Bridging the ARMAMENT TEST GAP

Addressing O-Level Armament Test Deficiencies on 4th and 5th Generation Aircraft

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Background

The U.S. Air Force (USAF) took delivery of its first F-15A in November 1974, nearly 40 years ago. Soon after the A-10A and the F-16A, followed years later by the F-15E, joined Tactical Air Command’s (TAC) fleet of war fighters and rounded out the current 4th generation fighter aircraft. These aircraft represented “state of the art” technology at the time and included sophisticated avionics, munitions, and armament systems.

The sophisticated armament resulted in the USAF equipping maintainers with a new generation of test equipment at the flightline, supporting organizational-level (O-Level) maintenance. One of the new pieces of test equipment the USAF issued maintainers was a small, hand-held armament tester called the Armament Circuits Pre-Load Test Set (ACPTS). The ACPTS was round, cylindrical, and resembled a beercan. Thus, the ACPTS quickly earned the nickname “beercan” among maintainers. The ACPTS was designed to perform stray voltage tests and provide basic voltage measurements in support of armament loaded on the aircraft. The F-16 ACPTS was a very simple device with a single measurement channel while the F-15 ACPTS (Figure 1), was a more robust product possessing two measurement channels. Both of these pieces of test equipment had to be combined with large box testers, such as the 75501 tester for the F-16, making the flightline near the F-16 cluttered and complicated.

Figure 1: Legacy F-15 and F-16 O-Level Armament Testers

Later, the USAF was forced to take the world’s first 5th generation aircraft, the F-22, through Initial Operational Test and Evaluation (IOT&E) without flightline armament test capability. Industry and the Air Force initially thought that the F-22’s built in test (BIT) and Prognostic Health Management (PHM) system would eliminate the need for dedicated armament test equipment. The IOT&E test professionals quickly proved there was an armament test gap that needed to be filled before the F-22 was declared ready for Initial Operational Capability (IOC). After IOT&E, the tester that was quickly fielded to close the F-22’s armament gap was a multi-box tester named COLT, but it proved to be inadequate on the flightline.

The Armament Test Gap

Over the years, all of these aircraft received numerous upgrades to their avionics and armament systems. From the F-22 to the A-10, all of the aircraft now possess “smart” (Mil-STD 1553 and 1760) weapons technology and enhancements to legacy weapons. Today’s armament systems do not even resemble the systems TAC, now called Air Combat Command (ACC), deployed almost four decades ago. Yet, maintainers are still required to use the same or similar ACPTS combined with the big box test equipment fielded to verify that these sophisticated armament and munitions systems are full mission capable (FMC). This combination of box testers and ACPTS equipment doesn’t deliver the capabilities needed to support today’s Smart weapons. Furthermore, as test equipment ages and becomes obsolete, procurement personnel traditionally execute a one-for-one replacement strategy, e.g., a new “beercan” is procured to replace the original ACPTS and the SST is procured to replace the 75501 for the F-16. However, in the case of the A-10C, the flightline test equipment needed to validate the alignment and proper functioning of the Joint Direct Attack Munition (JDAM) does not exist. Instead, pilots are required to taxi the aircraft around the airfield to perform this important JDAM load procedure. Today, the F-35 also requires pilots to complete JDAM validation functions by taxiing the aircraft for maintenance.

The advanced Smart armament and munitions employed today, combined with obsolete or inadequate test equipment deployed on the flightline, has created an armament test gap because of the inability of today’s O-Level testers to provide the necessary tools to test and maintain armament and munitions. The armament test gap represents major maintenance and readiness issues for maintainers and operators alike due to the necessity of having to implement of a multitude of workarounds on the flightline. The U. S. Navy and U. S. Marine Corps experience the same armament test gap on their aircraft and resultant inefficiencies.

The F-35 Lightning II is a 5th Generation aircraft that has not yet completed Initial Operational Test and Evaluation (IOT&E). However,
the armament test gap is already visible. With no JSF O-Level testers planned in the current sustainment plan, maintainers will not have any test and troubleshooting capabilities for the F-35’s sophisticated weapons systems. Like the F-22, the BIT and PHM systems will fail to fully test armament and munitions. Fortunately, the Joint Strike Fighter (JSF) Program Office government and industry leaders recognize the armament test gap exist today. However, developmental test schedules and the restrictive budget environment they operate in are preventing them from integrating the SmartCan™ on the F-35 today. As a result, maintenance and readiness issues are looming on the horizon before the JSF has even reached Initial IOC.

Bridging the Gap

Having identified the armament test gap in legacy 4th and 5th generation aircraft several years ago, Marvin Test Solutions developed, qualified, and successfully deployed the MTS-3060 SmartCan™ universal O-level tester across legacy aircraft and is planning to do the same for 5th generation aircraft. Despite maintaining the small footprint of a ACPTS, the MTS-3060 SmartCan™ bridges the armament test gap by combining all of the capabilities of the ACPTS and the 75501 tester in the case of the F-16, and provides maintainers with the necessary tools to adequately test and troubleshoot today’s aircraft loaded with legacy and smart weapons. Additionally, the Marvin Test Solutions SmartCan™ provides maintainers and operators the ability to confirm that their armament is fully mission-ready.

The MTS-3060 SmartCan™ (Figure 2) was initially deployed in 2011 and is already deployed on multiple legacy platforms flown and maintained by various foreign and domestic customers. In fact, the MTS-3060 SmartCan™ is capable of supporting all 4th and 5th generation fighters, bombers, and Unmanned Aerial Systems equipped with armament and munitions. The hand-held, AA battery-operated MTS-3060 SmartCan™ flightline tester weighs less than 3 lb. Despite its compact size, it packs the capability to conduct full pre- and post-load operation as well as pre- and post-flight troubleshooting tests on legacy systems such as AIM-9 and AGM-65. It also supports “smart” munitions including JDAM, SDB I and II, and AMRAAM that incorporate MIL-STD-1553 and 1760 interfaces.

The MTS-3060 SmartCan™ performs pre-load test by emulating the weapon, e.g., JDAM, and is able to verify full operational capability of the systems it tests. The SmartCan’s ability to replace both the F-16’s ACPTS and 75501, as well as all other legacy and 5th generation aircraft on today’s flightline, simplifies logistics while significantly reducing the cost of acquisition, test, maintenance, and tester footprint. In fact, the SmartCan™ costs a fraction of the ACPTS and 75501 (and current SST replacement tester) while delivering superior test capabilities.

MTS-3060 SmartCan™ Features and Benefits:
• 30 measurement channels
• Programmable loads
• Audio and video generation
• Squib measurement channels
• Full MIL-STD-1553 and 1760 support
The enhanced capabilities of the SmartCan™ include the recording of parametric test data that can be made available for later analysis by alternate mission equipment or weapons experts and trend analysts, the ability to update SmartCan™ software in the field, and employment of high-reliability cables and adapters. Maintenance features built into the SmartCan™ include built-in test (BIT), built-in self-test (BIST), and simplified calibration that eliminates the need for extended calibration-related downtime. In fact when needed, calibration can be accomplished on the flightline.

Summary

An armament test gap exists today across legacy 4th and 5th generation aircraft due to the inability of current generation test equipment to adequately test the armament required to support smart weapons. The MTS-3060 SmartCan™ Universal O-Level Tester represents a paradigm shift away from the traditional one-for-one test equipment replacement approach and a quantum leap in capabilities available to maintainers on the flightline who are working within the constraints of shrinking budgets. With the need to test smart armament and associated aircraft interfaces, provide rapid, on-aircraft troubleshooting, simplify the test process, and reduce the test footprint on the flightline, the SmartCan™ is playing a major role in standardizing and consolidating flightline test equipment across legacy 4th and 5th generation aircraft. Further reducing costs and ensuring success, with the SmartCan™, maintenance professionals are trained on the same armament and munitions test equipment across both legacy and future aircraft. The benefit of consistent training for all US Air Force maintainers and the use of common test equipment, despite the aircraft they find themselves working on in the future, can result in significant cost savings and standardization.

Bridging the armament test gap today, one aircraft at a time, the MTS-3060 SmartCan™ Universal O-Level Tester is already deployed and proven effective on the F-16 Block 15 and 50, F-15C, TA-50, FA-50, and F-5 aircraft. Several more aircraft are scheduled for integration and certification over the next 12 months.

Inspired by the demanding and critical nature of our customers’ missions, we strive to be the world’s most innovative, best-value test solutions provider. We provide deep customer support from requirements definition to deployment and through the life of every customer’s application.

As a member of the Marvin Group, an award-winning supplier with a 50-year history in the Defense and Commercial Aerospace industries, we have test solutions deployed in support of most of the major defense aircraft and munitions in use around the world. Marvin Test Solutions quickly delivers full-spectrum, successful test solutions from the flight line to the depot, making test, maintenance, and sustainment of the most mission-critical systems easier and faster.

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