Preventing Component Obsolescence and Vendor Lock-In with a Low-Cost Modular Open Architecture Radar System

Executive Summary

IERUS Technologies developed the Open System Configurable Architecture Radar (OSCAR), a flexible, next-generation platform for developing and deploying new radar capabilities across a wide range of mission spaces.

OSCAR is a software-defined radar (SDR) platform built upon a flexible software architecture for defining waveforms and new radar modes. Possible applications range from radar cross-section (RCS) characterization to counter-unmanned aerial systems (C-UAS) to synthetic aperture radar (SAR). With sample-to-sample control of the waveforms, OSCAR can be optimized to maximize target detection and discrimination performance, operate in adverse signal environments, and provide a low probability of intercept/detection capability. The RF front-end is built entirely from commercially available components to mitigate hardware obsolescence and avoid vendor lock-in issues.

Within 10 months of product inception, **IERUS developed and demonstrated OSCAR successfully on a number of blind tests**. Among these, OSCAR was able to repeatably and accurately characterize objects with low RCS features in an anechoic chamber environment. IERUS is continuing to expand and demonstrate OSCAR's capabilities across a range of customer requirements.

Project Background

Current industry practice for radar systems focuses on development and implementation of application-specific, custom hardware. This approach creates risks for customers in the aerospace, defense, and commercial sectors since costs, maintenance, upgrades, timelines, and parts supply are dependent on specific suppliers. Similarly, risk of component or system obsolescence exposes customers to potential of increased costs and timelines by forcing system or subsystem redesign.

Application-specific hardware also limits the radar's performance and flexibility. Within the aerospace and defense sectors particularly, customers desire multiple functions from the same hardware in order to reduce size, weight, and power as well as cost (SWaP-C), all while increasing mission flexibility and upgrade potential.

Team Background

Members of IERUS Technologies' RF Systems Innovation Cell, led by Dr. Daniel Faircloth, developed the first version of OSCAR. The OSCAR team consists of highly skilled experts in the areas of RF system design, antenna design, FPGA and embedded systems development, software architecture, and mechanical design. The OSCAR team has also sourced internal expertise in a number of radar disciplines including: RCS measurements, Doppler radar, and synthetic aperture imaging.

OSCAR was developed by IERUS in 10 months and costs 3-5x less than competitor solutions.
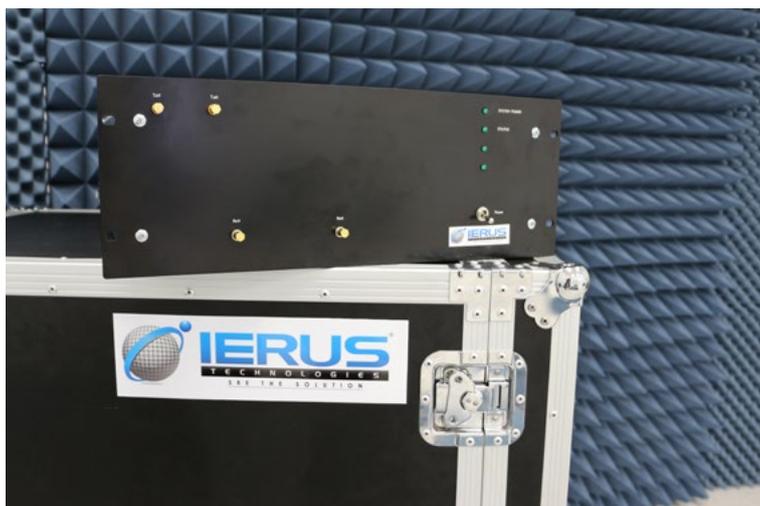
IERUS's Solution

In order to address the these needs, IERUS Technologies developed OSCAR to provide customers with a Modular Open System Architecture (MOSA), high performance, software-defined radar platform. For government customers, IERUS delivers OSCAR with Government Purpose Rights to eliminate vendor lock-in and component obsolescence, major risks for product adoption and lifecycle maintenance and upgrades. IERUS's OSCAR product provides the flexibility, accuracy, and maintainability desired by the radar community and at a much lower total cost of ownership than competing products.

To bring this solution to market quickly, IERUS employed our Agile software and hardware development processes with our rapid prototyping facilities to realize a first-demonstration capability in only 10 months. This short timeline is largely attributed to our highly skilled team and flexible, yet holistic, corporate environment at IERUS Technologies. IERUS brings this level of creativity and rapid innovation to every project.

How OSCAR Is Changing the Radar Industry

Traditionally, radars require complex RF front-ends with multiple stages of mixing, filtering, and amplification. This hardware complexity drives up SWaP-C and results in an inflexible hardware and software architecture. Using SDR technology, OSCAR provides users with an unprecedented level of control at lower cost and with a clear path for upgrades and maintenance. Further, OSCAR provides the flexibility required to minimize design and implementation of new operational modes, which otherwise would require a complete ground-up redesign with traditional radar. OSCAR's software architecture allows users to control the transmitted waveforms sample-by-sample, thus satisfying multiple mission needs without having to invest in an additional hardware components.

01 Software-Defined Radar

SDR technology removes much of the rigid, RF front-end complexity of radars by enabling direct conversion to intermediate frequency (IF) or RF signals. Further, with sample-to-sample waveform control, OSCAR supports pre-distortion of radiated waveforms thereby allowing optimal control of signal. In short order, OSCAR can be tailored to operate in adverse or "dirty" signal environments, support low probability of interception or detection modes, and maximize target detection and discrimination capabilities. Since OSCAR produces radar signals through software, there are few limitations on the signals it can produce, and this capability will continue to evolve as RF-digital technology matures.

Machine learning can also be incorporated with OSCAR's technology to optimize new waveforms that are tailored for high performance in multiple operational settings. Combining these technologies creates the possibility of highly accurate feature classification, object discrimination, and anomaly detection. With FPGAs directly integrated with the radar, machine learning can be applied closer to the front end of the processing chain thereby reducing data flow needs and producing high-value metrics and decision aids faster and more cheaply.

This combination of features is why **OSCAR is pioneering the way for software-defined radar systems to become the standard in radar systems**, today.

"OSCAR provides a flexibility which we are not aware of anywhere else in industry. With truly software defined operation and 100% COTS components, OSCAR can meet a wide array of mission requirements at low non-recurring, recurring, and life cycle costs."

- Dr. Daniel Faircloth, IERUS Chief Engineer

02 Government Purpose Rights

Along with being an industry leader in the rise of software-defined radars, IERUS Technologies has another defining factor—providing Government Purpose Rights (GPR) with OSCAR. The combination of a MOSA along with a COTS RF front-end and GPR provides government customers with vast customization possibilities, avoiding vendor lock-in and mitigating component obsolescence risk. With the MOSA design, OSCAR is easy to maintain, customize, and update in the future as hardware and software technology evolves. Using OSCAR, the latest RF hardware and software is easily within reach. With its software-defined approach, OSCAR can provide a faster response time to changes in mission needs.

03 Broadened Industry Scope

OSCAR costs 3-5x less than competitors. Plus, its recurring costs are significantly lower. By being more cost-effective, OSCAR opens the doors for other industries previously not open to this type of technology due to budget constraints or total cost of ownership concerns. For example, OSCAR can provide C-UAS detection and tracking for variety of users: convoys, forward operating bases, power plants, airports, stadiums, and embassies. Simultaneously, OSCAR provides a low-cost, yet high accuracy, solution for RCS characterization. Furthermore, OSCAR may serve as a development platform for testing new radar modes and algorithms.

Concluding Remarks

OSCAR is a ground-breaking, industry-disrupting solution. It pushes the bounds of how technological solutions are being developed for the government with its MOSA and Government Purpose Rights delivery. Additionally, IERUS is pioneering a shift in the radar industry with OSCAR's cutting-edge software-defined radar. With immense cost-savings and long overdue flexibility, OSCAR provides one solution for multiple missions and opens the door for affordable radar systems in lower-budget industries.

Did you know that electromagnetics solutions like OSCAR can help expedite technology transition time?

Let's discuss how IERUS can solve your toughest problem. Click the button to get started.

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