interview

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Roy Azevedo began his career in EW more than 20 years ago, when he joined Raytheon's Electronic Warfare Business as an antenna engineer. He spent the next two decades at Raytheon working in EW through a series of increasingly senior positions, including Systems Engineering Manager, Technical Director for ALE-50 Programs, and Director of Advanced Programs. In 2006, he was named Manager, Electronic Warfare and Deputy Vice President, Tactical Airborne Systems, of the company's Space and Airborne Systems business, where he is also a member of the leadership team. He manages an EW business comprising approximately 600 employees that is a leading developer and manufacturer of ESM receivers, RF jammers and towed decoys. Through his two decades of experience in the EW field, he has developed a unique insight into the EW market – an insight he recently shared with JED *Editor John Knowles.*

You have described your company's ALR-69A as the world's first and only true all-digital radar warning receiver developed to date. How do you define a digital RWR?

Once you get past the antenna, if you are working on digital signals from that point on, it's a digital receiver – as opposed to having a bunch of analog signals that are being decomposed and put through a digital signal processor.

Some RWRs available today incorporate digital elements but fundamentally have an analog architecture. The ALR-69A, which is in low-rate initial production for the US Air Force, is a digital open-architecture design, which permits easy reprogramming to keep pace with future threats. We believe it provides the optimal wideband receiver front-end for an integrated electronic warfare suite, particularly if that suite includes a DRFM [digital radio-frequency memory]-based jammer.

Without question, there is still a market for analog RWRs – affordability alone will dictate that military aircraft worldwide will have them for years to come. But if a digital RWR is affordable, it is definitely preferable to an analog RWR. When we have briefed our ALR-69A's cost and capability to prospective military customers, we have generally received very positive responses.

What advantages do digital RWRs offer?

A digital RWR offers higher sensitivity, which provides longer threat radar detection ranges than analog RWRs and better signal recognition in dense signal environments. In particular, a digital RWR gives you the ability to accurately identify threat signals earlier and unambiguously, which is an issue with older analog RWRs. That gives you a big advantage in terms of aircraft survivability.

Our customers also are seeking threat emitter precision geo-location using multiple RWRs, an emerging capability that a digital RWR facilitates. The ALR-69A provides it with the Advanced Tactical Targeting Technology [AT3] modification that we have developed. It's essentially just a drop-in circuit card that allows networking of multiple ALR-69As to share precise signal measurements and rapidly and accurately locate RF emitters without the use of external hardware.

Digital RWRs mark a big advance in airborne electronic warfare technology. By comparison, however, RF countermeasures, despite DRFMs and better processors, still use the same basic jamming transmitter technology, i.e., traveling wave tubes.

I agree entirely. What I believe will greatly evolve the transmitter side of the equation is the Navy's Next-Generation

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Jammer competition. [Editor: The Next-Generation Jammer program aims to develop a replacement for the venerable ALQ-99 jamming pods on US Navy EA-6B Prowlers that will transition to the new EA-18G Growler.] I include in that the techniques generation part of it and not just the antenna arrays and solid-state drivers. Unless the program's scope changes significantly, I believe that it will advance jamming technology applicable to multiple platforms and will drive that technology for many years to come.

We were one of the four companies – the others were BAE Systems-Cobham, ITT-Boeing and Northrop Grumman – awarded six-month technology-maturation trade-study contracts last February supporting development of innovative concept solutions at the system level. At Raytheon, we are applying a combination of multi-beam jamming techniques and antenna array technology to achieve a more effective, robust, open-architecture jammer.

The US fighter community has remained focused on RF threats as opposed to infrared threats and missile warning systems. Do you see that focus changing to include IR threats?

I believe that the fighter community will remain RF-centric. Fighters typically fly at medium altitudes above the reach of IR threats. But if IR-guided missiles become a major threat to tactical fighters, as they have to low-flying rotary-wing aircraft, the Navy and Air Force will have to respond.

Affordability is a big constraint. Even if you can buy inexpensive missile warning or other IR countermeasures systems, if you have to start cutting holes in an airplane, that starts to drive up the installation and integration costs. Weight is such an important parameter for fighter aircraft that any new system is going to have to buy its way on to the aircraft.

Is Raytheon working on upgrades to your ALR-67(V)3 RWR in use on the Navy's F/A-18E/F Super Hornets?

We work in a true partnership with the Navy and [F/A-18 manufacturer] Boeing on a technology roadmap for the ALR-67(V)3, whose capabilities continue to evolve. It already underwent an upgrade about two years ago in which we inserted digital channelized receivers like the ALR-69A's and a new processor with greater memory capacity, which increased its performance dramatically.

The ALR-67(V)3 offers a high degree of interoperability with Raytheon's APG-79 digital AESA [active electronically scanned array] radar also on Navy Super Hornets. The radar and the RWR can fully function simultaneously without interfering with each other, which is a major advance. It's well known that having a very good receiver in proximity to a transmitter poses integration challenges.

We received a follow-on contract award from the Navy in May, our 11th full-rate production lot, for ALR-67(V)3s to be used on Navy Super Hornets, Australian Super Hornets and older F/A-18A/B Hornets, and Canadian and Swiss F/A-18A/B Hornets. The Navy has ordered a total of 594 ALR-67(V)3 systems to date for itself and those international customers. And we are pleased that the Navy has decided to purchase ALR-67(V)3s to replace the ALR-67(V)2s on its legacy F/A-18C/D Hornets beginning in FY2010.

What are the next big international fighter competitions on which you are focused?

India's ongoing MMRCA [Medium Multi-Role Combat Aircraft] competition for 126 aircraft is one of the largest since the early 1990s. Our ACES EW suite is part of Lockheed Martin's F-16 bid, and Boeing's Super Hornet offering includes our ALR-67(V)3 RWR. Those aircraft are competing against Sweden's JAS-39 Gripen, the Eurofighter Typhoon, France's Rafale and Russia's MiG-35. Brazil's F-X2 fighter competition, which could be decided in October, could total 100-120 aircraft over a decade. Our ALR-67(V)3 is on Boeing's Super Hornet offering, which is up against the Gripen and the Rafale.

Most of the fighter aircraft offered today appear to have only a limited selection of integrated EW suites with predefined subsystems from which to choose. On the other hand, the US rotary-wing community, initially with the Joint and Allied Threat Awareness System [JATAS] program at Naval Air Systems Command, is moving toward the goal of an open-system, plug 'n' play EW architecture common to multiple aircraft types. This approach allows the user to mix and match various EW subsystems from different manufacturers that meet common interface standards without significant and costly integration challenges to each type of aircraft. Why isn't the fighter aircraft community moving in that direction?

I do believe that the fighter aircraft community wants to achieve that as well. It certainly would be beneficial for the airframe manufacturers to have an open mission systems architecture, because they could compete each of the subsystems one by one and eliminate the need for non-recurring engineering and integration work. From an EW standpoint, it would be desirable to be able to take a [jamming] technique implemented in one hardware set and implement it in another. But legacy architectures are very hardware-specific. That makes it difficult to port a technique from Box A to Box B. If we can overcome that challenge, it will provide a major benefit. And while it sounds easy to have plug 'n' play EW hardware, it's not.

Raytheon is significantly investing in – and considers it critically important for our systems engineers to be able to develop – open architectures. We are listening to what we are hearing from our customers, and we absolutely are addressing it with our investments.