

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-726

Topic # N162-106

Advanced High Speed Bus Technologies for Units Under Test (UUT), Test and Evaluation

A.T.E. Solutions, Inc.

WHO

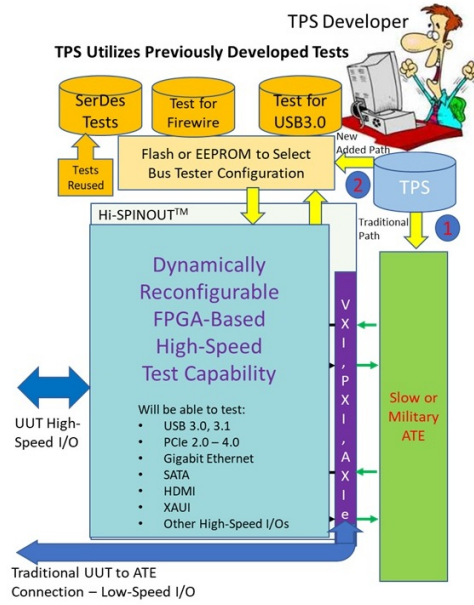
SYSCOM: NAVAIR

Sponsoring Program: PMA 260, Aviation Support Equipment

Transition Target: Aircraft avionics Units Under Test (UUTs) operating at multi-gigabit per second (Gbps) data communication rates, Electronic Consolidated Automated Support System (eCASS)

TPOC:
(732)323-4877

Other transition opportunities: Technology is applicable to all Department of Defense (DoD) test program set (TPS) development and automatic test equipment (ATE)



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WHAT

Operational Need and Improvement: A need exists to test high-speed input/output (I/O) signals from avionics line replaceable units (LRU) in military applications for automatic test equipment (ATE) developed prior to the use of data communication signals operating at Gbps data rates. The novel technology of A.T.E. Solutions, Inc. (A.T.E.) provides the necessary stimulus and response environment to test high speed I/O, resulting in lower test program set (TPS) development cost. A.T.E.'s solution is scalable and adaptable to support new and higher speed I/O bus structures for most ATEs.

Specifications Required: High-speed data buses represent new Navy avionics technology. To ensure an open architecture approach, UUT device interfaces (UDI) to test data communications should leverage industry standards. Advancements in ATE is required to support extremely high-speed data rates, complex timing, and synchronization, and high-speed multiplexing. Test parameters include statistical measurement, bit error rates, jitter and complex signal to noise and distortion measurement. Conventional test methodologies cannot achieve the test quality necessary to ensure proper performance of UUTs and maintain data integrity of high-speed net-centric information exchanges. This is driving the need for faster digital communication buses in ATE and UUT interactions.

Technology Developed: A.T.E. introduces Hi-SPINOUT (High-Speed Input/Output Test), a high-speed device interface implemented on a state-of-the-art field programmable gate array (FPGA) to support tests in the multi-Gbps range. Hi-SPINOUT employs dynamically reconfigurable synthetic instruments (SIs). SIs are under the control of the test program set (TPS) developer. High-speed serialization and deserialization (SerDes) tests are applicable for many different high-speed buses. Once a SerDes test has been developed it can be reused for other UUT tests. Similarly, entire TPSs can be employed in part or in full by other TPSs. Hi-SPINOUT is ATE-agnostic, so tests can be shared across service platforms.

Warfighter Value: Hi-SPINOUT supports tests of high-speed UUTs and reduces TPS development cost and lead times because TPS developers can reuse parts of previously developed tests. Tests developed for one ATE can be migrated and used on another ATE. With multiple TPS developers employing the same test, mistakes and omissions are more likely identified. To the warfighter, faster repair times, shorter lead time to test, more precise identification of malfunctions, better assurance of correct diagnosis all support mission completion. It also expands the ATE's useful life.

WHEN

Contract Number: N68335-18-C-0165

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|------------|--|------------|---------------|
| Conceptual Design of Hi-SPINOUT | N/A | Identification of commercially available FPGA that can meet the requirements of the Hi-SPINOUT design | TRL 3 | October 2017 |
| Fabrication of Hi-SPINOUT Prototype | Low | Demonstrate that high-speed Synthetic Instruments can be realized within the FPGA fabric | TRL 4 | February 2019 |
| Build a USB 3.0 UUT Communication with Hi-SPINOUT | High | Communication at the USB 3.0 Link layer will demonstrate a deeper connection than only through the Physical layer | TRL 5 | August 2019 |
| Interface Hi-SPINOUT, the USB 3.0 UUT to Navy's eCASS ATE | Med | Full communication between these elements enables testing, though debugging and integration issues may still exist | TRL 6 | January 2020 |
| Demonstrate eCASS ATE with Hi-SPINOUT test USB 3.0 at speed of 5 Gbps | Med | Known-good UUT passes test. Faults are injected. Test detects and diagnosis the faults. | TRL 7 | April 2020 |

HOW

Projected Business Model: The business model will consist of ways Hi-SPINOUT is made available: 1) In its basic form Hi-SPINOUT is sold as a programable and configurable item to provide high-speed capability to an ATE with some SIs included, 2) Additional Hi-SPINOUT SIs and intellectual properties (IPs) can be developed to customer specifications and sold separately, 3) Reusable test routines developed previously can be sold to speed test development, and 4) Test engineering services and support services are sold to create custom high-speed test solutions. While Hi-SPINOUT is an adjunct capability supplementing ATEs, it serves the TPS developer who can take advantage of test reuse.

Company Objectives: A.T.E.'s near term objective is to disseminate the Hi-SPINOUT paradigm to other services and is seeking TPS development projects that involve high-speed test applications. The Hi-SPINOUT concept, demonstrated for USB 3.0 on eCASS, is applicable to a variety of military ATEs involving high-speed buses. A.T.E. is looking to identify Navy, Army, Marine Corps, and Air Force high-speed TPS development initiatives in order to assist current TPS development efforts involving high-speed anywhere. Hi-SPINOUT is intended not only to provide tester functions, but also to serve test engineers in faster TPS development.

Potential Commercial Applications: Commercial board-level and system-level ATEs do not get updated more often than once every 3 to 5 years, typically once every 10 years. Therefore, high-speed data communications in commercial applications is also years ahead of current ATE speed and technology. Computers, mobile phones, automobile electronics and the internet of things (IOT) probably have the highest speed requirements. In each of these markets, high-speed ATE tests are inadequate. While high-speed test instruments exist from many instrument manufacturers, they are not necessarily oriented towards lowering the cost of test development. Hi-SPINOUT, exposed to a larger market will acquire more tests that can be reused and resold to others in the commercial and the military arenas, providing economy-of-scale cost savings. Product manufacturers can buy ready made tests for the high-speed communication part of their products, while lowering costs and time-to-market.

Contact: Louis Y. Ungar, President
LouisUngar@BestTest.com 310-822-5231