Computer Systems, Inc.
MERCURY

CUSTOMER REFERENCE STORY

Mercury's Innovative COTS Solution Enables Communications between Ships and ISR Assets – At Substantially Lower Cost

Reduces Element Counts by Nearly 50 Percent

Situation: Accelerating Time to Market for SATCOM Antenna Digital Techniques

A large communications solutions integrator for government applications produces and supports state-of-the-art, highly reliable systems that address the mission-critical challenges of its military and government customers, including the U.S. Navy, Air Force, and Army. The company uses commercial off-the-shelf (COTS)-intensive approaches to solve these types of system-level challenges while speeding time to market.

In particular, this provider focuses on the design and development of innovative, high-efficiency antenna solutions to receive and transmit RF signals over a broad range of frequencies. Applications for these antennas include integrated systems for missions such as satellite communications (SATCOM), airborne communications, space-based radar, and signal collection. The company employs approximately 75 antenna and 100 RF engineers to support more than 100 different antenna-related programs, business opportunities, and projects. Their creative work has resulted in over 80 antenna-related patents awarded and many more in process.

Critical Issue: A Better Design to Drive Down High Costs

Phased array antennas are the technology of choice for communications and radar because of their ability to communicate with multiple fast-mover and ISR targets without depending on moving parts, but the high cost associated with this technology has greatly restricted its application. Getting the data from the antenna to the central signal-processing computing system is also a major challenge. Although centralizing the processing at a shipboard site is more favorable, the distributed location of the antennae can create signal degradation, causing the signal to lose coherence. Naval ships, in particular, are electrically noisy environments, so a way to circumvent that problem is needed. Ultimately, the solution must also minimize analog components and simplify the design. Such a solution would coincidentally cut costs, decrease the footprint, and lower maintenance requirements, power requirements, and incidence of failure.

Reason: Challenges Require Superior Technology

The challenges of providing superior wideband beamforming antenna technology continue to center on several important areas:

- Tracking signals over longer distances
- Increasing agility to track assets more easily
- Improving beamforming precision to increase jam resistance
- Lowering costs through innovative use of off-the-shelf components

What Mercury Provided

To respond to these challenges, the company sought help from Mercury Computer Systems. Based on their wealth of industry experience, Mercury offered advisory support and designed a sophisticated technology platform that answered the customer's specialized need for wideband data links and satellite communications. Mercury worked closely with the customer to craft a comprehensive solution that includes a central signal processing subsystem and the Echotek™ Series ECV4-RFT 6U Wideband Remote Fiber Transceiver, which combines high-speed A/D technology, field-programmable gate array (FPGA) reconfigurable processing, and fiber I/O, creating a blend of powerful remote processing and low-latency data transfer.

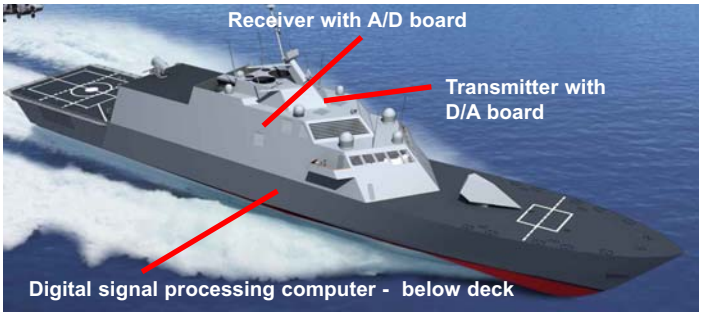
The ECV4-RFT is an innovative mixed-signal module with the unique ability to coordinate data streams to and from sets of spatially distributed sensors.

Echotek Series ECV4-RFT 6U Wideband Remote Fiber Transceiver

Capabilities of the Mercury Solution

This Mercury solution has improved signal processing performance by a factor of 20 over RISC processors for certain algorithms and dramatically lowered the size, weight, cost, and power consumption of the company's wideband signal-processing platform. The ECV4-RFT transceiver board, which is designed to be located near antennas, communicates with the signal processing subsystem via Digital IF (VITA 49) over fiber that can reach up to 100 feet long. With this configuration across the platform, the single signal processing subsystem can support multiple types of input.

The central signal processing subsystem employs a series of Mercury FPGA compute nodes (FCNs) integrated into one chassis. Each 6U VME board has two FPGAs that have 7 million gates each. The FCN boards provide a flexible, manageable way to exploit the power of FPGAs in the company's integrated solution.



Digital beamforming technology is an essential element in highly flexible, jam-resistant communications. Mercury's expertise in processing and connectivity allows platform designers to architect computing solutions in either tightly coupled or loosely coupled configurations.

Results

Reducing Element Counts by Nearly 50 Percent

Using this COTS solution from Mercury, the company's developers devised a methodology of high-bandwidth, coherent panel-combining that drastically lowers the cost of phased array antenna technology by decreasing the size and/or number of phased array apertures, as well as corresponding element counts – in some cases by as much as 50 percent. By increasing the density of functions on chips, more functions can fit on a board, reducing the number of boards in the design, decreasing the overall footprint, and improving reliability.

This approach features other advantages as well. It is deployed independently of the RF elements that comprise the phased array. The architecture can be configured for use in improving the performance of existing phased array systems, and the technique can be used to combine irregularly spaced fixed antennas into phased arrays.

Collaborating for Success

The Mercury team collaborated closely with the company's developers and monitored the progress of the program, workarounds, and other issues on a daily basis, with formal action-item lists and teleconferences. By sharing problems and solutions freely and quickly, the working relationship was strengthened, leading to the high degree of success of this program. Mercury also helped refine all the project documentation with a focus on maximizing results and minimizing overhead. Mercury's total commitment to the project enabled the team to successfully complete the design, test, and preliminary integration phases in time to support the company's demonstrations to the U.S. Department of Defense.

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