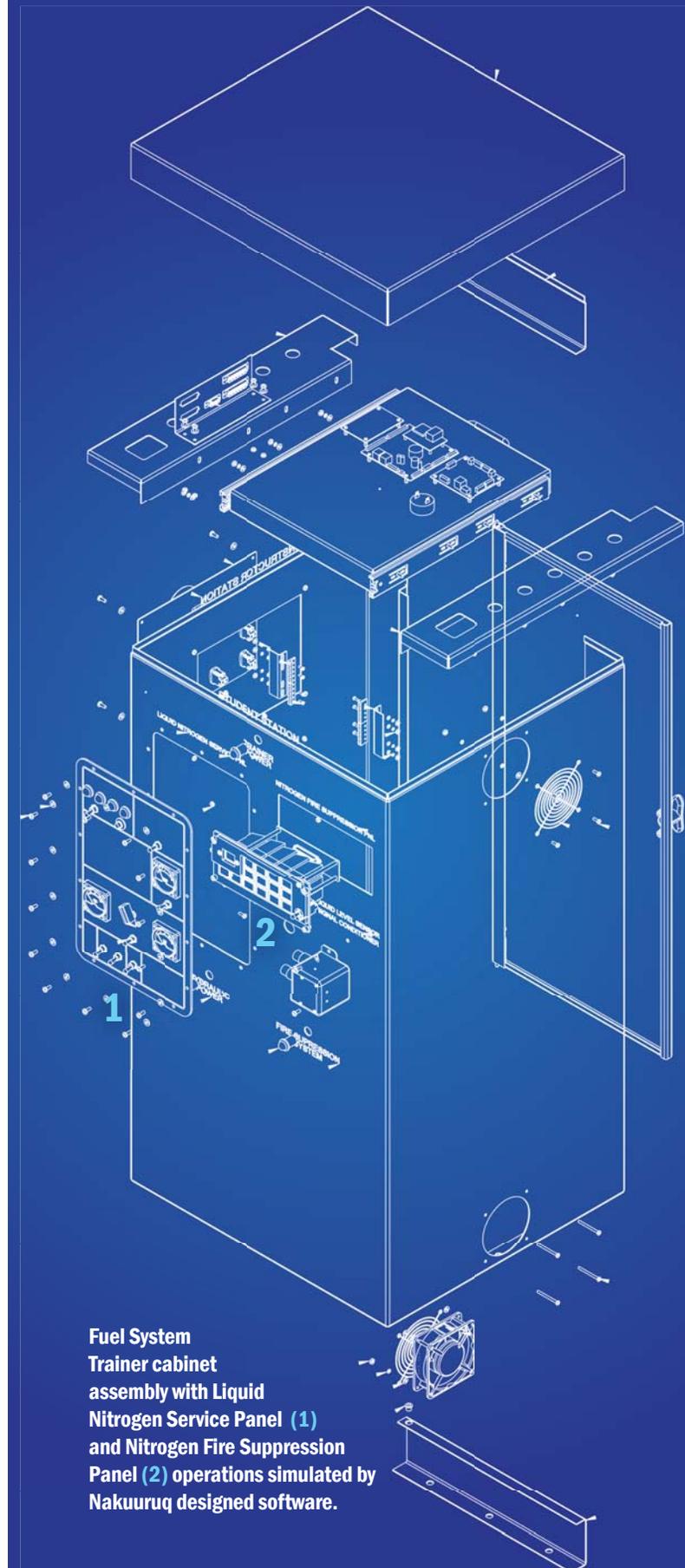
A software simulation running on a single board computer allows an instructor to train students on the five specific procedures for the Fuel Tank Pressurization System and Nitrogen Fire Suppression System. The operational switches, lights and gauges provide a realistic simulation of the system and offer students the opportunity to learn a wide variety of C-5 fuel system maintenance operations.

Post Delivery

Additional trainer enhancements

The trainers were delivered on time and fully compliant with the original requirements. Post delivery, the Nakuuruq team worked with the Government SMEs to explore additional improvements. For example, Nakuuruq engineers created fill/drain profile curves that were more realistic to the actual aircraft. We sped up some of the longer time delays to reduce instructor and student wait times thus improving training efficiency while maintaining trainer effectiveness. We also adjusted the timings associated with some of the switches and indicator lights. Using storyboard/white board techniques, we created an enhanced simulation for a significant increase in the overall training fidelity and experience.

We quickly made these improvements at no additional cost to the client base on our initial selection of the Digj international BL2600 single board computer for this project. Our approved design for using software and software simulations enabled the Nakuuruq team to make these improvements without the need for hardware modifications.



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