In This Issue - Technically

***Ask the User:* A Practical Approach to Test Program Set Development**

The development of a military weapon system is a long and arduous process. How to maintain that system after it is fielded is often a quick afterthought. The Automatic Test Equipment (ATE) and associated Test Program Sets (TPSs) are selected and developed based solely on the physical operating specifications and test parameters of the system. Those who will actually use the ATE to repair the system and those who will maintain the TPS software usually have little or no input until the ATE and TPSs are delivered and operating. This paper provides a case study of the development and acceptance of an ATE and TPS for the AN/ALQ-172 Electronic Countermeasures (ECM) system. It does not dwell on the specific technology and mathematical analyses designed into the TPS, but instead focuses on the end goal – using the TPS to repair the system. We discuss the initial development of the TPS without user input, then discusses some of the problems discovered when software maintenance engineers and system repair technicians became involved. The case study concludes with a review of the final TPS acceptance testing and an overview of the benefits and costs of involving the user throughout the development process.

State-of-the-Art in Speaker Recognition

Recent advances in speech technologies have produced new tools that can be used to improve the performance and flexibility of speaker recognition. While there are few degrees of freedom or alternative methods when using fingerprint or iris identification techniques, speech offers much more flexibility and different levels to perform recognition: the system can force the user to speak in a particular manner, different for each attempt to enter. Also, with voice input, the system has other degrees of freedom, such as the use of knowledge/codes that only the user knows, or dialectical/semantical traits that are difficult to forge.

This paper offers an overview of the state-of-the-art in speaker recognition, with special emphasis on the pros and cons, and the current research lines. The current research lines include improved classification systems, and the use of high level information by means of probabilistic grammars. In conclusion, speaker recognition is far away from being a technology where all the possibilities have already been explored.

Ultrawideband Radar Special Features & Terminology

We have noted much Ultrawideband (UWB) progress. The basic advantage of UWB radars over conventional narrow-band (NB) radars is an increase in the information quantity concerning a target that gives a rise to the information quality.

The well-known Shannon formula relates the number of information channel transmitted units per a second H, to the channel frequency bandwidth Δf and a ratio of the signal power Ps to the noise power Pn: $H = \Delta f \log (1 + Ps / Pn)$.

The formula indicates that an increase in the information quantity due to a rise in the signal-to-noise ratio is limited by the logarithmic nature of this dependence. So, to increase the information quantity transmitted, it is required to widen the channel's frequency bandwidth.

Next Generation of Guidar Technology

The next generation of Guided Radar (GUIDAR) is based on Ultra Wide Band (UWB) radar signal processing. Just as spread spectrum technology has revolutionized the communications industry UWB is dramatically changing radar signal processing. These advanced signal processing techniques are adapted to leaky coaxial cable technology in the next generation GUIDAR to provide new features and enhanced performance.

At the core of the new technology is an ultra high-speed digital correlator implemented in a Field Programmable Gate Array (FPGA). Complementary orthogonal codes based on Golay codes are used to produce thumbtack correlation functions simultaneously in multiple range bins. The net result is "near continuous wave (CW)" performance (97% duty cycle) in forty to eighty 11.6-meter long-range bins with targets located within one meter along the length of cable. This is a dramatic improvement over the 3% duty cycle of the original GUIDAR and the typical 100 to 200 meter long zones of current CW leaky cable sensors.

Orthogonal complementary codes are transmitted on each of two leaky coaxial cables. The responses from the parallel receive cables are fed to a direct digital receiver. The orthogonal nature of the code allows the composite coded pulse response to be de-multiplexed into the independent response for each of the two cables. This ultra-high speed correlation process involves the addition and subtraction of the sampled in-phase and quadrature-phase responses to the multiple range bin accumulators at 10 million samples per second.

Synchronous sampling at twice the chip rate ensures that each target is observed in three adjacent sample bins. The phase and amplitude response in the three adjacent samples are combined to precisely pinpoint (within 1 meter) the locations of targets along the length of each of the two cables.

The ability to precisely locate and track multiple simultaneous targets on each of two cables leads to numerous new features and performance benefits relative to existing leaky cable sensors. With a separate calibrated threshold for every meter of cable the sensor sensitivity is much more uniform and installation restrictions on burial depth, cable spacing, and medium homogeneity can be relaxed. Potential sources of nuisance alarms can easily be located and overcome. The pinpoint location can be used to provide better CCTV assessment, target capture for video motion sensors and more effective response to intrusions. Through the use of parallel cables the sensor can be used to detect the direction of crossing and to classify targets such as small animals, people, and vehicles.

This patented next generation of GUIDAR technology represents a dramatic step forward from that which was introduced at the 1976 Carnahan Conference in Lexington, Kentucky, and the numerous CW leaky coaxial cable sensors that evolved from that work. This technology effectively addresses residential, commercial, industrial, and governmental requirements including those relating to Homeland Security, military operations, and prisons.

Future Test System Architectures

An expanding number of test system architectural choices has caused confusion in the test engineering community. This shows the strengths and weaknesses of existing test system architectures including rack and stack systems with GPIB instruments and modular systems like VXI and PXI. It will provide a glimpse into an emerging new architecture: LAN-based test systems.

The paper will review key concerns such as costs, channel counts, footprints, IO speeds, ease-of-integration, and flexibility. The objective of the paper is to provide engineers insight into the most effective test systems for their future applications.