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FRCSE trainer repair team ensures aviator pipeline far into future

Fleet Readiness Center Southeast Flight Check personnel turn the propellers on a T-44C Pegasus King Air Trainer aircraft on the back flight line at Naval Air Station Jacksonville, Fla., Jan. 27. (U.S. Navy photo by Victor Pitts/Released)

JACKSONVILLE, Fla. – Fleet Readiness Center Southeast (FRCSE) is making depot-level repairs and modifications at the facility to the Beechcraft T-44A and C model Pegasus King Air fleet used to train Navy and Marine Corps aviators on multi-engine aircraft at Naval Air Station (NAS) Corpus Christi, Texas.

The FRCSE T-44 Advanced Multi-Engine Trainer Team is overseeing a major rewire, Aircraft Condition Inspection (ACI), wing spar replacement and an upgrade to the avionics system with digital display converting the aircraft from an “A” to “C” model.

“This is a huge team effort involving FRCSE production and manufacturing, our engineering and production support teams, CNATRA (Chief of Naval Air Training), NAVAIR (Naval Air Systems Command), and PMA (Program Manager Air) 273,” said Bill Connelly, the FRCSE program manager for trainer aircraft. “This was not an easy undertaking.”

The aging trainer fleet with 54 aircraft, each flying for more than 32 years, supports CNATRA’s vital training mission.

Connelly said FRCSE is now providing one-stop shopping for work previously performed by multiple contractors, a situation that increased service costs and slowed down the aviator pipeline with aircraft being out of service more frequently.

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He credits the professionalism, skill level and work ethic of the FRCSE artisans who provide the touch labor for the trainer platform. Connelly said they are returning a high quality product to CNATRA with increasingly shorter turnaround times as the artisans gain experience and become more efficient.

FRCSE inducted the first T-44C trainer on April 1, 2010, which came to the depot for a left-hand wing spar replacement and Attitude Heading and Reference Systems (AHRS) relocation.

Artisans relocated the AHRS box from directly behind the pilot's seat on top of the floor to 4-feet aft and under the floor panels. This new configuration eliminated the need to remove the AHRS boxes and mounts when pulling the cabin floorboards for routine inspection of the underlying aircraft structure. It also eliminated the requirement to re-level the box electronically by leveling the plane on jacks followed by performing a software-leveling procedure.

Relocating the AHRS box caused another troublesome issue with the aircraft. Multiple T-44C trainers were experiencing numerous failures of the AHRS on takeoff and in flight posing safety concerns requiring termination of training flights under Visual Flight Rules. Pilot and co-pilot displays were blanking out, eliminating all information without warning to the pilots.

CNATRA Fleet Support Team (FST) engineers evaluated the AHRS failures and discovered the relocated AHRS box was susceptible to propeller harmonics-induced vibrations affecting the Inertial Measurement Units (IMUs) contained within. They found the IMUs were susceptible to failure when excited at a frequency of 108 to 109 hertz.

The FST designed a modified AHRS mounting plate assembly to reduce the effects of rotational harmonics, a frequency problem commonly encountered with propellers. FRCSE machinists fabricated the new assemblies that maintainers are retrofitting on the T-44C fleet in Texas.

FRCSE inducted the second aircraft for rewire several weeks after the first trainer arrived in 2010. An earlier hazard risk assessment revealed a potential electrical fire hazard. In June 2010, a commercial vendor began the T-44 rewire efforts until FRCSE assumed the work shortly after.

Connelly said old, brittle electrical wiring was "the main driver" accelerating the team's rewire efforts.

Engineering Team Lead David Pfeffer said the CNATRA FST and the FRCSE T-44 production team worked closely with NAVAIR PMA 273 to bring the work back to the military depot.

Pfeffer said the T-44 fleet is plagued with a similar wiring concern that has affected many Navy aircraft over the years, that being the extensive use of polyvinyl chloride (PVC) encased wiring, also known as Kapton wiring.

"The heat from the engine exhaust is causing the insulation around the wire to become brittle along the wing leading edge creating a potential for fire," he said. "PVC smokes profusely and produces toxic fumes. It's a big concern."

The starting point for wiring efforts at FRCSE began with more than 200 containers of loose materials collected from the

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commercial vendor initially performing wiring modifications and upgrades.

The T-44 rewire modifications and avionics upgrades proved challenging with little or no technical data, manufacturing drawings, detailed technical directives or work instructions available from former contractors.

The team launched an extensive reverse-engineering effort utilizing a rewired T-44C trainer provided by CNATRA with avionics upgrades already incorporated on the aircraft. They developed detailed work instructions, manufacturing and installation drawings, and bills of materials consisting of thousands of components. The team also procured and assembled all required kits to execute the modification program.

Electronics Engineer Charlotte Faulk, the avionics team lead, headed efforts to reverse engineer the wiring harnesses that run the length of the airframe. She created manufacturing drawings from the existing wiring diagrams and worked closely with FRCSE Cable Shop personnel who provided real-time feedback.

“We had five sets of harnesses from the vendor,” said Faulk. “The cable shop verified that the harnesses were built correctly and made wiring changes to the harnesses as necessary. They worked closely with engineering and the T-44 line artisans to create rewire harnesses that ran from wingtip to wingtip.”

The T-44 team revised about 50 of the preexisting systems and component drawings, created 20 new manufacturing and installation drawings totaling 205 sheets, wrote and issued a comprehensive technical directive in the form of a four-part airframe change, Air Frame Change (AFC) 20, and updated numerous aircraft maintenance publications.

The Avionics System Upgrade (ASU) requires artisans to replace the T-44A’s analog steam gauge instrument panel and corresponding wire harnesses with a Rockwell Collins Pro-Line 21 avionics suite incorporating modern multifunctional color displays, AHRS and an Emergency Locator Transmitter (ELT).

Artisans are replacing the TR70-17 ELT and antenna with an Artex 406N ELT capable of transmitting in the 406.028 MHz range while simultaneously providing global positioning and unique aircraft identification.

They are also replacing the heavier, obsolete PC-17 static inverters located outboard of each engine nacelle with lighter solid-state static inverters. Further, they are relocating the inverters to the avionics bay for easy access.

Additionally, the T-44 team is conducting the depot-level ACI required at 5-year intervals that includes the latest aircraft configuration updates.

Parts acquisition continues to prove challenging for the team given the trainer aircraft were commercially supported for the life of the plane until 2010. Defense Logistics Agency (DLA) does not stock the parts, which causes long delays when contracting with commercial vendors.

FRCSE artisans have completed 13 aircraft involving a variety of repairs and upgrades. They are currently working seven T-44

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aircraft, four of those are ASU with rewire modifications required for the “A” to “C” model conversion with two scheduled for completion in mid-April. An additional three aircraft are undergoing ACI with wiring modifications.

The FRCSE T-44 team is uncovering and correcting the effects of years of wear and tear on an aircraft that operates in harsh environments. These repairs and upgrades will not only reduce future maintenance costs and improve mission readiness of the T-44 platform but also ensure the pipeline of Naval aviators will continue far into the future.

The trainer fleet must continue to maintain airworthiness through its planned sundown in 2025.

Overhaul and Repair Supervisor Tim Duncan (left) and T-44 Trainer Engineering Team Lead David Pfeffer inspect the wing butt joint and spar cap for corrosion on a T-44 Pegasus King Air trainer at Fleet Readiness Center Southeast Jan. 27. (U.S. Navy photo by Victor Pitts/Released)

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Electronics Engineer Charlotte Faulk, the T-44 avionics team lead, checks the nose wiring harness for an avionics systems upgrade on a Beechcraft T-44 Pegasus King Air Trainer at Fleet Readiness Center Southeast Jan. 27. Faulk headed efforts to reverse engineer wiring harnesses that run the length of the aircraft. (U.S. Navy photo by Victor Pitts/Released)

Aircraft Electrician Robin Anderson performs a wiring modification on the glass cockpit of a T-44 trainer aircraft at Fleet Readiness Center Southeast June 9, 2010. The Avionics Systems Upgrade with digital multifunction display converts the aircraft from an "A" to "C" model. (U.S. Navy photo by Victor Pitts/Released)

Trainer Aircraft Program Manager Bill Connelly (left) and Aircraft Electrician Paul Brown discuss the installation of an engine wiring harness on a trainer aircraft at Fleet Readiness Center Southeast Jan. 27. (U.S. Navy photo by Victor Pitts/Released)

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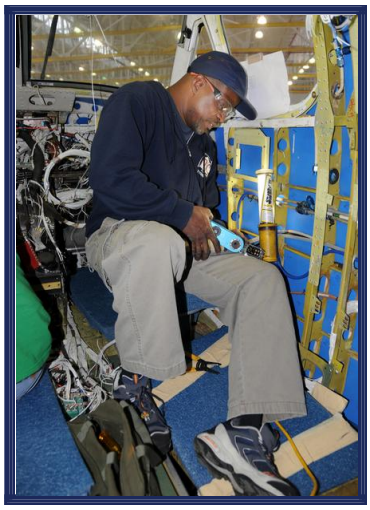

Aircraft Electrician Demetrius Henderson replaces a circuit breaker panel in the cockpit of a T-44 Pegasus King Air trainer at Fleet Readiness Center Southeast Jan. 27. (U.S. Navy photo by Victor Pitts/Released)

The Fleet Readiness Center Southeast T-44 Advanced Multi-Engine Trainer Team completes the first depot-level repairs and modifications including a major rewire, avionics systems upgrade with digital display, Aircraft Condition Inspection (ACI) and configuration updates to an aging trainer aircraft Nov. 8, 2011. The T-44 Trainer fleet supports the Chief of Naval Air Training mission of training Navy and Marine Corps pilots on multi-engine aircraft. (U.S. Navy photo by Victor Pitts/Released)

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Aircraft Electrician Al Lambert inspects an engine control wiring harness from a T-44C Pegasus King Air aircraft at Fleet Readiness Center Southeast Jan. 14, 2011. The facility is implementing a rewire change, along with avionics upgrades to the aging trainer fleet. (U.S. Navy photo by Victor Pitts/Released)

Sheet Metal Examiner/Evaluator Stan Kennedy performs a structures inspection on the interior cabin airframe of a T-44 Pegasus King Air Trainer at Fleet Readiness Center Southeast Jan. 14, 2011. (U.S. Navy photo by Victor Pitts/Released)

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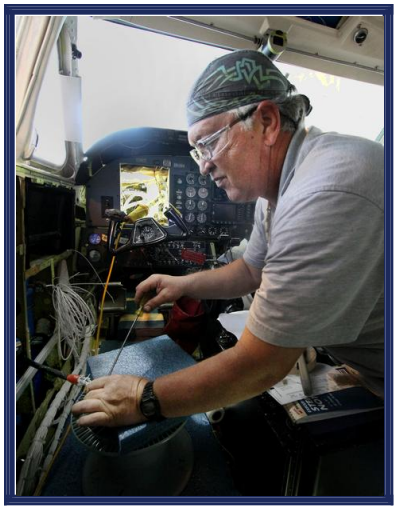
Aircraft Electrician Bruce Arthur installs wiring on a T-44 turboprop trainer aircraft undergoing an upgrade from an "A" to "C" model at Fleet Readiness Center Southeast Feb. 21. (U.S. Navy photo by Marsha Childs/Released)



Aircraft Electrical Worker Ronald Johnson upgrades the avionics systems in the cockpit of a T-44 Pegasus trainer aircraft at Fleet Readiness Center Southeast June 9, 2010. The upgrades convert the aircraft to a glass cockpit that features electronic digital displays. (U.S. Navy photo by Victor Pitts/Released)

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Aircraft Mechanic Michael Dooley (left) and Aircraft Examiner and Evaluator Alvaro Marquez remove the cabin heater from a T-44 Pegasus King Air trainer in a production hangar during aircraft modifications at Fleet Readiness Center Southeast Jan. 14, 2011. The trainer fleet is undergoing major upgrades to keep the platform flying until its planned sundown in 2025. (U.S. Navy photo by Victor Pitts/Released)