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JED

The Journal of Electronic Defense

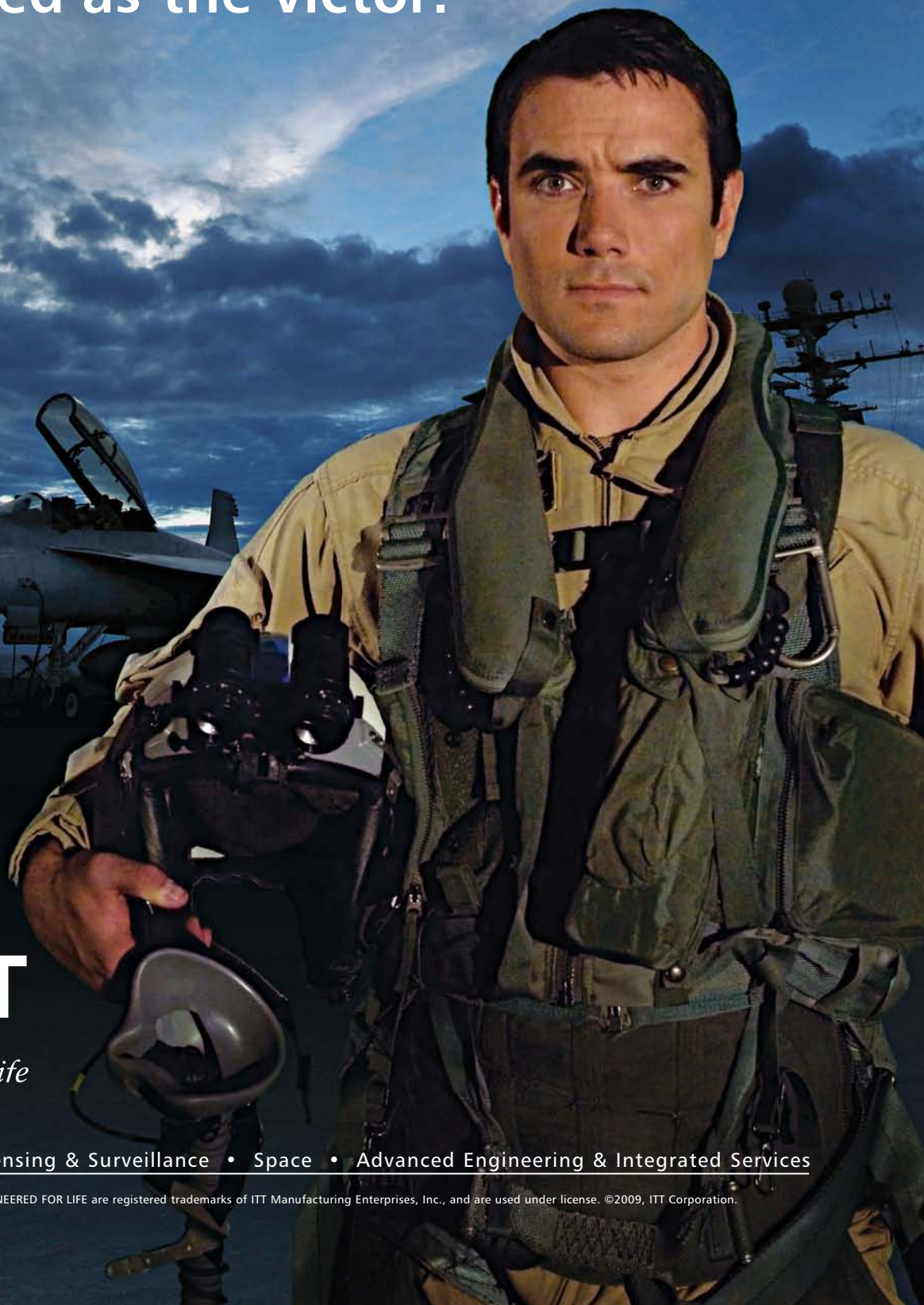
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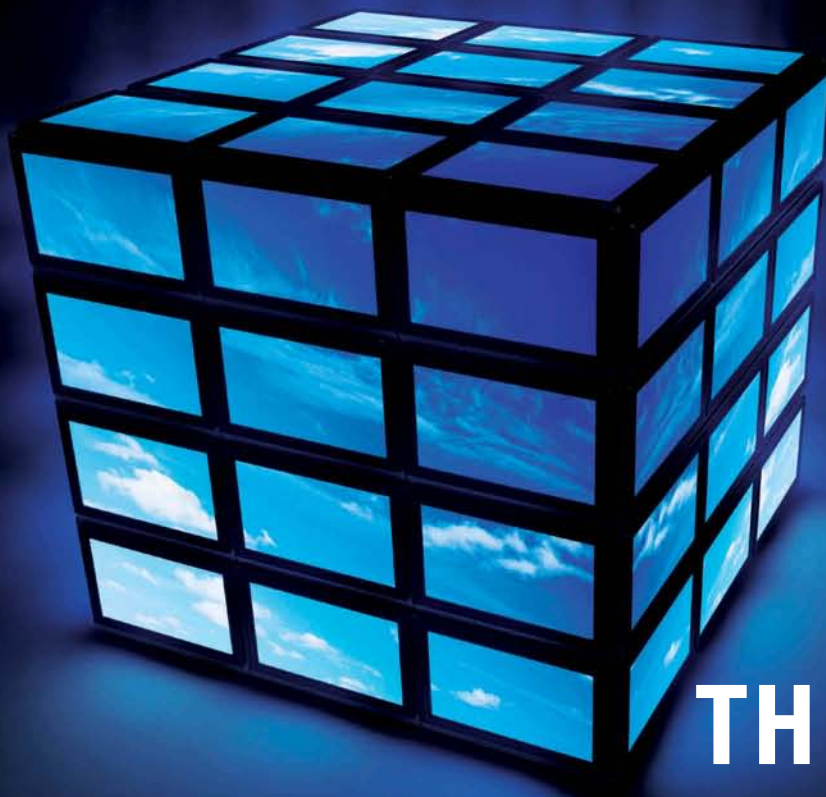
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KILLING THEM SOFTLY

Unless you only read *JED* for the sports section, you have no doubt followed the excellent work that the Joint Electronic Warfare Center (JEWEC) has performed over the past few years. Re-established by US Strategic Command (STRATCOM) in 2006 after an eight-year absence, the JEWEC has improved EW on several fronts, providing outstanding operational support to US and allied forces in Afghanistan and Iraq and informing senior decision makers in the Pentagon about the shortfalls and solutions needed to build a better corporate strategy for EW.

As of last month, however, the JEWEC has ceased to exist. Its parent organization, the Joint Information Operations Warfighting Center (JIOWC), re-designated the JEWEC as the EW Division of the JIOWC. On the surface, this is a mere name change. The JIOWC EW Division is still staffed and funded as it was when it was the JEWEC – for the moment. But this “name change” has serious implications for the EW support that STRATCOM provides. It diminishes the limited autonomy the JEWEC had over its billets and funding. The change also limits the EW Division’s direct liaison authority, which is its ability to directly support forces in the field.

The long-term implications of the JEWEC “name change” are more problematic. I have little doubt that the JIOWC, left unchecked, will suffocate its EW Division over the next couple of budget cycles, until the division becomes almost irrelevant to the warfighters it must support and the DOD leaders it informs. Unless senior leaders intervene and fence off the EW Division’s funding and billets (something that was much easier to do in the days of the JEWEC), I expect the JIOWC will whittle the EW Division into a much smaller organization that only supports IO planning, as opposed to meeting the diverse and extensive EW needs of the Joint Force.

You might say my criticism is premature, if not unfair. After all, it is only a “name change,” right? No, this “name change” reflects a lack of thinking (or awareness) on the part of STRATCOM, and it puts an indispensable EW organization in jeopardy. With considerable stakes (and many lives) at risk, why should anyone in the EW community, in STRATCOM or in the field wait around to “see what happens?” Instead of watching the EW Division atrophy, I hope that STRATCOM or the Joint Staff perceives this as an opportunity to properly establish and resource a new Joint EW Center, or dare I say, a Joint EW Command led by a flag-rank officer.

Unless the senior DOD leadership forces itself to take a hard and honest look at the critical role of EW in modern warfare, it will only see EW as a mere adjunct of IO or cyber or some other planning function or mission area. In the meantime, EW will continue to be (dis)organized and (mis)managed according to the interests of whichever entities want to co-opt it. That de facto policy is not merely a string of missed opportunities. It is a collective strategic failure.

– John Knowles



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 Fort Lauderdale, FL
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 Santiago, Chile
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INTERNATIONAL CROWS



As I read through last month's edition of the *JED*, I began to think about the tremendous reach that our Association has through its broad and diversified membership. Although I was aware of this prior to my Presidency, I was not as "dialed in" to the importance of this diversity until now. Today, our membership and their associated chapters thrive within eight regions. Two of those regions are classified as "international" and span the globe outside of the continental United States. These two regions provide the AOC with a rich and varied look at Electronic Warfare. From the northern European Viking Roost in Stockholm, Sweden to our Taipei Chapter on Taiwan to the Australian Chapter "down under," AOC members are actively working in the EW mission area and contributing to the body of knowledge of our profession.

This month, our newest chapter will celebrate their inaugural event in Bangalore, India. EW India 2010 will begin on February 10 and will act as a fabulous start for our India Chapter. As highlighted in last month's *JED*, India has established a significant EW capability addressing all aspects of the doctrine, organization, training, material, leadership, personnel, and facilities (DOTMLPF) construct. The importance of EW has obviously taken hold in a country that has great economic and political importance to the region and the globe. I look forward to seeing members of the India Chapter at AOC events around the world.

I would also draw your attention to the Australian EW and IO Convention being held in Adelaide, Australia on 12 and 13 April of this year. This convention will be my first international trip as President of the AOC and I am looking forward to meeting the loyal, vibrant AOC members from that great nation and region as well. I also look forward to hearing how these members think and represent EW technically and doctrinally.

Diversity is critically important to any organization, and the AOC is no different. We have the benefit of having 63 chapters spread across the globe and the skills and expertise these members bring to the Association cannot be underestimated. Just as we heard from my friend John Clifford of the United Kingdom Chapter last month, I urge all of our "international Crows" to contribute to our great association with your thoughts on where EW is headed. Also, please let us know what your chapters are doing! After all, we are an international organization chartered to advocate for a critical mission area which binds us all together.

Non Videbunt
- Chris "Bulldog" Glaze



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REVAMPED ARMY SIGINT AIRCRAFT READY TO FLY

Flight testing of the Army's first modernized and refurbished RC-12X Guardrail signals-intelligence (SIGINT) aircraft is scheduled to begin soon. The Army said early last month that the aircraft had successfully completed electromagnetic interference and compatibility (EMI/EMC) testing at Eglin AFB, FL, required for air worthiness certification. Northrop Grumman Mission Systems-ESL (Sacramento, CA) is the Guardrail prime contractor. The company is slated to deliver the first four RC-12X aircraft to the Army this summer.

Guardrail is a modified Hawker Beechcraft King Air B200 twin-turboprop with a crew of two and fitted with communications and electronic intelligence (COMINT/ELINT) systems. It has a maximum altitude of 35,000 feet and can spend about five hours on station. Guardrail's SIGINT payload is remotely controlled by operators in a ground processing station as the aircraft loiters in a stand-off position up to 180 km from its target area, and the SIGINT data are transmitted to the ground station for analysis.

During the EMI/EMC tests, various combinations of the modernized aircraft's avionics and sensor payload equipment were operated independently and simultaneously within a shielded chamber to identify potential sources of interference or compatibility issues.

The Army's Guardrail Modernization program is extending the service lives of 36 operational RC-12s by about eight years and standardizing their configurations and adding new hardware and software to improve their sustainability. Each aircraft is being taken out of the field and having its interior gutted and a new digital cockpit installed by Steven Aviation (Greenville, SC). Northrop Grumman is scheduled to complete delivery of all aircraft by 2014.

The modernization program also is providing a suite of federated COMINT payloads with increased capability for irregular warfare missions. The core of the new COMINT suite is Northrop Grumman's Enhanced Situational Awareness (ESA) system, a derivative of the Airborne SIGINT Payload (ASIP) the company developed for the Air Force's high-altitude U-2 aircraft and Global Hawk unmanned aerial vehicle. The five other COMINT payloads are the Communications High-Accuracy Location System-Compact (CHALS-C) from Lockheed Martin MS2 (Owego, NY); a Special Signals exploitation package from Zeta Associates (Fairfax, VA) developed using the government's non-proprietary X-MIDAS software environment; a High-Band COMINT system from Argon ST (Fairfax, VA); and two other classified systems. — G. Goodman



F-35 PROCUREMENT FACES CUTS

According to documents obtained by Bloomberg News, last month Defense Secretary Robert Gates ordered a delay in acquisition of the F-35 Joint Strike Fighter, in pre-release budget documents itemizing plans leading up to unveiling of the FY2011 defense budget, which is scheduled for release this month.

The delay reduces the DOD's planned purchase by 10 aircraft for FY 2011 and a total of 122 through FY12-15, funneling

the more than \$2.8 billion that would have been used to make those purchases into continued development.

The move marked a shift by Gates, who last year had expressed interest in accelerating F-35 purchases to complete the program sooner and, hopefully, save money for the government. The plan also would have benefited Lockheed Martin, the main contractor, as the acquisition phase is more lucrative than research and development. Now, the extended development



phase is likely to result in additional costs the company must absorb.

The concern appears to be Lockheed's ability to produce aircraft at planned cost and schedules, with the suggestion that the development phase may extend beyond October 2014 because of delays in delivery on 10 of 13 aircraft needed to fly 5,000 test sorties required.

This change also includes plans for the US Navy to spend \$2.4 billion on 26 Boeing-produced F/A-18E/F aircraft in 2011 and 2012, ostensibly to help fill the gap left by aging fighter jets as the services wait for the JSF.

The documents reveal plans to reduce F-35 purchases every year between 2011 and 2015, shifting \$320 million to the development budget in FY2011 – a figure that increases to \$544 million in FY2012 and \$716 million in FY2013 and \$872 million in FY2014. – E. Richardson

USAF JAMMER ON STEADY PATH

The US Air Force's Miniature Air-Launched Decoy-Jammer (MALD-J) is set for a Critical Design Review, which will allow it to enter engineering and manufacturing development. MALD-J adds a small radar-jamming payload to the basic MALD, a cruise missile-like, turbojet-powered, expendable maneuvering decoy with a range of 500 nautical miles. Raytheon Missile Systems (Tucson, AZ) completed MALD-J's first free-flight test last month following numerous captive-carry flights. The Air Force expects to make a Milestone C decision for MALD-J to enter low-rate initial production (LRIP) early next year.

MALD-J will provide "stand-in" jamming close to enemy air defense radars.

The basic MALD is a maneuvering decoy that began LRIP in June 2008. It is 9.5-feet long, 9 inches in diameter and weighs less than 300 pounds. MALD is launched by fighter and bomber aircraft (the F-16 and B-52 initially) and flies a preprogrammed flight path into hostile air space. It mimics the combat flight



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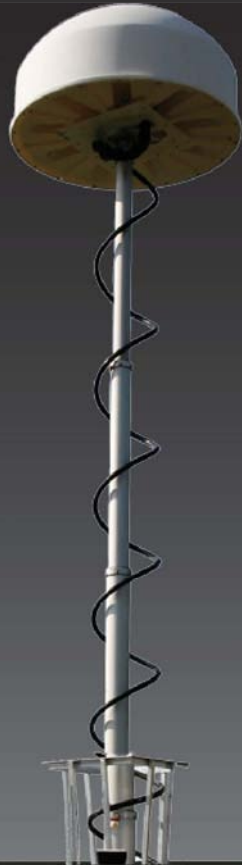
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profiles and radar signatures of US strike aircraft to distract and confuse enemy air defenses. MALD successfully completed 33 of 35 flight tests.

MALD-J will reduce the need to send aircrews into harm's way to conduct suppression of enemy air defense (SEAD) missions. — *G. Goodman*

AFRL ISSUES COMINT BAA

The Air Force Research Lab (Rome, NY) has issued a Broad Agency Announcement (BAA) soliciting white papers for scientific studies and experiments related to support of automated communications intelligence (COMINT) collection and processing.

The BAA seeks innovative solutions and algorithms for: "1) Developing techniques for the automated detection, identification, characterization, and geolocation of existing and emerging signals of interest; 2) Advancing digital signal processing hardware and software methodologies in support systems; and 3) Integration of these capabilities into information operation systems."

The lab specifically seeks solutions for problems, including assistance in automatic detection of target signals. "Due to the proliferation of wireless devices

worldwide, there are significant amounts of signals of interest across the spectrum. The ability for automated processing in dense signal environments, low power

ARMY MOVES TO ACQUIRE NEW RSS SYSTEM

The US Army has announced plans to "rapidly" acquire an Enhanced Medium Altitude Reconnaissance and Surveillance System (EMARSS). The program is seen as a replacement for the Aerial Common Sensor (ACS) program, which the Army has struggled to develop for the past decade.

EMARSS is a manned multi-INT airborne Intelligence, Surveillance and Reconnaissance (ISR) system designed to provide persistent capability to detect, locate, classify, identify and track surface targets quickly and with a high degree of accuracy in all environments and weather conditions. Acquisition is being handled through the CECOM contracting center on behalf of the program manager for the Aerial Common Sensors (ACS).

The planned EMARSS will be included on an adapted commercial aircraft equipped with EO/IR full motion video sensors, a COMINT collection system, an Aerial Precision Guidance (APG) system with line-of-sight and beyond line-of-sight communications suites. The aircraft, according to the solicitation, will operate as a single platform in support of tactical missions and, as such, is also set to include a self-protection suite.

Once awarded, the contract will run 42 months, with the delivery of the first four systems within 18 months of contract award. The remaining 24 months would include additional testing, sustainment and maintenance, as well as a possibility of low-rate initial production (LRIP).

The initial information was due January 15, and more than 20 companies have expressed interest in the project. — *E. Richardson*

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signals low signal-to-interferer noise ratio (SINR), and power control etc., is highly desired," the solicitation notes.

AFRL also seeks technologies to enable SIGINT platforms with improved ability to "automatically detect, identify, sort, track, prioritize and reliably classify and more importantly geolocate signals of interest," with request for "specific emitter identification techniques."

In addition, improved geolocation technology that would further enable SIGINT platforms to locate RF threat emitters is deemed a "critical focus area of research covered by this BAA."

Total funding for the BAA is roughly \$4.9 million, and is expected to be parceled out increments of \$1.5 to \$1.6 million over the next three fiscal years, with individual awards ranging from \$250,000 to \$700,000 annually for periods not more than 24 months.

White papers for FY2010 awards should be submitted by March 30, 2010, with awards for future fiscal years being due on March 30 of that year. Technical point of contact is and the person to whom papers should be submitted is

Douglas G. Smith, (315) 330-3474, e-mail: Douglas.Smith@rl.af.mil; contracting point of contact is Lynn G. White, (315) 330-4996, e-mail: Lynn.White@rl.af.mil. Reference BAA number BAA-10-06-RIKA. – JED Staff

US DEFENSE COMPANIES START 2010 WITH REORGANIZATIONS

Three major US defense companies – ITT, Boeing and Lockheed Martin – began the New Year by reorganizing their internal structures to better take advantage of the current global marketplace.

Last month, ITT announced a strategic realignment of its defense segment, including a new name: ITT Defense and Information Solutions. Current Electronic Systems and Communications Systems divisions, along with a portion of the Intelligence & Information Warfare division are being merged to form a new Electronic Systems division, still based on Clifton, NJ. Electronic Systems will shift focus from "producing separate, point-of-use products to secure, networked communications systems and powerful sensing, surveillance and reconnaissance

technologies that address the entire spectrum of electronic warfare."

Also last month, Boeing renamed its St. Louis-based defense unit (the former McDonnell Douglas operation) Boeing Defense, Space and Security, dropping the name Boeing Integrated Defense Systems. The new unit remains in St. Louis. However, it will be a "somewhat smaller organization" than the previous unit as the company was already in the midst of shedding 1,000 jobs. The new unit retains Boeing Military Aircraft, Network and Space Systems and Global Services & Support and consolidates other divisions, including turning Communications Networks into a new division called Network and Tactical Systems.

Lockheed Martin also finished a restructure last month, realigning two of its prior stand-alone businesses – Maritime Systems & Sensors and Systems Integration in Owego, NY – under the new heading of Mission Systems & Sensors, or MS2. The new MS2, announced last November, became official January 1, adding the former Owego products, processors and integration expertise into

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its maritime portfolio. The shift also allowed the company to eliminate about 1,200 positions from its MS2 business.

The new MS2 includes five lines of business: Ship & Aviation Systems, Undersea Systems, New Ventures, Surface Sea-based Missile Defense Systems and Radar Systems. Ship & Aviation Systems includes most of the Integrated Defense Technologies line of business, the former Systems Integration - Owego and elements of the former Tactical Systems line of business, as well

as Lockheed Martin UK - Integrated Systems. - *E. Richardson*

In Brief

ITT (Clifton, NJ) has received a \$111 million contract from Naval Air Systems Command (Patuxent River, MD) to modify, manufacture, test and deliver 17 ALQ-214 radio frequency defensive electronic countermeasures engineering development model (EDM) units and three ALQ-214 test benches. The units are being used for test and evaluation

of possible engineering changes for the ALQ-214 configuration on the F/A-18C/DE/F aircraft and work is expected to be completed by June 2013.



Lockheed Martin Maritime Systems and Sensors (Manassas, VA) has received an initial \$40.7 million order under an indefinite-delivery/indefinite-quantity (IDIQ) firm-fixed-price contract for the production and delivery of SYMPHONY improvised explosive device (IED) jammer systems. The contract includes assorted testing materials and field and engineering services, as well as options that, if exercised, could boost the value of the contract to \$940 million. Work will be done in Manassas, VA, and Clearwater, FL, in theater and in locations outside the contiguous US, and is expected to be complete by September 2014.



Boeing (St. Louis, MO) has received a \$54 million advance acquisition contract from Naval Air Systems Command (Patuxent River, MD) for long lead materials and other efforts related to the full-rate production of Lot 35 F/A-18 and E/A-18G aircraft. Work is expected to be complete by December 2010.



Wyle Laboratories (Huntsville, AL) has received a \$10.8 million cost-plus fixed-fee, IDIQ contract to provide airborne electronic attack engineering support for the EA-6B, EA-18G and other advanced AEA programs at the Naval Air Warfare center Weapons Division. Work is expected to be complete by January 2015.



Raytheon (Tucson, AZ) has received a \$12.4 million contract from the US Air Force, as part of a task order from an existing contract, to buy 43 range safety systems for decoy operational testing and initial operational test and evaluation for the miniature air launched decoy and jammer (MALD-J).



Northrop Grumman (Rolling Meadows, IL) has been awarded a \$5.9 million



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contract from the US Air Force option to provide contractor logistics support for the LITENING targeting pod.



Boeing (St. Louis, MO) has been awarded a \$6.4 million contract from the US Air Force to incorporate AAR-47AV(2) missile warning system changes to the avionics modernization program for the C-130.



The Naval Surface Warfare Center (Crane, IN) has announced its intent to award a sole source, non-commercial firm-fixed-price and IDIQ contract to **MITEQ** (Hauppauge, NY) for a low noise amplifier as a key component of the signal condition for the Multi-Mission Advanced Tactical Receiver System (MATT) used on the EA-6B and EA-18G aircraft.



Naval Air Systems Command (Patuxent River, MD) has announced plans to

negotiate a sole-source contract with **Alliant Techsystems** (Clearwater, FL) for production, incorporation and implementation of updates to the operational flight program for the AAR-47 Missile Warning Set, improving operator interfaces and technical data and software for the AAR-47 and APR-39 Radar Signals Detecting Set. ATK is also receiving a sole source, cost-plus-fixed-fee modification to a delivery order from NAVAIR for implementation of Hostile Fire Indication (HFI) capabilities into the AAR-47.



The 542nd Combat Sustainment Group (Warner Robins ALC, GA) has awarded a five-year, \$3.5 million contract for support services to **Chenega Government Consulting** (Ashburn, VA). The contract covers financial management, IT, facilities maintenance and admin support for the sustainment activities of the 542nd CBG.



The **General Services Administration (GSA)** is expected to award a one-year, firm-fixed-price performance based services contract this month for Service Life Extension Program (SLEP) for the ALM-256 Intermediate Level Support Equipment (ILSE), which supports maintenance on the ALQ-131, and the ALM-233 Automatic Support Equipment, which supports the ALQ-184. The contract would require delivery of phase one hardware kits beginning April 16.



Cobham (Lansdale, PA) has received an \$11.5 million contract from the US Navy for development of the Band 5/6 traveling wave tube replacement module assembly for the ALQ-99 Band 5/6 transmitter, which is a key component of the ALQ-99 tactical jamming system carried by EA-6B and EA-18G aircraft. The contract includes a basic award and four options, with the first phase risk reduction. ✈



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w a s h i n g t o n report

DOD ISSUES FY2010 STTR SOLICITATION TOPICS

The Department of Defense has announced the “pre-release” of its first FY2010 Small Business Technology Transfer (STTR) solicitation. The solicitation covers a variety of Army and Navy topics, including several EW initiatives.

The Army’s STTR solicitation describes a project titled, “Coherent Beam Combining of Mid-IR Lasers” (Topic A10a-T007). Under this effort, the Army is seeking research into development of “robust, high-efficiency mid-infrared lasers based laser beam combining of quantum cascade or other mid-IR laser diodes.” The objective is to achieve power outputs of “several to a hundred Watts” in the 3- to 5-micron and 8- to 12-micron bands for IR countermeasures (IRCM) and stand-off sensing applications. DARPA has already funded development of quantum cascade lasers (QCLs) in the 4- to 5-micron band for IRCM applications, and the Army has supplemented this work with initial QCL research into the 3-5 and 8-12 micron bands. This effort would continue that work by demonstrating a “design of beam-combined high performance mid-IR laser arrays based on QCLs or other semiconductor lasers with power output of 3W or more (i.e. greater than state-of-the-art output power over single lasers with comparable wall-plug efficiencies).” The topic point of contact is Mike Gerhold, (919) 549-4357, mike.gerhold@us.army.mil.

Another project in the Army solicitation is titled “Photonic Amplifiers Based on III-nitrides Grown on Si Substrates” (Topic A10a-T015). This effort will investigate development of a new class of photonic amplifiers to be used in communications and countermeasures applications. Phase I research will focus on “proof-of-concept of a technology for growth

of III-nitride photonic device structures on Si substrates.” The topic point of contact is John Zavada, (919) 549-4238, john.zavada@us.army.mil.

The Navy STTR solicitation included several directed-energy and EW-related research topics. Naval Sea Systems Command’s Directed Energy and Electric Weapon Systems Program Office (PMS-405) is supporting a project titled, “High Efficiency Gain Media for Eye-Safer 1.55 μ m Ultrafast Fiber Amplifiers” (Topic N10A-T012). This effort will focus on developing a “high efficiency erbium glass gain media optical amplifier to scale the average power of eye-safer ultrafast fiber laser sources,” for use in directed energy weapons, IRCM applications and LADAR. The topic point of contact is J. Thomas Schriempf, (202) 781-1196, john.schriempf@navy.mil.

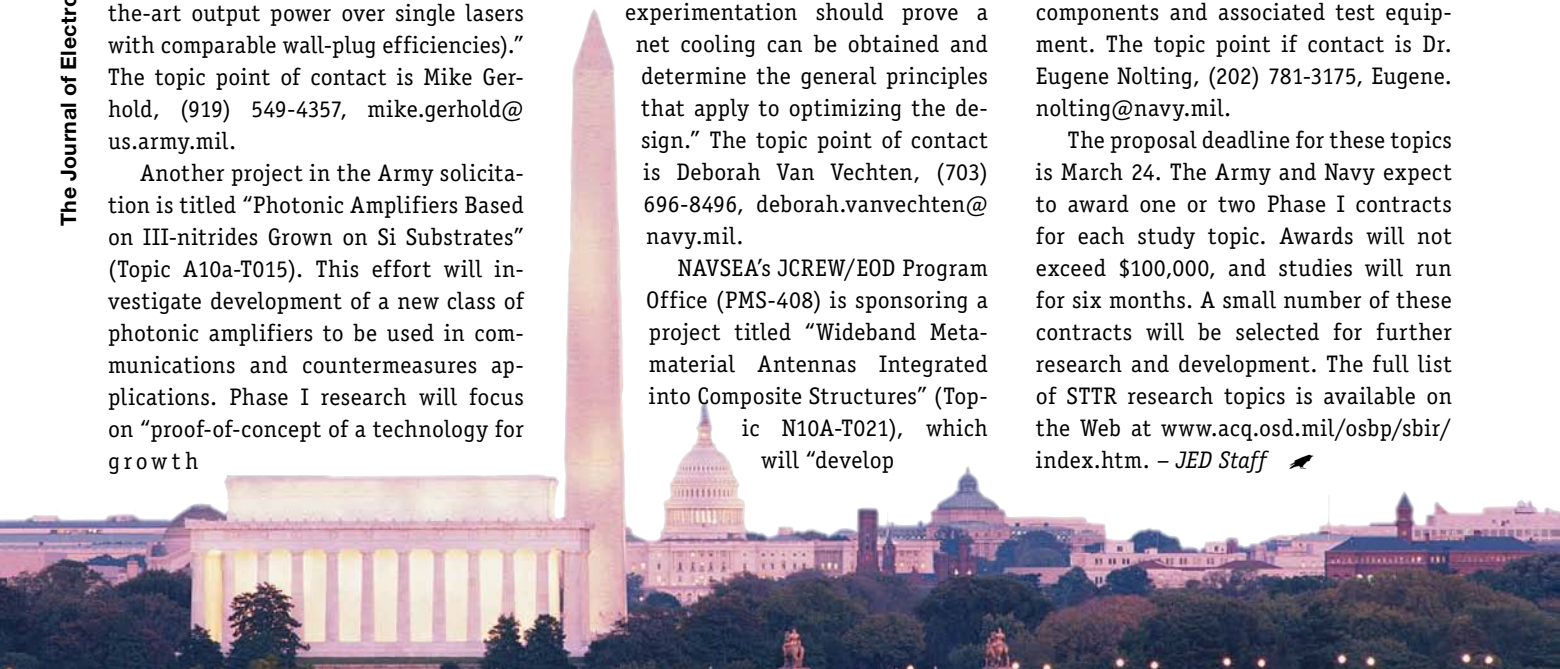
Another Navy research project, titled “Optical Cooling or RF Systems (Topic N10A-T017) will investigate optical cooling techniques that may be useful in removing heat from RF apertures and amplifiers. Aimed at supporting the Navy’s Surface EW Improvement Program (SEWIP), the research will focus on designing a scheme for cooling high-power density (e.g., GaN) power amplifiers using the anti-Stokes effect. Initial experimentation should prove a net cooling can be obtained and determine the general principles that apply to optimizing the design.” The topic point of contact is Deborah Van Vechten, (703) 696-8496, deborah.vanvechten@navy.mil.

NAVSEA’s JCREW/EOD Program Office (PMS-408) is sponsoring a project titled “Wideband Metamaterial Antennas Integrated into Composite Structures” (Topic N10A-T021), which will “develop

methodologies and manufacturing processes for integrating the antenna’s conductive elements and devices directly into the composite structures of the platform such as ship topside superstructure or Marine Corps vehicles.” Phase I work will focus on material/component-level modeling of integrated wideband antenna concepts. The work should result in one or more candidate designs for a wideband antenna integrated within a composite structure. The topic point of contact is Dave Tremper, (703) 696-0065, tremper@onr.navy.mil.

In the directed energy arena, the Free Electron Laser Innovative Naval Prototype (FEL INP) program at the Office of Naval Research (ONR) is sponsoring research into “Development of High-Efficiency, High-Power Electron Beam Accelerator Technologies” (Topic N10A-T023). This project aims to develop technologies supporting the development of a mega-watt class electron beam accelerator for ship self-defense applications. “Research will focus on novel strategies for designing and developing high quantum efficiency (>5%), long life cathodes for use in high duty factor DC, normal conducting RF and superconducting RF guns.” Phase I work will cover development of design for both the accelerator components and associated test equipment. The topic point if contact is Dr. Eugene Nolting, (202) 781-3175, Eugene.nolting@navy.mil.

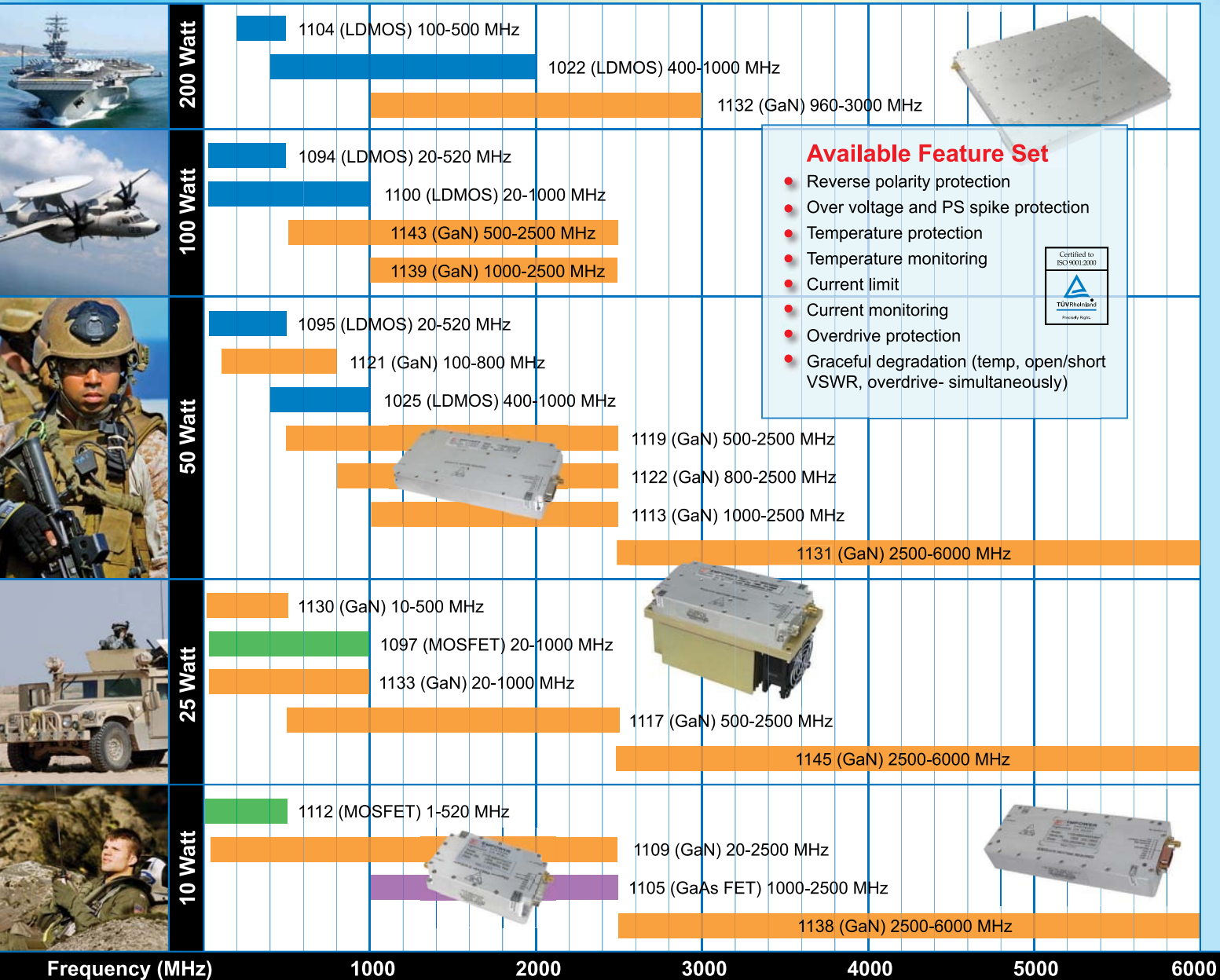
The proposal deadline for these topics is March 24. The Army and Navy expect to award one or two Phase I contracts for each study topic. Awards will not exceed \$100,000, and studies will run for six months. A small number of these contracts will be selected for further research and development. The full list of STTR research topics is available on the Web at www.acq.osd.mil/osbp/sbir/index.htm. – JED Staff ✍



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w o r l d report

BRAZIL FIGHTER COMPETITION NARROWS

Reports from the Brazilian media suggest that the final report on the country's planned fighter jet acquisition favors the technical and military capabilities of the Dassault Rafale and Boeing's F/A-18 Super Hornet over the Saab Gripen NG.

The country plans to acquire 36 new fighters to replace aging aircraft and the procurement, said to be worth 10 billion Brazilian reals (roughly US\$5.4 billion), is one of the increasingly hard-fought global fighter acquisition programs currently up for grabs – the largest still being India's planned \$10 billion fighter acquisition.

In what appears to be a visible sign of some in-fighting between Brazil's Air Force and its President, according to the *Folha de San Paolo*, last fall, the Brazil-

ian Air Force, in an initial report to the government, had ranked the Gripen first, followed by the Super Hornet and the Rafale, citing the lower costs and opportunity for in-country technology development. At around the same time, during a visit from French President Nicolas Sarkozy, Brazil's President reportedly said that Rafale was Brazil's choice in the fighter competition. However, the Air Force report was subsequently leaked, sparking criticism from the country's Presidential Palace and accusations from government officials that the military was attempting to force through its own choice.

The new report, issued last month, has apparently satisfied the president. It does

not rank the finalists, but details the advantages of the other two aircraft, which are in production, tested and feature two engines and notes that the single-engine Gripen NG is still being developed.

The Air Force, which briefed Brazilian Parliament members on the reasons for its choice last year, preferred the Gripen NG in part because it was still being developed, which might increase the opportunities for Embraer to absorb technology, as well as for lower acquisition and maintenance costs. However, given the preference of some senior government officials for the Rafale, it's uncertain in which direction the country will ultimately take its acquisition. – *E. Richardson*

In Brief

- **EW Simulation Technology** (Farnborough, UK) has received a \$1.5 million order from Sweden's Saab for a RSS8000 radar threat simulator. The simulator would be used to support ground test and simulation facilities for the company's JAS-39 Gripen fighter.
- **Babcock** (London, UK) has received a long-term contract from the UK Ministry of Defense (MOD) to provide in-service support to the Eddystone Communications Electronic Support Measures (CESM) system for submarines. The contract, which runs through 2013, covers continued design and integration support for the previously involved Babcock system, along with engineering, logistics and other support.
- **LIG Nex1** (Seoul, South Korea) has received a contract from Saab to provide local parts for the company's naval ESM system, planned for South Korea's second batch of Class 214 submarines. The contract, worth MSEK114 (roughly US\$15 million), is for delivery of the ESM systems to Howaldtswerke-Deutsche Werft GmbH (HDW), which is equipping combat systems for the six new submarines.
- **ELTA**, the wholly owned subsidiary of Israel Aerospace Industries, has announced management changes. Yosef Fouks, formerly general manager of ELTA's SIGINT, EW & Communications division has become general manager of the company's Microwave and Antenna Systems Division. Eyal Danan, who had served as general manager of the microwave division, has become general manager of the SIGINT, EW and Communications Division.
- Previously announced plans for **Egypt** to acquire 24 F-16 fighters through Foreign Military Sales (FMS) channels are, according to Lockheed Martin, moving ahead. The company announced the deal, reportedly worth \$3.2 billion, in late December, indicating that Egypt and the US had reached an agreement for provision of the aircraft with a contract scheduled to be signed early this year. In related news, **Morocco** finalized its plans to buy 24 Block 52 F-16s from the company via FMS. Last month, Lockheed received an \$841 million contract for the planes, which have been pending since 2007. Raytheon has been selected to supply the EW suite for the Moroccan aircraft.
- **Northrop Grumman Systems Corp.** (Bethpage, NY) has received a \$6 million firm-fixed price, cost-plus-fixed-fee delivery order against a previously issued order from Naval Air Systems Command (Patuxent River, MD) to provide engineering, technical and sustainment services in support of E-2C aircraft for the Taiwan Air Force. Work will be performed in Bethpage, NY and Pingtung Air Force Base, Taiwan and is expected to be complete by January 2011.
- **CAE** (Montreal, Canada) has received a contract from the Royal Netherlands Air Force, valued at more than C\$100 million, to expand CH-47 Chinook helicopter training at the company's Medium Support Helicopter Aircrew Training Facility in the UK. ✎

MASTER IN STRATEGY



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By Glenn Goodman



INT

The US Navy has maintained a strong commitment since the 1970s to providing its surface combatant ships with advanced tactical communications intelligence (COMINT), or cryptologic, sensor systems. Cryptology has long been a proud Navy competency.

This summer the service will complete installations, begun in 2003, of a new COMINT system on most (about 75) of its surface combatants. Called Ship's Signal Exploitation Equipment (SSEE) Increment E, it has been replacing an array of legacy shipboard COMINT systems.

Following on the heels of SSEE (pronounced "sea") Increment E is an even more capable Increment F system. It is slated for a Milestone C low-rate initial production (LRIP) decision by Defense Department officials this month following successful development and operational testing. Increment F is scheduled to achieve an initial operational capability in the last quarter of 2011.

Argon ST (Fairfax, VA) is the prime contractor for both the Increment E and F systems. The company won the Increment E development contract in 2000 and the Increment F development contract in 2006. Argon ST's teammates for Increment F are Raytheon, TICOM Geomatics, TASC, Boeing's Digital Receiver Technology and ARINC Engineering Services.

Surface Ship COMINT Platforms

Surface ships offer a number of advantages as COMINT (and electronic intelligence or ELINT) platforms compared with reconnaissance aircraft. They can collect signals from long ranges while remaining on station at sea for long periods of time, and can provide continuing access to areas that would otherwise be difficult to monitor. While an aircraft can get closer to the sources of signals of interest, its time on station is limited. In addition, aircraft typically have size, weight and power (SWAP) and flight dynamics constraints relating to COMINT equipment and external antennas.





While the available space on a surface ship for a COMINT system can also be at a premium, the system is not as SWAP-limited. Overall, the cost per collection hour for a shipboard COMINT system is said to be dramatically lower than for an airborne system.

One of the challenges faced in operating a COMINT system on a surface ship is managing the “noisy” radio-frequency (RF) environment. There are numerous communications and radar transmitters on a ship. Ideally, the COMINT receiving antennas should be located as far away as possible from the transmitting antennas to limit RF interference and allow COMINT operators to listen for weak adversary communications signals. Various techniques are employed on US Navy surface ships to surmount this issue, such as using filters to block the reception of undesired signals and situating topside antennas smartly.

In the case of the US Navy, the biggest advantage of having a COMINT system on nearly all of its surface combatants is the continuing forward presence and routine availability around the globe the ships provide. Dozens of Navy surface ships are forward-deployed on a daily basis and able to perform long-range COMINT missions at will from key locations, such as the Persian Gulf, the northern Arabian Gulf, the Sea of Japan, the Taiwan Strait and the Mediterranean Sea. Of course, those ships are not only COMINT platforms but perform many other missions, such as anti-submarine warfare, strike warfare, surface warfare and ballistic missile defense.

The operational requirements of US Navy surface combatants changed significantly in the 1990s as the service shifted its primary focus from open-ocean “blue-water” operations against the Soviet Navy to littoral (coastal) missions. The Navy soon began operating its surface ships in smaller carrier/expeditionary strike groups instead of large carrier battlegroup formations. The littoral focus changed the operational requirements for US Navy shipboard COMINT systems due to the dense signal environment in littoral zones with the high volume of commercial and military communications and shipping traffic.

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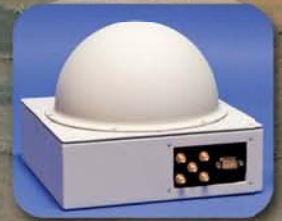
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Over the past decade the primary mission of Navy (and Air Force) COMINT platforms shifted from collecting signals for national/strategic intelligence purposes to more directly supporting the tactical operations of Marine and Army forces in regional conflicts. (One result, said a retired Navy officer, was that the COMINT system on a Navy ship became as important a tactical sensor as the ship's electronic support measures system, radars, sonar suite, etc., instead of just a tenant intelligence system.)

The advent of the Global War on Terror and the irregular wars in Iraq and Afghanistan have made the tactical COMINT systems on Navy surface combatants valuable assets to both theater commanders and troops on the ground. As the ships patrol off foreign coastlines, their COMINT system operators can listen for specific adversary communications far ashore thanks to very sensitive digital wideband receivers that can detect low-power emitters.

Like airborne COMINT systems, the shipboard systems must filter thousands of digital communications signals – particularly from cell phone devices – using automated signal-processing hardware and software to intercept and geolocate the source of enemy voice and data communications. The ready availability and rapidly advancing technology of commercial mobile wireless cellular communications devices has made the job of tactical COMINT systems much more demanding, producing growing types of threat signals that have to be detected and exploited.

SSEE Increments E and F

In the mid-1990s, the Navy undertook an initiative called Maritime Cryptologic Systems for the 21st Century (MCS-21). Its aim was to develop a single family of interoperable surface, airborne and subsurface COMINT systems that could be upgraded with non-proprietary, commercial off-the-shelf (COTS), government off-the-shelf (GOTS), and non-developmental-item (NDI) hardware and software to reduce modernization costs while keeping pace with the challenging and dynamic requirements of littoral missions. The Navy published a new, open-standard Maritime Cryptologic Architecture that became the foundation

for the SSEE Increment E program.

Kerry Rowe, Argon ST's president and chief operating officer, told *JED* that one of the visionary aspects of SSEE Increment E was that it marked a fundamental shift away from a custom hardware-centric approach with block upgrades to a software-based approach for readily inserting new or improved capabilities into the system through pre-planned product improvements (P3I).

SSEE Increment E's open-system hardware architecture, which uses general-

purpose COTS digital receivers and signal processors, hosts different software applications to perform COMINT functions against threat signals of interest in particular frequency bands. Increment E is built on Argon ST's Lighthouse software architecture, which is also the basis for the Banshee COMINT subsystem the company provides L-3 Integrated Systems for the Navy's EP-3E aircraft. Both use very similar software.

SSEE Increment F leverages the Increment E system in providing "a single

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core architecture to support quick modernization and/or upgrades to incorporate technology advances to address emerging threat risks," said Christopher Parente, the Navy's Principal Assistant Program Manager for Information Operations in PMW 120 (the Battlespace Awareness and IO Program Office under the Program Executive Office for C4I) in San Diego.

As he told *JED*, "We developed the software in a way to facilitate future expansion and modification. What we've done

with the SSEE Increment F program is develop a set of criteria that new software capabilities will have to meet prior to inclusion in a subsequent P3I software build. A current success story that we have for the Increment F LRIP build is the inclusion of two high-priority capabilities into it."

The Increment F system, he added, includes an entire "hotel rack" of available space (for a tall stack of 19-inch-wide receivers, processors, etc.) dedicated for future upgrades.

In terms of improvements over Increment E, Parente said the Increment F system features "enhanced antennas, improved signal acquisition and direction finding, vastly improved RF distribution and conditioning, improved sensitivity, a more dynamic range, and an improved publishing and reporting capability that feeds data into our national [intelligence] systems."

A key thrust of Increment F's development has been a requirement for a net-centric capability. This allows the afloat Increment F sensors on dispersed ships to be linked in a secure Internet-like network by which they can pass data among them and coordinate their efforts. As Jeff Brown, Argon ST's director of national intelligence systems, told *JED*, "Multiple Increment F systems can complement each other in prosecuting threat signals. The systems can be deployed as a true net-centric collection of sensors as opposed to individual sensors operating independently."

Parente added, "One of the key successes of the Increment F program to date is its ability to feed data directly into the national systems without any need for translation or operator intervention."

Another key feature of Increment F is its ability to be operated remotely by cryptologists at other locations not on the ship.

"SSEE Increment F is entirely remote-able, given sufficient bandwidth," Parente said. "In the future, members of the Navy's Information Dominance Corps will remotely operate SSEE Increment Fs at sea from Navy sites around the world. This capability will also give warfighters a reach-back capability for information warfare support."

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As Brown noted, one of the challenges faced by the Navy is that it may not have enough COMINT linguists fluent in a particular language to put one or two with the SSEE system on every deployed surface ship. Or in a dispersed strike group of ships, the linguist who is needed may not be sitting on the ship that has access to the threat signal. With remote-ability, a ship's SSEE Increment F system will be able to tap linguists on other ships or far away at shore sites.

"The possibility of conducting remote operations could lead to a whole new paradigm for the manning of surface combatants with cryptologic technicians," Parente said. "The possibility of reducing the number of embarked operators does exist and could change the way we operate."

A key P3I frequency-extension upgrade in development for both the SSEE Increment E and F systems is called Paragon. "Paragon delivers improved access to and exploitation of high-priority signals beyond its current reach," Parente said. "It increases frequency coverage by factor of about six, which in turn will result in increased number of signals of interest exploited."

The company HYPRES (Elmsford, NY) is pursuing ultra-fast, high-performance, superconductor-based (super-cold) digital receiver and antenna technology under Argon ST's SSEE Increment F contract as a future P3I option. Rowe noted, "Their work is providing some very interesting results. It has gone from science to practical prototyping. Their challenge now is to make the technology useful aboard ship."

"As we introduce SSEE Increment F into the fleet, the amount of data feeding into the national systems from Navy platforms will increase ten-fold," Parente said. "The Increment F system brings a more robust antenna set than predecessor systems, so given the number of unique maritime collections we're seeing with the Increment E systems, the improved systems – along with their increased volume – will bring maritime signals intelligence contributions to a whole new level." 🦋

Photos courtesy US Navy.

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Feb 15-18: *Unclassified* / Feb 19 (Optional): *US Only*

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What's New in Antennas?

By John Knowles

In today's rapidly evolving defense electronics market, antenna designers are facing a multitude of operational and system requirements. Military users want wider frequency coverage in their EW, SIGINT, communications and radar systems, which translates into a need for better antenna performance over a wider frequency range. At the same time, the size of EW, SIGINT, radar and communications systems is decreasing. This has enabled relatively small platforms, such as tactical UAVs and 4x4 ground vehicles, to carry more electronic payloads and equipment. These types of platforms can present a formidable





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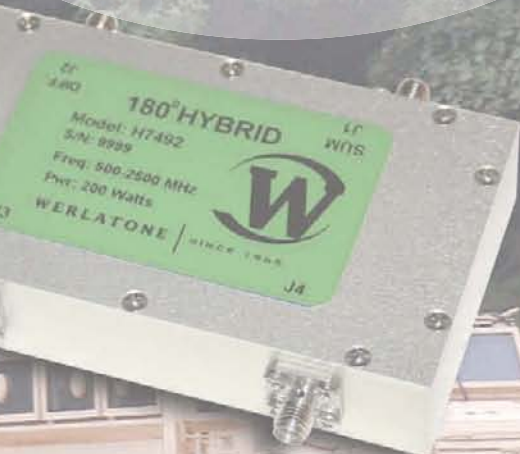
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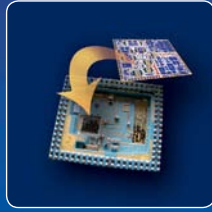
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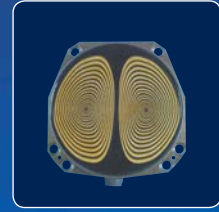
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challenge to the antenna designer, partly because they offer less surface area for antennas and because platforms, such as small UAVs, are weight-sensitive.

In the past, the typical solution for wideband frequency coverage was to create an "antenna farm" on the platform, with various types of antennas optimized for specific functions and frequency ranges. Each system (radar, EW, SIGINT, communications, etc.) would often utilize a dedicated antenna or set of antennas optimized for its purpose. These antennas would be located in positions that would best suit each system's performance while minimizing RF interference with other systems on the platform. Though antenna design trade-offs are always made, most platforms (especially aircraft) offered enough surface area to achieve the desired capability.

On a small platform, however, "antenna farm" solutions are not feasible. Size and weight requirements on a tactical UAV may call for an embedded antenna solution, but bandwidth requirements from 0.2 to 4 GHz may suggest a different approach. Even on larger weapons systems, such as a ship, antenna collocation on a mast or superstructure can lead to interference problems. Antenna design becomes even more complicated if the host platform features low-observable technology or must operate co-

vertly. Fortunately, antenna technology has kept pace with these developments.

TRENDS

The two most significant trends in the antenna market today are the need for wideband performance and the desire for integrated antenna designs.

Wideband solutions offer several advantages, in terms of reliability (fewer parts) and cost (buying and mounting a single antenna as opposed to multiple antennas). The need for integrated and conformal antenna designs is pushing antenna companies away from the idea of a "product catalog" and into a market more often calling for solutions tailored to a specific platform or program. While this type of custom antenna development may appear to be more expensive, many antenna designers see their products as the enablers of the systems that use them. In that sense, the expense of building custom antennas that enable an IED jammer to operate from a tactical UAV or a phased array active protection system to defend a ground vehicle against armor penetrating munitions is well worth the cost.

SOLUTIONS

Electrically small tuned antennas offer many advantages for applications on small platforms. The antennas can be placed in close proximity (utilizing lim-

ited space) and they can enable the use of phased arrays in small surfaces. However, antenna developers are trying to improve the efficiency of these antennas, as well as overcoming their narrowband matching impedance limitations. One promising area of research is metamaterials, which offer the possibility of overcoming the efficiency-bandwidth limitations of normal materials. This would enable smaller antenna elements to cover wider frequency ranges and make better use of available surfaces on smaller platforms.

One company making use of metamaterials is Fractal Antenna Systems (Waltham, MA). A fractal is a shape that can be split into parts, each of which is a copy (or a near copy) of the whole. Fractals can be used as design elements to reduce the size of an antenna, while minimizing performance tradeoffs. As a design element, fractal technology is extremely versatile. Fractal technology can be used in a variety of antenna types, including dipole, monopole, patch, conformal, bicone, discone, spiral, and helical, and covering a 200:1 frequency range.

First RF (Boulder, CO) is another company exploring the use of metamaterials in its antennas. Incorporated in 2003, the company has captured significant market share in its short history, partly through its success as an antenna supplier for IED jammer programs. Like Fractal Antenna Systems, First RF has developed a proprietary antenna design element that it has adapted for a wide variety of antenna applications. The company has been very successful in attracting government-funded research and development funds. It has won 40 Phase I Small Business Innovative Research (SBIR) contracts, 23 of which have transitioned to Phase 2. One future trend the company is monitoring is the integration of EW and communications systems, particularly on ground vehicles. The company has executed contracts in support of the JCREW and JTRS programs, and it sees the two areas coming together into a single system.

While companies such as Fractal and First RF are pushing the limits of electrically small antennas, several other companies are active in more traditional

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EW and SIGINT antenna programs. L-3 Communications Randtron Antenna Systems (Menlo Park, CA) is among the leading suppliers in the antenna market, offering a wide range of multi-omni spiral antennas (the company manufactures the wing-tip and fin-cap antennas for the ALR-56C RWR) and interferometer and blade antennas for ESM applications.

Two companies are manufacturing dual-polarized sinuous antennas for the EW market. Sinuous antennas offer better performance than typical spiral antennas. But they are difficult to produce and, as expected, cost more. L-3 Randtron produces a variety of dual-polarized sinuous antennas ranging in size from 2 to 15 inches. Q-Par Angus Ltd. (Leominster, Herefordshire, UK), perceiving a growing demand for sinuous antennas in the European EW market, has introduced a new range of products covering the 0.2- to 2-GHz, 0.7- to 4-GHz and 2- to 18-GHz frequency ranges. Q-Par Angus also produces a wide range of high-power antennas for shipboard jammers and ELINT antennas for ground vehicles.

Cobham Defense Electronic Systems (Lansdale, PA) has become a major player in the antenna market through its acquisition of several antenna manufacturers, including Nurad, Continental Microwave and BAE Systems' Lansdale Operations. The company makes spiral antennas, horn antennas and log-periodic antennas. It also manufactures conformal and embedded antennas for wideband applications on LO aircraft.

In the SIGINT market, TCI International (Fremont, CA) has announced the Model 647, a direction-finding (DF) and signal monitoring array covering 0.2- to 8-GHz. The antenna offers a typical accuracy of 2 degrees RMS and can support DF of WiFi, WiMAX and WLAN/WLAN signals. In 2008, the company introduced the Model 643 dual-polarized DF antenna, which covers the 0.2- to 3-GHz range. It can interface with the company's Scorpio software and enable rapid location measurements of horizontally polarized signals – something that has been difficult to achieve.

REMAINING COMPETITIVE

As more programs seek unique embedded and conformal antenna designs, it would seem the primes (either the weapons system manufacturers or the system integrators) would take a greater interest in in-house antenna design and manufacturing. While this is true to some degree, the fact is that many antenna companies have found their unique expertise is in high demand and their manufacturing capabilities remain cost-competitive in this environment.

With companies such as Cobham snapping up several antenna manufacturers in recent years, there are certainly fewer small, dedicated antenna companies in the market today. But most antenna manufacturers have found a way to remain viable in the market, either as trusted partners to the major defense primes or as experienced advisors to military program offices, who are trying to get a better handle on what is possible in the rapidly evolving world of multi-function RF systems. ✈

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EW Against Modern Radars – Part 3

Frequency and Angle Deceptive Jamming

By Dave Adamy

Last month, we discussed cover jamming and deceptive jamming in range. This month, we will continue our coverage of deceptive jamming with techniques that break the angle track or frequency track of hostile radar. When a radar's range track is broken, several milliseconds may be required to reestablish tracking, after which the range track must be broken again. However, if angle track is broken, the radar must typically return to a search mode to locate the target in angle – which can take seconds.

Angle Deceptive Jamming

Older radars required movement of the antenna beam to track targets in angle. Consider the received power vs. time diagram for a conically scanned radar shown on the top line of **Figure 1**. The antenna movement describes a cone. When the antenna is pointed closer to the target, the received signal is stronger and when it is pointed away from the target, the signal is weaker. The radar moves the center of its scanning pattern in the direction of the maximum return power to center the target in the scan. Both the radar receiver and a radar warning receiver on the target see this same power vs. time plot. If a jammer located on the target transmits a burst of strong pulses (synchronized with the radar's pulses) at the weakest signal strength time (see the second line of **Figure 1**), the radar will see a power vs. time plot as shown on the third line of **Figure 1**. Because the radar develops guidance signals from this information, the processing will see the power data in its (narrow) servo response bandwidth as shown by the blue dash line. Hence, the radar will direct its scan axis away from the target – breaking the angle track. This is called "inverse gain" jamming.

If the radar has a non-scanning illuminator, but scans its receiving antenna, the jammer on the target will be unable to know the phase of the sinusoidal power variation with time. Thus, the jammer is unable to time its pulse bursts to the minimum received power

times. However, if the jammer times its bursts slightly faster or slower than the known scanning rate of the radar antenna, the jamming can still break up the angle tracking by the radar. This will still allow effective jamming, although not as effective as though the burst were optimally timed.

Figure 2 shows angle jamming of a "track while scan" (TWS) radar. On the first line, the skin return from the TWS

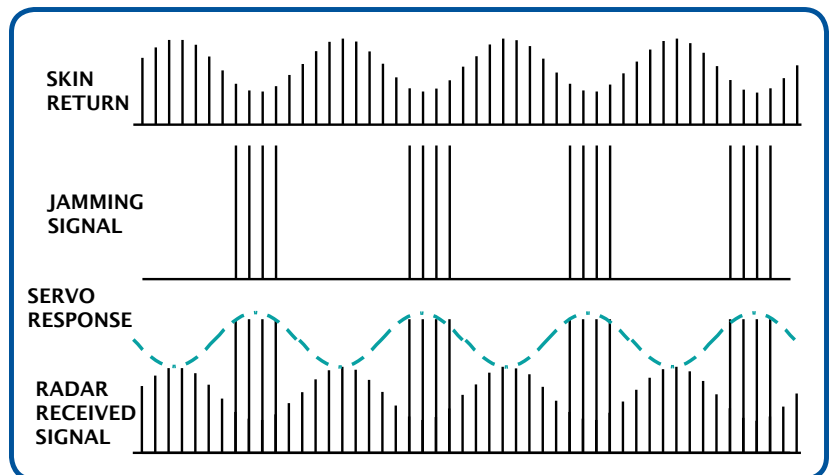


Figure 1: Inverse gain jamming causes a radar to correct its angle guidance in the wrong direction.

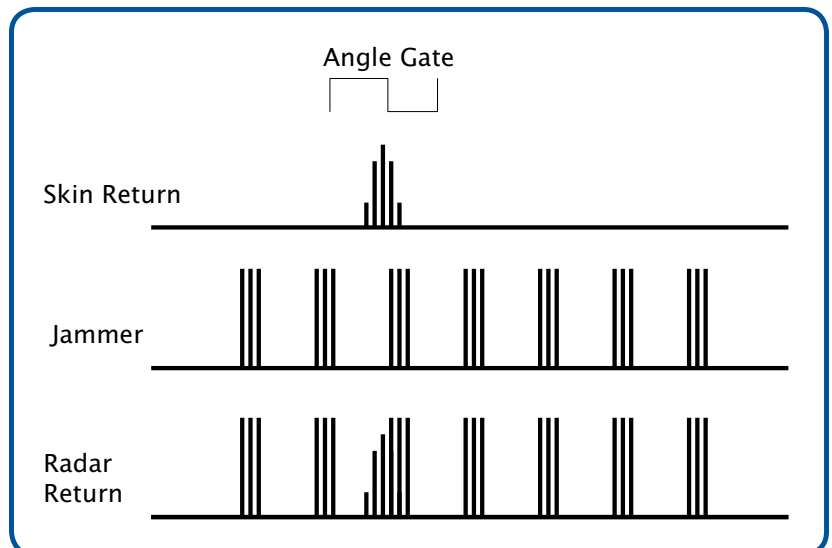


Figure 2: Inverse gain jamming causes a "track while scan" (TWS) radar to move away from its target in angle.

radar shows a burst of pulses as the beam passes the target. The radar will use angle gates to determine the angular location of the target. It will move the angle gates to equalize the power in the (in this case) right and left gates. The intersection between these two gates represents the angle to the target. If a jammer on the target generates a series of synchronized pulse bursts as shown on the second line of **Figure 2**, the radar will see the combined power vs. time curve shown on the third line. This will load up one side of the angle gate, causing the radar to move away from the angle of the target.

AGC Jamming

Because of the huge dynamic range over which a radar must operate, it must have automatic gain control (AGC). AGC is implemented by measuring the received power level at some point in a circuit and adjusting a gain or loss at an earlier stage of the circuitry to equalize the signal strength at the measurement point. In order to be effective, the AGC circuit must have a fast attack/slow decay characteristic. Line 1 of **Figure 3** shows a sinusoidal power vs. time curve as would be generated in a con-scan radar return. If a strong narrow-band jamming signal is added to the skin return, the high level pulses will capture the AGC so that the sinusoidal signal from the con-scanning antenna will be significantly reduced as shown on the second line of the figure. The sinusoidal signal will actually be reduced much more than shown in the figure, making it impossible for the radar to track targets in angle.

Other Angle Jamming Examples

There are several other examples of angle jamming; for example, inverse gain can be used against a lobing radar. However, the above angle jamming descriptions show how angle jamming works and will support our later discussions. One important point is that the above examples were for radars that must move their antennas and receive multiple skin return pulses to support angle tracking. There is an important class of radars, called "mono-pulse" radars, which get complete

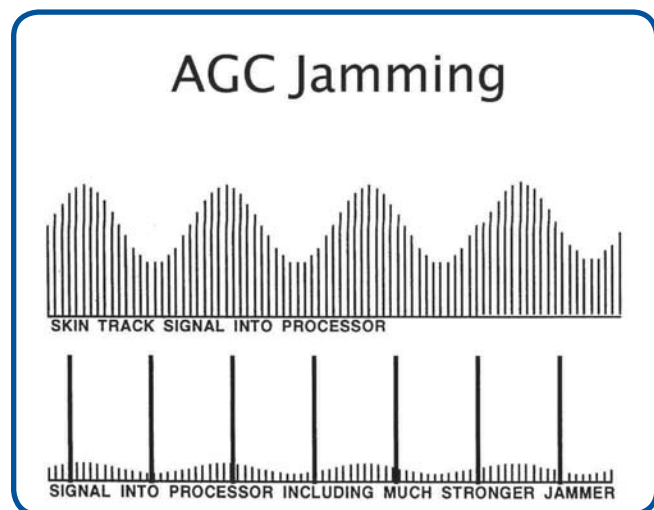


Figure 3: AGC jamming generates strong, narrow pulses at about the target signal modulation rate to capture the radar's AGC.

angle information from each received skin return pulse. Next month, we will cover jamming techniques effective against these types of radars.

Frequency Gate Pull Off

It is often important to deceive a radar in frequency. The received frequency of a skin return signal is determined by the transmitted frequency and the rate of change of range between the radar and the target. The first line of **Figure 4** shows the signal strength vs. frequency for skin returns from a Doppler radar. Note that internal noise in the radar shows at the lower frequency range of the return. There are also multiple ground returns. If this is an airborne radar, the largest and highest frequency (i.e., highest velocity) ground return would be from the ground the aircraft is passing over. Lesser returns are from terrain features being passed. These returns are at lower Doppler frequencies because of the offset angle of the terrain feature from the flight path of the aircraft. Finally, we see the target return, which is at the frequency related to the closing velocity between the radar and the target. The radar will place a velocity gate around the target return frequency to allow the target to be tracked. If the jammer places a signal in the velocity gate and then sweeps the jamming signal away from the target return frequency, the radar will be caused to lose velocity track on the target. This technique is called velocity gate pull-off.

Note that some radars can discriminate against range gate pull-off jamming by correlating the rate of change of range (caused by the range gate pull-off) to the Doppler shift of the skin return. In this case, it may be necessary to perform both range and velocity gate pull-off.

What's Next

Next month, we will discuss angle deception in mono-pulse radars. For your comments and suggestions, Dave Adamy can be reached at dave@lynxpub.com. 🦋

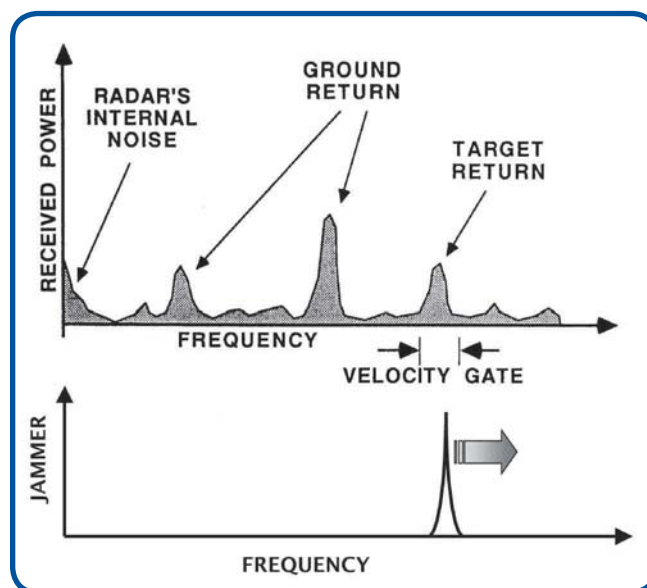


Figure 4: Frequency gate pull off places a jamming signal in the radar velocity gate, captures the gate and moves it off of the target return.

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The new family of Communications Intelligence and Electronic Warfare solutions, CIEW, launched May 2008, reflects the user-oriented design of latest-generation digital COMINT and EW equipment and systems. Its open architectures and software-defined exploitation facilitate integration of COMINT/EW into sensor-commander-shooter networks on the digitized battlespace.

Together with Thales Aerospace, Thales Land & Joint Systems makes up the first SIGINT/EW solution provider in Europe. Its equipment, systems and mission packages are integrated on sea, air, space and land platforms, including manpack payloads adapted to the current operational environment.

In order to provide product, systems and value-added services tailored to its customers' needs, Thales relies on its domestic proximity and the support of a global expertise network. In the field of EW, this network comprises five important European competency centers (France, UK, Italy, Germany and Switzerland).

INSTITUTE/ UNIVERSITY MEMBERS

G

GEORGIA TECH RESEARCH INSTITUTE (GTRI)

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The Georgia Tech Research Institute is nationally renowned in Electronic Warfare. As the applied R&D arm of Georgia Tech, GTRI has been nationally recognized for over 30 years as experts in the analysis, design, and development of effectiveness analysis and threat simulation systems. It was also more than 30 years ago that the Peachtree Roost was formed by members of GTRI.

Today, our excellence continues not only in the ECM technique development, modeling and analysis area but in modernization of radar warning receivers, jamming systems, and test systems. GTRI has participated in the development of future integrated electronic warfare systems and is working in the next generation systems of systems or net-centric warfare. Because GTRI is not a manufacturer, its researchers can provide government and industry unbiased, independent technique effectiveness and technology insertion solutions.

GTRI researchers teach a wide range of continuing education courses serving the electronic warfare community.

M

MERCER ENGINEERING RESEARCH CENTER

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Mercer Engineering Research Center (MERC) is a non-profit operating unit of Mercer University, a private, comprehensive university located in Macon, Georgia. Mercer, established in 1833, is one of the oldest universities in the South.

MERC was established in 1987 as the research extension of the School of Engineering and has grown from an initial staff of three to a vibrant customer support oriented organization of 165 engineers, scientists, managers, logisticians, and business consultants. MERC occupies a modern 110,000 sq. ft.

facility with offices, conference rooms, and laboratories in Warner Robins, GA.

MERC supports the Warner Robins Air Logistics Center (WR-ALC) and AF Reserve Command located at Robins AFB; the Air Force Research Laboratory (AFRL) located at Wright-Patterson AFB, OH; Naval Undersea Warfare Center (NUWC) in Newport, RI; the Marine Corp Logistics Base (MCLB) in Albany, GA.; and the Air National Guard in various research and development efforts.

MERC has over 250 man-years of electronic warfare analysis, HW/SW design and development experience. MERC's competencies include electronic combat systems engineering; analysis, design, and fabrication of electronic test equipment; advanced RF and EO/IR signal processing algorithm development and much more.

GROUP MEMBERS

A

AAI CORPORATION

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AAI Corporation – an operating unit of Textron Systems, a Textron Inc. company – is a leader in the development and production of innovative, high-technology products and services for military and government customers in the United States and internationally. The company's high-technology products and services include unmanned aircraft systems, training and simulation systems, automated aerospace test and maintenance equipment, armament systems, aviation ground support equipment and logistical, engineering and supply chain services.

Simulation and Training: The company's training and simulation systems include embedded shipboard naval crew trainers, air defense trainers, maintenance trainers and electronic combat trainers. Best known among AAI simulation and training products are the Onboard Training (OBT) systems now being delivered to the United States and Australian navies.

Test and EW Systems: AAI has a considerable heritage of developing innovative flight line and depot-level test equipment. The portable Joint Service Electronic Combat Systems Tester, or JSECST, is used on air base flight lines and aircraft carrier decks to ensure the mission readiness of EW systems and isolate any failure to the faulty box, antenna or cable.

ADVANCED CONCEPTS INC.

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Advanced Concepts Inc. (ACI) was founded in 1991. The company offers IT and engineering and management services and solutions to federal, state and local governments. With more than 15 years of experience supporting the intelligence community within the DOD and other US government entities in fields ranging from intelligence analysis and systems integration to research and system design, ACI has the knowledge, experience, clearances and dedication to assist its customers in reaching their goals.

ACI provides diverse scientific and engineering services to both government and commercial customers in the following areas: system information assurance and network security solutions, IT solutions and services related to distributed architectures, systems engineering and technical assistance, product development and integration and program management.

ACI's experienced and cleared personnel provide system/network administration, network and system tool research and evaluation, network engineering, systems and software engineering, configuration management, site administration, software scripting and equipment purchase and evaluation.

ADVANCED TESTING TECHNOLOGIES INC.

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Advanced Testing Technologies Inc. (ATTI™) is a leading provider of automated test equipment (ATE) solutions. For the past 20 years, ATTI has provided state-of-the-art test systems to its customers. ATTI maintains a dedicated staff that specializes in ATE-related hardware and software. Utilizing ATTI's commercial off-the-shelf (COTS) BRAT® family of testers, ATTI has leveraged the open architecture of the BRAT® to solve the diverse testing problems of multiple customers. This open-architecture approach provides an optimal test system configuration with the potential for future expansion, and an environment to protect customer investment in test stations and test programs and from obsolescence and diminishing manufacturing source (DMS) production impact.

Although the US Air Force is the company's primary customer, the BRAT® is in operation for NATO, Turkey, Greece, the Netherlands, the Royal Saudi Air Force, Italy and Japan. The BRAT® family of testers crosses multiple aircraft platforms

and levels of maintenance. Platform experience includes the E-3 AWACS (707 and 767), the E-8 JSTARS, the RC-135 Rivet Joint, the C-5 Galaxy, the C-141 Star Lifter, the F-16 Falcon, the A-10 Warthog, the F-15 Eagle and the F-4G Wild Weasel. Available in both depot/back-shop and deployable configurations, the BRAT® is war-tested, having been deployed in support of ongoing global war on terrorism (GWOT) operations. ATTI has operating locations throughout the US and in foreign countries.

AERONIX

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Aeronix products include high performance, low cost ESM solutions for manned and unmanned applications. In addition, Aeronix provides system engineering and design services in the areas of electronic support measures, communications equipment, and information assurance.

AETHERCOMM INC.

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Aethercomm designs and manufactures high-power RF and microwave amplifiers for use in CW and pulsed applications. Aethercomm products operate in the DC-40 GHz frequency range. Aethercomm utilizes the latest in RF device technology (GaN, SiC, LDMOS, GaAs and others) available in the market today. Aethercomm products are used in radar systems, EW systems, communication systems and test and measurement applications. Aethercomm also designs and manufactures transmitters, transceivers and RF/microwave subsystems and systems. Aethercomm offers a wide variety of standard and custom solutions.

AIRSCAN, INC.

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AirScan is celebrating its 20th year as an industry leader in Airborne ISR and Geospatial Intelligence. AirScan divisions provide ISR/GSI platform design, fabrication, and modification; platform/payload systems integration; installation and field support of air-to-ground data transfer and control systems; and training and deployment of ISR/GSI personnel.

AirScan also provides turn-key Airborne ISR and Geospatial Intelligence services to US military commands and governmental agencies, deploying and supporting its own ISR/GSI platforms, payloads, and

personnel. These turn-key services include the collection, processing, and exploitation of Full Motion Video (EO/IR), Synthetic Aperture Radar, High Resolution EO, and LiDAR imagery.

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Akon is the leading supplier of cutting-edge microwave products for airborne, ground, shipboard, space and growing communication markets. The company's in-house capability spans from design conceptualization to high-volume production runs, as well as expertise knowledge of integration to the customers' applications.

ALION SCIENCE AND TECHNOLOGY

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Alion Science and Technology is a 100 percent employee-owned contract research and development company providing technology services to primarily high-level defense and government agency customers. Building on more than 65 years of experience, Alion employee owners are experts in wireless communication, defense operational support, industrial solutions, chemical technology, explosive science, information technology and transport technology. Based in McLean, VA, Alion has more than 3,600 employees at major offices and laboratories in 50 cities worldwide. Alion's staff of spectrum managers, scientists and engineers has supported the DOD continuously for more than 45 years. Alion is at the forefront of emerging spectrum technologies and is expanding its role in EW and various intelligence disciplines.

ALLIANT TECHSYSTEMS – ATK

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ATK is a premier aerospace and defense company employing more than 17,000 employees in 21 states. ATK was first established in 1990, when Honeywell spun off its defense businesses. Today, ATK is a major defense contractor for propulsion, composite structures, precision munitions, ammunition and EW systems.

ATK is the manufacturer of the AN/AAR-47A(V)2 and B(V)2 missile/laser warning self-protection system that is currently deployed on more than 3,000 aircraft worldwide. The AAR-47 system features a high probability of detection and low false alarms, with a fully integrated laser detector system.

ATK also is a qualified source for advanced multispectral countermeasures, such as the MJU-62/B and M-212 flares. These aircraft defensive decoys are compatible with standard ALE-4X dispensers.

Its Mobile Ground to Air Radar Jamming System (MGARJS) offers EW protection for high-value targets and installations. The system provides air surveillance, acquisition and analysis of airborne radar systems. ATK's Advanced Weapons group is producing the Advanced Anti-Radiation Guided Missile (AARGM) for US and coalition warfighters. AARGM is an advanced weapon system for engaging and destroying enemy air defenses and time-critical, mobile targets.

AMPEX DATA SYSTEMS

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Ampex Data Systems designs and manufactures solid-state memory airborne data acquisition systems and ground-based storage systems. The product line features recorders and front-end data acquisition for applications from HD and SD cameras to sensors and instrumentation data sources. A variety of these robust data interfaces allow the user to configure integrated data system solutions.

ANAREN, INC.

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Founded in 1967 as a supplier of microwave components and subassemblies to the defense electronics markets, today's Anaren (NASDAQ: ANEN) is a worldwide innovator of standard and custom high-frequency technology for the defense, space, wireless infrastructure, and consumer electronics sectors.

Anaren's Space & Defense Group is a trusted subcontractor to the world's Tier 1 defense OEMs, offering turnkey, vertically integrated solutions (from extensive design engineering, modeling and analysis – to sophisticated automated manufacturing and testing). The company's high-density, mil-spec technologies include: IMAs (passive, active; RF/analog/digital/mixed signal), multi-chip RF modules, support of next-gen AESAs (manifolds, T/R modules, control), broadband receivers for missile applications, RF and LO distribution for complex receivers, beamformers for satellite communications antennae, switch matrices for redundancy and signal routing, antenna feed networks for surface, airborne, and space radars, digital RF memories and frequency discriminators, RF integrated backplanes, tuners and

front-end receivers, passive and active antenna front-end calibration networks, wide range of passive and active Mil-spec components (including RAD-hard).

NEW to Anaren's S&D Group (FY 2009), Anaren acquired MS Kennedy Corp (Liverpool, NY) and Unicircuit, Inc. (Littleton, CO) in August 2008, greatly enhancing Anaren's ability to design, develop, and manufacture complex RF solutions.

ANATECH ELECTRONICS

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Anatech Electronics, Inc., is an ISO 9000:2000-certified company headquartered in Garfield, NJ, that for 20 years has focused on the design and manufacturing of RF and microwave filters and related products for electronic warfare and other defense applications, and for wireless and industrial applications as well. Anatech is a registered supplier with Aerospace Corp., L-3 Communications, BAE Systems, Boeing, General Dynamics, Harris Corp., Lockheed Martin, NAVSUP, Northrop Grumman, Peterson Air Force Base, Raytheon, Rockwell Collins, SPAWAR, and other defense contractors. The company follows MIL-STD-45208A and MIL-F-18327 and is an approved GSA vendor. In addition to manufacturing filters and other MIL-standards products, Anatech also provides engineering services for defense contractors and the government, tailored to solving complex interference problems within existing systems. Visit Anatech at www.anatechelectronics.com or its Web store at www.amcrf.com.

ANNAPOLIS MICRO SYSTEMS INC.

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Annapolis Micro Systems is the world leader in commercial off-the-shelf (COTS), FPGA-based, high-performance processing products for radar, sonar, SIGINT, ELINT, digital signal processing, FFTs, communications, software radio, encryption, image processing, prototyping, text processing and other processing intensive applications.

The company has COTS hardware and software solutions for VME, PCI, CompactPCI, PMC and CardBus, with a large, growing list of I/O options, including 1.5 GHz A/D, 105 MHz A/D, Fiber-optic G-Link, Fiber Channel, Ethernet, WSDP™ and FPDP, all using the latest Xilinx Virtex II and/or Virtex E FPGAs. Its revolutionary CoreFire™ design suite enables very fast and easy application development, reducing risk, cutting cost and improving time to market.

The company's international customer base includes all the major defense

contractors, many government labs, universities and large and small commercial entities. Incorporated in 1982, this woman-owned small business is a powerful addition to any defense contractor's team.

ANRITSU COMPANY

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For over 40 years, Anritsu has supplied effective test and measurement solutions to the DOD and other branches of the US Government, and to the contractors supporting them. As commercial wired and wireless technologies migrate into government applications, Anritsu is leveraging its worldwide industry leadership to provide a full complement of solutions that support core programs in the Global Information Grid - including MUOS, FCS, and JTRS - and the Department of Homeland Security.

Anritsu's long history of excellence in government support and contract awards includes: The first mini-OTDRs supplied to the Navy and Marine Corps; numerous optical BER testers sold to DOD R&D facilities; the leading supplier of cable and antenna analysis platforms to every military branch; the leading supplier of high-frequency signal generators to the Navy, Marine Corps and Air Force.

Products include: Handheld Cable and Antenna Analysis (Anritsu's Site Master™ handheld analyzers), Hands-Free Wireless Technology and GIG Optical Backhaul.

Anritsu wired and wireless R&D tools include full suites of spectrum analyzers and signal generators, mobile phone testers, and signaling protocol testers, WLAN test systems, BER testers, and VNAs. These systems support radar profiling and testing as well as test and analysis of transmitter/receiver systems and RF/microwave components.

APPLIED GEO TECHNOLOGIES

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AGT is Applied Geo Technologies - the premier, Tribally-owned provider of aerospace and defense services in the United States. With operations across the South, our clients depend on us to provide leading-edge expertise and manufacturing services for a wide variety of high-tech applications. Our mission is exceeding expectations through customer focus, commitment to employees and sustained shareholder value.

AGT is a leading provider of specialized laboratory, metrology, manufacturing, engineering and other advanced services tailored to meet the needs of our aerospace, defense and commercial clients. AGT is a chartered corporation, wholly owned by the Mississippi Band of Choctaw

Indians (MBCI), dba Chahta Enterprise, certified by the US Small Business Administration (SBA) as a Tribally-owned 8(a), HUBZone and Small Disadvantaged Business. AGT is ISO 9001:2000-certified.

AGT was founded in 2001 as the Tribe's first high-tech business venture, in an effort to create future job and business opportunities for the Mississippi Band of Choctaw Indians. AGT is headquartered in the Choctaw TechParc, a 150-acre business community dedicated to serving the needs of today's high-tech industries with the service, commitment and technology of tomorrow.

APPLIED SIGNAL TECHNOLOGY

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ARINC ENGINEERING SERVICES, LLC

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ARINC Engineering Services, LLC, a portfolio company of the Carlyle Group, provides a wide range of engineering services to the EW, information warfare (IW) and information operations (IO) communities within the DOD. These include threat and technology analysis, concept exploration, tradespace analysis, systems development and integration, test and evaluation (T&E) and operational support of joint exercises. ARINC has developed electromagnetic analysis tools for performing numerical prediction of antenna performance to include three-dimensional antenna patterning analysis, two-dimensional propagation and coverage analysis, electromagnetic Interference (EMI) and electric current distributions for aircraft carrying high-power transmitters such as Commando Solo, Compass Call, the EA-18G Growler and the EA-6B Prowler.

ARINC provides a diversity of technical work, ranging from electronic attack effectiveness simulations and mission planning capabilities to creating realistic battlespace environment simulations in the Navy's Air Combat Environment Test and Evaluation Facility (ACETEF). ARINC developed and operates the Army Interoperability Network (AIN), which supports the development, testing, integration and certification of command, control, communications, computers, intelligence, EW and sensors (C4IEW&S) systems. ARINC also provides engineering and technical support services to the Navy's SPAWAR Space and Naval Warfare Systems Center.

ASELSAN A.S.

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ASELSAN, a Turkish joint stock company, has sustained its position as a reliable source, a system solution provider and a renowned leader of the Turkish defense industry since its establishment in 1975.

In consideration of its field of activities, ASELSAN is organized into three main divisions: Communications Division, Microwave and System Technologies Division and Microelectronic Guidance and Electro-Optic Division.

ASELSAN is ISO 10012-certified and possesses NATO quality assurance standards. AQAP-110-120 and other relevant international military standards are successfully being applied in the design, test and production phases of the programs undertaken, as well as after sales support.

Within the know-how and experience accumulated in 30 years of leadership in the defense electronics field, ASELSAN offers state-of-the-art equipment and systems in the following fields: military/professional communications, EW and intelligence, command control, fire support and control, defense and weapon systems, electro-optic and avionics and navigation.

ASELSAN provides modern and high-end systems within the EW field. The equipment and systems already fielded by ASELSAN are tactical communications monitoring and jamming systems, radar detection and jamming systems, direction-finding systems, EW self-protection systems for fighter aircrafts and airborne signal monitoring systems.

ATDI

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ATDI is a world leader in radio planning and spectrum management software. It provides a large range of software products and services covering all areas of radio network planning, spectrum management, radio propagation simulation, command and control systems, spectrum monitoring and digital cartography.

With seven offices in three continents and a solid network of distributors around the world, ATDI is a truly global company, able to provide support and services to its customers around the clock and around the globe.

HTZ warfare *nG*, ATDI's EW software, is a comprehensive radio planning (software) application for military networks. It is a complete system providing a wide set of technical solutions for the deployment of tactical and infrastructure communication networks. It enables the design and

optimization of communication networks, thanks to specific tools tailored to simulate any type of network in the V/U/SHF band. Used in particular to plan communication infrastructures for armies and administrations, HTZ warfare *nG* also is used for enhancement studies to improve radio-based air navigation systems across the world.

AVALON ELECTRONICS INC.

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Avalon Electronics specializes in the design and manufacture of advanced wideband disk recorders for airborne, mobile and ground-based SIGINT applications. The company's mil-spec'd product range includes IF and baseband video recorders with recording bandwidths of up to 100 MHz, and compact recorders with bandwidths of up to 50 MHz. Single- and multi-channel variants also are available. The company's product range is supported by a variety of remote control, data management and data analysis software tools. Its clients include many of the world's armies, navies and air forces, as well as leading civilian SIGINT data collection and analysis agencies.

AZURE SUMMIT TECHNOLOGIES, INC.

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Azure Summit Technology is a research and development firm specializing in systems engineering, algorithm development and application of advanced technologies to SIGINT and EW Systems. We are a small business and are active in the DOD SBIR program. The founders have more than 50 years of experience developing hardware, software and signal processing algorithms. Azure's mission is to solve high-priority national problems using small, highly qualified teams of scientists and engineers. Our strengths are in blue-sky thinking, breakthrough innovation and the stubborn pursuit of solutions to next and future generation problems. Azure is interested in a broad set of problems, but has a core focus on Interference Suppression/Cancellation, Direction Finding and Geolocation.

Azure is currently researching and developing technologies for a diverse problem set: EW Co-Site Interference Mitigation, Digital Beamforming/IC Algorithms, Small-UAV DF and Geolocation, Phased-Array Radar Digital Receiver/Exciter (DREX), Signal Processing Solutions to defeat RCIEDs, Robust Distributed GPS Apertures.

B**BLACKHAWK MANAGEMENT CORPORATION**

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BLACKHAWK is a woman-owned corporation with a workforce of 300 employees. BLACKHAWK services include acquisition management, integrated logistics support, systems and sustainment engineering, training development and information technology services. Its customers include NASA; the US Army Communications Electronics Command, PEO-Intelligence Electronic Warfare; the Tank Automotive Armaments Command; the US Air Force Outreach Program Office (AFOPO); the US Air Force Crypto Logical Support Group (CPSG); the US Air Force Intelligence Agency (AIA); the US Air Force Center for Environmental Excellence (AFCEE); the US Army III Corp.; the US Air Force Research Laboratory; the US Air Force Special Operations; and the FAA.

BLACKHAWK's continued growth is attributable to teamwork, sound management, proven processes and a commitment to customer satisfaction through its delivery of cost-effective services exceeding customer expectations. BLACKHAWK has offices in Ft. Walton Beach, FL; Fort Monmouth, NJ; San Antonio, TX; Dallas, TX; Warner Robins, GA; and several overseas locations, including the UK and Japan.

BOOZ ALLEN HAMILTON

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Booz Allen Hamilton has been at the forefront of strategy and technology consulting for more than 90 years. Providing a broad range of services in strategy, operations, organization and change, information technology, systems engineering and program management, Booz Allen is committed to delivering results that endure. Headquartered in McLean, VA, Booz Allen has 20,000 employees and generates annual revenue of approximately \$4 billion. Integrating the full range of consulting capabilities, Booz Allen helps government clients solve their toughest problems. It supports defense clients at all levels – senior executives, warfighters, acquisition managers, technologists and program managers – with the entire spectrum of Booz Allen's strategy consulting and technology expertise.

Booz Allen delivers independent results to DOD EW clients in modeling and simulation, systems engineering and integration, economic and business analysis and cyber analysis. It is focused on providing immediate technical solutions to current operations, and it delivers EW life-cycle management services that span science and technology through development, fielding and operations for joint-service EW systems.



CACI INTERNATIONAL INC.

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CACI International Inc. provides the professional services and IT solutions needed to prevail in today's defense, intelligence, homeland security and federal civilian government arenas. It delivers enterprise IT and network services; data, information and knowledge management services; business system solutions; logistics and material readiness; C4ISR integration services; cyber security, information assurance and information operations; integrated security and intelligence solutions; and program management and SETA support services.

CACI is a world leader in delivering valuable solutions that help America's intelligence community counter global terrorism. It is engaged across a wide range of intelligence disciplines, from the most complex space-based operations to human source intelligence. It focuses on two distinct customer categories – national strategic and law enforcement, and tactical and military service. Its overriding goal is to provide strong capabilities at the nexus of intelligence and security that have the greatest value to its clients' missions in support of national security, intelligence and homeland security.

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CAP Wireless has provided quality small signal and high power amplifiers, and Amplifier-based subsystems to the defense electronics and commercial communications markets since 1996. Our underlying strategy is that extensive use of sophisticated EDA tools can enable cost-competitive custom designs with performance characteristics superior to off-the-shelf products. A scalable

business model coupled with experienced manufacturing partners enables us to address quantities from one-off to production runs in the tens of thousands on tight schedules, with proven quality and reliability.

CAP Wireless' Spatium™ spatial-combining platform enables us to manufacture the highest power-bandwidth product solid state amplifiers available today. This industry-changing technology enables the solid state replacement of travelling wave tube microwave and millimeter wave amplifiers for ground-based, airborne and shipboard operations.

CERALTA TECHNOLOGIES INC.

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M/A-COM SIGINT Products is the most trusted name in the SIGINT industry. Its products are used in multiple fixed-site, maritime and airborne platforms for applications in SIGINT, ELINT, satellite telecommunications and radar environments. M/A-COM SIGINT Products is the world's largest producer of RF microwave (search and set-on) receivers and tuners, IF converters and radio frequency distribution peripheral equipment. M/A-COM brings more than 50 years of experience in the design and manufacturing of microwave technology, and its SIGINT products are best-in-class in terms of performance, reliability and affordability.

COBHAM SENSOR SYSTEMS – BALTIMORE

Formerly Nurad Technologies, Inc.
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Cobham Sensor Systems – Baltimore (Cobham), *formerly Nurad Technologies, Inc.* is the single source for antennas, radomes and advanced composite structures. Founded in 1965, Cobham has distinguished itself as a world leader in the design, development and production of antennas and radomes for use in Electronic Warfare (EW) and Communication, Navigation and Identification (CNI) applications.

Cobham's antennas and radomes are currently deployed on nearly every military aircraft in the US. Cobham has accomplished this by building a broad and deep portfolio of antenna and radome technology, and by establishing an unmatched capability for high-quality, on-time manufacturing. We specialize in the following: Composite RF Structures

(Radomes), Frequency Selective Services (FSS), Antenna / Radome Subsystems, Advanced Composite Structures, Reflectors and Sub-reflectors, Broadband Horns & Notches, Blade Antennas, Low Profile Antennas, Conformal Antennas

Cobham has the facilities, personnel and experience to produce antennas and radomes that satisfy even the most demanding environmental conditions, including military aircraft, unmanned systems, munitions, launch vehicles, shipboard and ground mobile applications.

COLSA CORPORATION

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COLSA Corporation is a technology services and solutions company with significant experience providing engineering, IT and programmatic solutions for Government and Commercial customers. We design, develop, and implement solutions that will improve operations and capitalize on technology. We understand the challenges our customers face and we work closely with each one to deliver the right solution.

Modeling and Simulation is a critical component of our engineering discipline and supports the design, testing, analysis, and training domains for a wide spectrum of programs. COLSA has expertise in M&S disciplines that include Windows-based Constructive Simulation models development and test all the way up through High Performance Computing (HPC) high-fidelity physics-based simulations for complex problem solutions in fluid dynamics, missile design, radar systems and signatures, and Genetic and Evolutionary Computing strategies. COLSA engineers are familiar with both domestic and military simulation applications in a wide variety of platforms and languages.

Operating the One Semi-Automated Forces (OneSAF) Co-Development Lab for the Space and Missile Defense Command, COLSA has developed and successfully handed over to the Army modules representing space and electronic warfare systems.

COMTECH PST CORPORATION

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Founded in 1987, Comtech PST designs and manufactures solid state high power amplifiers, from 1MHz to 6GHz, with output power levels ranging from 2 watts up to multi-kilowatts. Our products are utilized in a variety of military and commercial applications, including: electronic warfare, radar/IFF, military communications, SATCOM, EMC/EMI

testing, and medical testing and treatment systems.

CPST has developed a robust line of linear and pulse amplifier products utilizing LDMOS, Gallium Arsenide, Silicon Carbide, and the latest Gallium Nitride transistor technologies, enabling us to continually expand and improve the performance characteristics of our power amplifiers. Our vast array of solid state power amplifier products are available in modules, or as rack-mountable power amplifiers. While we currently offer a standard amplifier product line, we also develop customized amplifiers to meet unique program and project specifications.

CPST's Hill Engineering Division specializes in solid-state control devices serving broad bandwidths ranging from 10 MHz to 18 GHz, with power handling from 1 Watt to 8 kW. These include high power RF and microwave switches, high power microwave limiters, low power microwave switches and low power microwave multi-function control assemblies.

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Communications & Power Industries (CPI), headquartered in Palo Alto, CA, is a leading provider of microwave, RF, power and control solutions for critical defense, communications, medical, scientific and other applications. CPI develops, manufactures and distributes products used to generate, amplify and transmit high-power/high-frequency microwave and RF signals, and/or provide power and control for various applications.

End-use applications of these systems include the transmission of radar signals for navigation and location; the transmission of deception signals for electronic countermeasures; the transmission and amplification of voice, data and video signals for broadcasting, Internet and other types of communications; the supply of power and control for medical diagnostic imaging and the generation of microwave energy for radiation therapy in cancer treatment; and for various industrial and scientific applications.

CRANE AEROSPACE & ELECTRONICS

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The Electronics Group of Crane Aerospace & Electronics designs and manufactures high-density, high-reliability electronics for aerospace, space, military, medical, industrial and commercial applications. Our solutions include Power, Microelectronics, Microwave Systems and Electronic Manufacturing Services.

Our Power Solutions provide power electronics to the defense, aerospace, space, medical and industrial markets. Our light weight and high reliability products range from full sized high voltage, high current power supplies to miniature DC/DC converters.

Our Microwave Systems Solutions design and manufacture high performance, millimeter wave, microwave, RF and IF components, subsystems and systems for government, industrial and military end use customers. We specialize in mission critical, harsh environment products to meet your requirements for communications, C4ISR, space, radars and simulators, electronic warfare and missiles.

Our Electronic Manufacturing Services and Microelectronics Solutions provide custom design or build-to-print solutions for microelectronics, cards, subsystems, and systems.

Crane Aerospace & Electronics is a segment of Crane Co. and a major supplier of critical aircraft and electronic systems and components. To learn more about our products or request information, please visit www.craneae.com

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Backed by five decades of experience, Cubic Defense Applications (CDA) supplies live, constructive, virtual military training systems, integrated services and communications products to the US DOD, government agencies and allied nations.

The company designs instrumented range systems for fighter aircraft, armored vehicles and infantry force-on-force live training. CDA provides everything from weapons effects simulations and laser-based tactical and communications systems to precision gunnery solutions.

CDA's mission support services include planning and operational support for theater and worldwide exercises, training doctrine, curriculum, leadership development, force modernization for NATO entrants, open source data collection and engineering and technical support.

CDA also provides world-class communications products for intelligence, surveillance and search-and-rescue markets. These include jam-resistant data links, signals intelligence receivers and direction-finding (DF) systems for military and signals intelligence markets. CDA's DF

technology has been customized for civil aviation, homeland security and military training applications.

CURTISS-WRIGHT CONTROLS ELECTRONIC SYSTEMS

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Curtiss-Wright Controls Electronic Systems is a leading supplier of highly-specialized, high-performance data recorders and storage products as well as high-speed data communications for real-time systems. Our innovative products are used in simulation, process control, advanced digital signal processing, data acquisition, image processing, and test and measurement - virtually any application where critical data must be transferred quickly and accurately.

Our expertise lies in data recording, storage and communications. We offer high-performance recording and playback solutions for any application, from those requiring frequent "snapshots" of small packets of data to those requiring acquisition of long periods of streaming data. LinkXchange® switches are scalable, versatile, multi-purpose switches that provide protocol transparent connections for digital signals up to 10 Gbps. With LinkXchange switches, network and system configurations can be made quickly and easily through an easy-to-use interface, thus saving time and money. Our high-speed data communications products include SCRAMNet+, FibreXtreme® Serial FPDP products achieve sustained data throughput up to 247 MB/sec, 1553 Solutions™ include microcode-based MIL-STD-1553 boards, GUI interface software, and the latest in advanced bus switching technologies. I/O Solutions™ feature a complete line of advanced modular I/O modules and high-density carriers.

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CyberVillage Networkers is an Internet/Intranet software development and marketing firm headquartered in Ellicott City, MD. It comprises a team of talented senior technology consultants, engineers, marketers, graphic artists and designers dedicated to the effective design and implementation of government, business and organization Internet/Intranet sites, web-enabled applications and knowledge management.

The company's staff has extensive experience in engineering and management of high-tech companies. Its clients rely on its expertise to help them streamline and promote their services,

products and organizations using web-enabled technologies.



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DARE Electronics, Inc., specializes in designing and manufacturing custom and standard relays, including time delay relays, over/under voltage sensing relays, over/under frequency sensing relays, phase sensors, power monitors, current sensors, flashers and other electronic and electromechanical devices. DARE's high-accuracy electronic and electromechanical devices are used in various EW applications by the military, aerospace and ground support industry. DARE is known for its design excellence, commitment to quality and on-time delivery, having received numerous awards and recognition for its 100 percent on-time quality performance.

For more information about DARE, please visit www.dareelectronics.com.

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Since 1992, David H. Pollock Consultants (DHPC) has been devoted to supporting the DOD and Fortune 500 firms with C4ISR technology assessment, modeling and simulation, systems engineering and concept demonstrations. With locations in Westwood, NJ, and Eatontown, NJ, DHPC has seen substantial growth in the past 10 years.

The company's expertise is in ASE system modeling and hardware-in-the-loop simulations, vulnerability and susceptibility exploitation and assessments; IRCM, MWS, RWR design analyses, technology assessments and propagation interaction; counter-IED concept demonstrations and threat exploitations; pointing and tracking design, modeling and simulation; systems analysis and risk assessments; sensor digital modeling and simulation; field test planning, direction and reporting; and research and development, experimentation and simulation laboratory design, development and operation.

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dB Control Inc. designs and manufactures reliable high-power microwave amplifiers, transmitters, high-voltage and low-voltage power supplies and modulators for radar, electronic countermeasure (ECM), communication and instrumentation applications. The company's products can be quickly and easily configured to meet custom specifications and platform requirements for ground-based, shipboard and high-altitude military manned and unmanned aircraft. By using a modular construction based on mature technologies and proven designs, and by working with standard modules and manufacturing processes, dB Control produces products that cost less, are easy to maintain and are available in production quantities.

Many dB Control products contain tightly packaged high-voltage circuitry. Critical to the success of these designs is the encapsulation process that has been perfected in dB Control's advanced encapsulation laboratory. All encapsulated modules are manufactured in house. Assembly of these tightly packaged products is performed by experienced specialists trained in the safe assembly of products containing high-voltage circuitry. dB Control's excellent reputation for encapsulation and high-voltage winding, and its ability to assemble high-voltage circuitry, is known throughout the industry.

For companies looking to outsource, dB Control offers specialized contract manufacturing services for high-voltage transformers, power supplies and specialized high-voltage assemblies. Full-vacuum encapsulation, pressure cure and conformal coating laboratory services are available, as is transformer winding and testing.

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As an agency within the Canadian Department of National Defence (DND), Defence R&D Canada (DRDC) ensures that Canada's needs in science and technology for defense and security at home and abroad are consistently met. DRDC provides crucial support to the DND and Canadian Forces (CF) through planning, research, analysis, development and experimentation. It delivers innovative new technologies that offer the CF a decisive advantage and strengthen the security posture of the nation.

DRDC delivers excellence through a broad spectrum of leading-edge research, technology and analysis, exemplified by its EW projects. Its EW expertise includes radio-frequency communications, advanced radar detection and analysis systems, electronic support measures systems, sensing, electro-optical warfare and other technologies to improve the operational self-defense capabilities and situational awareness on the battlefield.

DRDC's research centers across Canada advance its technology exploitation activities to realize the benefits of Canada's investment in research and to enhance the flow of discoveries, inventions and new concepts from laboratories into commercial products, processes and services. Its centers foster strategic partnerships in order to pool resources, share facilities and to network with the private sector, government and universities.

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Defense Research Associates, Inc. (DRA) is a small business specializing in developing innovative technologies, in conjunction with Government research laboratories, and transitioning them to support the warfighter.

Among DRA's ongoing programs, DRA has been instrumental in the advancement of Sense & Avoid (SAA) technology, an ongoing Advanced Technology Demonstration program with the US Air Force Research Laboratory (AFRL) enabling UAS to fly in US national and international airspace systems; Multi-Mode Collision Avoidance Systems (M²CAS), fusing cooperative with non-cooperative SAA technologies; Affordable Visible Missile Warning Systems (AVMWS), highly reliable, affordable optical missile warning systems utilizing low-cost CCD technology and high-performance processors; the Vigilant Sensing System (VSS), a small multi-sensor platform that mounts to common high-voltage power lines that inductively draws its power from the power line and uses the power line for communication and control; and the Remote Auxiliary Power System (RAPs), a very simple but effective power harvesting system that acts as a universal extension cord.

DELTA MICROWAVE

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Founded in 1973, Delta Microwave is a top manufacturer of custom and standard microwave components. Our product lines include filters, filter/amplifiers, multiplexers, and integrated assemblies covering frequencies from 1 MHz to 40 GHz.

Applications for our products include military/defense, space, and high reliability commercial applications. Delta Microwave is an AS-9100, and ISO-9001:2000 registered company. Delta Microwave is a veteran owned small business.

DRS CODEM SYSTEMS INC.

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DRS Codem Systems is a leading provider of innovative engineered solutions for communications and surveillance applications. The Company's expertise spans the entire systems software and hardware development life-cycle from the concept to the design and development of new technologies for the production and implementation of modern complex intelligent systems, to the training of the end-users.

DRS Codem is a leading provider of SIGINT, COMINT, Antenna Control Systems and Internetworking Communications. For more than 30 years, DRS Codem has developed engineered solutions for communications and surveillance. Markets include the Department of Defense and Homeland Security as well as Regulatory and Intelligence agencies in the United States and throughout the world.

DRS Codem's disciplines include; Direction Finding, Electronic Warfare, Radio Frequency and Signal Analysis, Digital Signal Processing, Communications Processing, Intelligence Support Systems, Modems and Secure Communications.

DRS C3 SYSTEMS

DRS Signal Solutions

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DRS Signal Solutions, Inc. is a world leader in high-performance Signal Intelligence (SIGINT) tuners, receivers, data recorders, signal processing, microwave components and geolocation systems. Our products and systems support missions such as survey, collection and geographic location.

With more than 45 years experience of advanced technology development and engineering, Signal Solutions is unmatched in the industry and provides unique solutions for a secure future. Today, Signal Solutions is a leader of

innovative, flexible open architecture solutions exploiting small size, weight, and power consumption. Our products are adaptable for land, sea and air operations across a variety of platforms as well as tactical man-portable capabilities for the individual soldier. Signal Solutions applications are deployed worldwide by virtually all United States military and government agencies, as well as several allied international governments and defense prime contractors.

Signal Solutions is committed to technical excellence, innovative approaches, and dedication to both our employees and customers. Meeting Today's Challenges to Provide a Secure Future.

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DRS Soneticom focuses on solutions for geolocation systems, wireless communications protocols, and digital signal processing supporting the growing defense, homeland security, and spectrum management markets. The company possesses expertise in communications systems, applications development and product engineering. Soneticom's current customers include both governmental and commercial entities.

Sonicom joined the DRS Defense Solutions Group in September 2009. The products offered by Soneticom are highly complementary to the DRS core intelligence systems business. They can be employed in communications intelligence (COMINT), electronic warfare (EW) and radio spectrum management applications. Soneticom has a strong lineage of customer relationships, a growing installed base of products, and an established position in growing markets.

DRS Soneticom is committed to technical excellence, innovative approaches, and dedication to both our employees and customers. Meeting Today's Challenges to Provide a Secure Future.

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E

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Elbit Systems of America is a leading provider of high performance products and system solutions focusing on the defense, homeland security, commercial aviation and medical instrumentation markets. With facilities throughout the United States, Elbit Systems of America is dedicated to supporting those who contribute daily to the safety and security of the United States. Elbit Systems of America, LLC is wholly owned by Elbit Systems Ltd. (NASDAQ: ESLT), a global electronics company engaged in a wide range of programs for innovative defense and commercial applications.

ELCOM TECHNOLOGIES INC.

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Elcom Technologies Inc. is a privately held US Technology Company that designs and manufactures broadband instruments and modules for RF and microwave applications. Primary markets served include aerospace/defense, SIGINT, SATCOM and commercial communications.

Elcom specializes in low-phase noise RF/MW design and manufacturing. Products range from compact synthesizers used in UAV applications to integrated instruments and subsystems utilizing RF DSP technology in applications including radar simulation, EW test, COMINT, ELINT, TELINT and SATCOM. Products include broadband fast-switching synthesizers, tuners, converters and receivers with 1U or VME form factors. Frequency ranges up to 40 GHz are available and custom designs up to 60 GHz are within the company's capabilities.

Due to its proprietary topologies and design innovations, Elcom has achieved smaller size, lower power consumption, lower phase noise and lower microphonics than products typical to the industry. Elcom is ITAR- and ISO-certified. Internal HALT HASS capabilities are available for product testing in applications associated with rugged operating environments. The company can provide both COTS and customized solutions, depending on customer requirements.

ELECTRO-METRICS CORP.

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Electro-Metrics is a leading designer, producer and integrator of antennas and equipment for TSCM, COMINT, EW, SIGINT, broadband RF testing and other

communications applications. Electro-Metrics' antennas cover the frequency range from 100 kHz to 40 GHz.

The company's products are used for detection and measurement of electromagnetic signals across all frequencies, and are most used for wireless voice and data communications.

Electro-Metrics' antennas and electromagnetic sensors have been selected by numerous agencies in the US government as the standards for use in communications security application. The high-performance antennas and antenna kits have been designed in cooperation with the foremost experts in the communications security field to provide maximum performance with high portability and durability. As a result, they are used throughout the security services for the most demanding tasks in securing high-level communications situations.

In addition to the communications security applications, Electro-Metrics' antennas and sensors also are used in instrumentation applications that require highly accurate measurement of electromagnetic signals.

Today, companies whose names are household words rely on Electro-Metrics' equipment and systems. Government agencies around the world (including the highest levels of the US government) use the company's equipment to secure their most sensitive communications.

ELISRA ELECTRONIC SYSTEMS LTD.

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Elisra Electronic Systems Ltd., a member of the Elbit Group, is a global EW leader, with integrated solutions tailored to customer requirements and platforms. The company specializes in the development, manufacture, supply and integration of multispectral advanced EW suites, including RF, RWR, ECM, ESM, ELINT, laser, LWS and IR missile warning systems.

Elisra's proven performance as a systems integrator is supported by in-house capabilities ranging from microwave components to fully integrated EW suites. The company is the prime contractor for the Israel Air Force and Navy EW systems.

As the major supplier of EW systems to all branches of the Israel Defense Forces, and the provider of customized solutions to its worldwide customers, Elisra's EW systems are installed on more than 30 types of aircraft and helicopters. For the new millennium, Elisra has expanded its family of EW systems to offer fully integrated solutions for the latest-generation aircraft fighters and helicopters.

EM RESEARCH INC.

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EM Research is the microwave industry-leading designer and manufacturer of high-performance standard and custom-designed frequency synthesizers, phase-locked oscillators and signal sources for commercial and military systems. The company specializes in surface-mount and modular phase-locked oscillators (PLO) and frequency synthesizers (PLL) from 4 MHz to over 18 GHz.

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EMS Technologies Inc. keeps people, systems and data connected wherever they are - on the ground, in the warehouse, in the air or in space. EMS is a wireless and satellite communication solutions leader and serves aeronautical, defense, maritime, commercial space and supply chain markets through its LXE, EMS SATCOM and Defense & Space Systems divisions. The company is headquartered in Atlanta, employs approximately 1,000 people worldwide and operates major manufacturing facilities in Atlanta and Ottawa, Canada.

EMS Technologies' Defense & Space Systems division develops advanced RF systems for military applications serving the battle space in communications, surveillance and EW. With co-engineered microwave solutions optimized for the platform and tough environments, its systems are integrated into programs that serve the world's leading defense and space prime contractors, the US DOD research labs and ultimately, by enabling solutions, the warfighter. Key assets in the fight are surveillance through radars and electronic countermeasures. Plus, small form factors of EMS high-power, low-loss and high-performance passive and active microwave system elements enable missions more effectively. EMS RF systems are embedded in the military's most distinguished systems.

ENDWAVE CORP.

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Endwave Defense and Security is an operating division of Endwave Corp., supporting the stringent requirements of our defense and homeland security customers, offering dedicated service and

providing the higher level performance, packaging and testing that is required by these demanding applications. Endwave's experience in this arena spans two decades and includes some of the most sophisticated hi-rel military and homeland security applications.

Endwave Defense and Security products operate from 1-100 GHz and include integrated transceivers, JCA Amplifiers™, ALC Log Amplifiers™, oscillators, synthesizers, up-/downconverters, frequency multipliers and microwave switch arrays. With an unparalleled library of circuit building blocks at its fingertips, the company offers a strong capability to deliver standard and customized solutions. A continuous exchange of technology breakthroughs and manufacturing process improvements flows between its defense and commercial business units. This commercial/defense balance allows Endwave to deliver the MIL-SPEC integrity and COTS mentality its nation's defense and homeland security applications require today.

EONIC B.V.

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EONIC is a global supplier of best-of-class signal acquisition systems for intelligence, surveillance and reconnaissance applications. SIGINT is a complex process that involves capturing, recording, screening, segmenting and transporting relevant data for further analysis. Operators and analysts are confronted with increasingly sophisticated and elusive signals that are spread over wider segments of the frequency spectrum, often in a chaotic and noisy RF environment. Legacy recorders cannot cope with these demands. So when expanding or upgrading your SIGINT capabilities to match today's requirements, consider EONIC's state-of-the-art wideband recorders. Its wideband recorders provide unmatched performance, both in bandwidth and signal integrity. Open interfaces facilitate integration into larger systems, and users can easily manage ELINT and COMINT processes with the comprehensive graphical user interface included with each system. Designed to capture, detect, monitor, record and analyze the most sophisticated of signals, EONIC products offer solutions today to the intelligence challenges of tomorrow. EONIC - digitally mastering the spectrum.

ESL DEFENCE LIMITED

A subsidiary of AAI Corporation — an operating unit of Textron Systems, a Textron Inc. company
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ESL is a leading provider of test and training products for defensive aid suites and self-protection systems. The company has specialist expertise in electronic warfare (EW) systems, including electro-optic (EO), infrared (IR), and radio frequency (RF) technology, through the development of its own products and those of its parent company, AAI Corporation — an operating unit of Textron Systems, a Textron Inc. Company.

The company specializes in innovative system design, manufacturing, and product support of EO/IR and RF stimulators and flight line test sets (FLTS) for military applications, in addition to undertaking EW research, development, and in-service support on behalf of government agencies and prime contractors worldwide.

ESL aims to deliver confidence to flight crews and aircraft maintenance support organizations through a combined array of advanced, combat-proven EW test and training products and technologies. As such, we manufacture a wide range of products for testing ultraviolet (UV) and IR missile, laser, and radar threat warners; IR jammers; and directed IR countermeasures (DIRCM).

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Esterline Defense Technologies (EDT), comprised of Armtec Defense Products Co., Armtec Countermeasures Co. and Wallop Defence Systems Ltd., designs, develops and manufactures state-of-the-art combustible ordnance products, infrared decoy flares and radar countermeasure chaff for air and shipboard applications and a variety of pyrotechnic devices for use in land-based, maritime and airborne applications of armed forces across the world. EDT provides a comprehensive service of capabilities, resources and experience with four locations across the US and two locations in the UK.

Our Armtec Defense Products Co. serves the widest customer base for combustible ordnance in the world, with over 90 million deliveries to date. Our combat proven Armtec® products include 60mm, 81mm and 120mm mortar increment propellant containers, combustible

cartridge cases used on all 120mm ammunition for the Abrams Main Battle Tank and 155mm modular artillery charge systems (MACS) for artillery. In addition to high volume production facilities we also maintain modern research and development and pilot plant facilities.

ET INDUSTRIES

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ET Industries is a high-technology, leading-edge company specializing in the design, development and manufacture of state-of-the-art radio and microwave frequency, narrowband and wideband subsystems and components.

The company was created with the sole purpose of assisting customers to investigate and solve problems that are very advanced technologically and may require critical schedules for completion. ET Industries therefore welcomes such programs. The company provides application-specific custom designs to meet special requirements of its customers.

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ETM Electromatic, Inc. is an industry leader in high voltage and microwave power. Located in the San Francisco Bay Area, ETM has over 35 years of experience in the design and manufacture of high voltage power supplies and microwave power transmitters. ETM's focus is to provide Tailored Power Subsystems to System Integrators in a number of different marketplaces, including the Radar and EW markets. ETM supplies high power CW Radar Jamming systems and high power Pulsed Radar systems for fixed, ground mobile, shipboard and airborne platforms. With experience integrating nearly every type of microwave device with our powers supplies, ETM's microwave capabilities range from 10 watts to megawatts of power. ETM's products are fully qualified to withstand the requirements of military standards or exposed outdoor environments. ETM's products also support the requirements of the Communications, Testing, Medical and Security marketplaces.

In an effort to fully support our System Integrator clients ETM takes full pride in our disciplined and professional Program Management team to support the needs of a comprehensive customer SOW. ETM supports our customers for the life of our products with Through Life Support efforts, Depot Support, and tailored

logistics. ETM quality system is AS-9100 certified.

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e2v is a leading designer, developer and manufacturer of specialized components, semiconductors and subsystems. Celebrating more than 60 years of bright ideas, e2v continues to break new ground with advances in technology. e2v TWTs, microwave components and high-rel microprocessors are incorporated into many ECM devices and rugged, reliable Stellar satcom amplifiers are essential for military communications. e2v also designs and manufactures the world's fastest and lowest-power analog-to-digital converters that are used in a wide range of military systems around the world.

A US-based company, QP Semiconductor was recently acquired by e2v, adding to its portfolio by designing, re-engineering and providing a full range of manufacturing capabilities to extend the life of classic integrated circuits for a range of mission-critical programs designed to deliver high performance in extreme conditions. QP was admitted to the Defense Supply Centre Columbus (DSCC)-qualified manufacturers list in 1998 and supplies more than 3,000 qualified semiconductor components on the DSCC-qualified manufacturing list.

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EW Simulation Technology Limited (EWST) is a UK Company (owned by Herley Industries Inc.), specialising in the design and manufacture of multi-spectral Radar Threat and Electronic Countermeasures Simulation Equipment for EW training and test & evaluation applications. EWST's products include the RSS8000 Radar Threat Simulator, Chameleon-II ECM/RTG simulator, PTS-8000 portable multi-spectral test set and the MERTS mobile high-power test and evaluation system.

The Company has been established in the radar threat and ECM simulator business since 1984 and has a well-proven and distinguished track record world-wide. The success of EWST has been through the supply of high quality products together with a total commitment to post sales service and logistic support.

EWST manages a continuous product improvement design philosophy with the ability to upgrade older products with the latest designs. The Company operates a fully documented quality control system certified to ISO9001:2000.

Since 1984, EWsT has supplied over 100 simulation equipments to naval, air force, army and civilian customers in more than 20 countries around the globe. Backed by a network of local sales and representative offices, and with a related facility in Nowra, Australia, EWsT offers a total capability for marketing, sales, design, manufacture and support of its simulator products.

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Electronic Warfare Associates-Australia Pty Ltd (EWA-Australia) is a Canberra-headquartered company with offices in Adelaide and Brisbane. We are an ISO 9001:2008 certified, vendor independent company focusing on the provision of EW and related systems engineering support to Australian and regional Defence, Government and industry. EWA-Australia's Defense experience includes Project Management, Systems Engineering and Integration, Test and Evaluation, business analysis and Information Security. We also offer a growing range of commercial and government Information Security services, including IT security reviews, threat and risk assessments, network and application vulnerability assessments and penetration testing.

Our EW technical specialists and consultants typically have more than fifteen years of EW experience in Australian Defence as Engineers, Operators, Intelligence Analysts or Research Scientists. EWA-Australia also has Defence systems engineering experience in communications, weapons systems, command support systems, avionics and related fields, as well as its wide range of information security solutions.

EWA-Australia's services are offered to its Government customers through a number of standing offer contracts. EWA-Australia also offers a range of customer-tailored training courses and seminars on a wide variety of EW and information security topics.

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Founded in 1980, Giga-tronics Incorporated (Nasdaq "GIGA"), an ISO 9001 and AS 9100 certified company, headquartered in San Ramon, California, is a leading engineering-and-design manufacturer of best-in-class RF and microwave signal generators, microwave power amplifiers, USB power sensors, microwave power meters and broadband switching matrices. R&D, production and test managers, scientists, engineers and technicians, around the world, use Giga-tronics test equipment to realize higher productivity and greater ease of use in many applications: ATE systems, aerospace and defense, communications and general microwave component test. Visit Giga-tronics at www.gigatronics.com or view a Giga-tronics video presentation at www.gigatronics.com/gigavideo/gigatronics_video.html.

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HUBER+SUHNER offer a wide range of products and services that provide the platform to build modern defense systems. Uncertain conditions, extreme environments and challenging operational demands require the highest quality. The company's many years of experience in the development and production of cables, connectors, EMP protection devices and assembled cable systems guarantee optimized solutions.

With its project-oriented business model, HUBER+SUHNER handles even complex and ambitious projects. High quality,

quick and reliable service, worldwide presence and continuous innovation make HUBER+SUHNER the ideal partner for defense system solutions.

HUBER+SUHNER's product areas encompass RF interconnect, including RF/microwave cables, RF/microwave connectors, RF/microwave assemblies and attenuators, terminations, DC blocks and bias-tees; fiber-optic, including mobile systems, multi-fiber assemblies, field termination and maintenance and installation solutions; and protection (EMP and NEMP), including high RF power solutions, lambda 1/4 technologies, dateline protectors, DC pass and block solutions, DC injector types, self-extinguishing gas capsules and RF limiters.

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Innovationszentrum fuer Telekommunikationstechnik GmbH (IZT) specializes in the most advanced digital signal processing and field programmable gate array (FPGA) designs in combination with high frequency and microwave technology. Its product portfolio includes equipment for signal generation, receivers for signal monitoring and recording, transmitters for digital broadcast, digital radio systems and channel simulators. IZT offers powerful platforms and customized solutions for high signal bandwidth and real-time signal processing applications.

In the context of demanding surveillance technology, IZT provides the IZT R3000 digital wideband receiver family, which is one of the most comprehensive receiver platforms combining state-of-the-art high frequency technologies with the latest developments in digital signal processing. Key features such as broadband spectrum and multi-channel demodulation via Gigabit-LAN interface, highest linearity and very low phase noise are extended by direction-finding capabilities and optional synchronization equipment.

IZT distributes its products worldwide in cooperation with its international strategic partners IZT Pacific, IZT Technologies and MaXentric Technologies. The product and project business is managed from

its principal office located in Erlangen, Germany. Its customers are civil companies, governmental agencies and armed forces. The IZT quality management system is ISO 9001:2000-certified.

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Since 1953, Instruments for Industry, Inc. (aka IFI) provides of global support custom designing, developing and manufacturing high power Amplifiers ranging DC-40GHz CW and Pulse. Devices include Solid State, Tetrode Tube and TWT. Customers can purchase complete solutions for their testing requirements from a single source along with single amplifier solutions which are ideal for all types of testing simplifying the customer's test setups by providing time savings for other necessary lab tasks. IFI manufactures single amplifier solutions for 10KHz-3.0GHz and 0.8-18.0GHz in addition to fully customized products for indoor/outdoor programs. Packaging includes rack mount, ruggedized, airborne, mobile, transportable versions, or custom. Applications include EMI/EMC testing, Automotive, Educational, Biological, Military, EW/ECM, Communications, Radar testing/Pulse source, Aircraft testing, and Space Qualification testing. In addition, IFI provides antennas, TEM Cells, and various RF/Microwave (waveguide/coaxial) accessories. The company utilizes a global support network to service customers. This is why IFI is "The Power of Choice!"

ITCN INC.

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ITCN Inc. provides test instrumentation and engineering services to commercial and government customers worldwide for use in developing, operating and maintaining complex, computer-based embedded systems and applications.

ITCN has a comprehensive staff of hardware and software engineers. Its services include requirements definition, prototyping, system engineering, electronics design and software design. Its engineering services are not only for ITCN products, but for any customer requirement.

Its SystemTrace[®] products provide a complete instrumentation system for acquiring data from an embedded system. This includes modules that monitor data on media such as computer backplanes and

buses and connect to a control computer via an Ethernet network.

The C-TAC Plus is used to support legacy embedded systems for software development, system integration and maintenance. C-TAC Plus is a combination of an In-Circuit-Emulator (ICE), software analyzer and data acquisition system.

The CMDS Firing Pulse Interval Tester is a suite of test components designed to analyze firing pulse timing from a Countermeasures Dispensing System (chaff and flare dispenser). The tester includes pulse testers, a pulse collector and Windows[®]-based software.

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iVeia, LLC is a veteran-owned small business located in Annapolis, MD. iVeia is a COTS supplier focused on leading edge technology in an ultra small credit card-sized form factor. It offers the Titan-V5e and the Titan-PPCx. The Titan-V5e is an advanced SBC that combines a PowerPC GPP and Xilinx Virtex-5 FPGA.

The Titan-PPCx is a high-performance low-power system-on-a-module (SOM) designed for advanced embedded applications. It combines a gigahertz+ PowerPC General Purpose Processor (GPP) and a low power FPGA with 2GB of DDR2 memory in a credit-card sized form factor that meets today's challenge of a modular processing platform.

iVeia's system-on-a-chip (SoC) technology and tools provide an easy-to-use, deployable platform for high-performance signal and image processing applications. "The low power and small size of the Titan-V5e enables our customers to push their critical processing out to the edge - something they couldn't do before with typical COTS hardware," said Michael Fawcett, CTO of iVeia. "Our flexible architecture allows us to provide a number of COTS and quick-turn I/O solutions for a variety of markets, including unmanned vehicles, robotics, portable and handheld applications, wireless communications and machine vision."

JABIL DEFENSE AND AEROSPACE SERVICES

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Jabil Defense and Aerospace Services (JDAS) provides trusted defense and aerospace electronics manufacturing and support services worldwide. Its unique business model allows it to be true partners with its customers, while

providing exceptional quality, efficiency and responsiveness.

In addition to electronic design and manufacturing services, the company provides life-cycle support, which includes traceability to the component level; obsolescence planning and management; real-time access to factory floor data; full program visibility; lean life-cycle solutions, from design through manufacturing and repair; and advanced engineering and design capabilities.

Customers realize competitive benefits by taking advantage of access to Jabil's "global footprint," which encompasses its global defense and aerospace electronics manufacturing capabilities; its strategically-placed repair facilities worldwide, including FAA145 facilities; its single instance global enterprise resource planning system (SAP) in all Jabil facilities; leveraging global electronics material spending in excess of \$10 billion USD; and, most importantly, its unwavering commitment to quality and delivery.

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JB Management Inc. (JBM) is a Service Disabled Veteran Owned Business providing professional support and highly skilled technical services to clients worldwide.

Headquartered in Alexandria, VA, JBM supports its customer base in multi-faceted business endeavors across the United States, focusing on demonstrated proven performance and the creation of long-term relationships. Today, JBM also provides operational systems integration, logistics services and information operations assistance to US forces deployed to Iraq, Kuwait and Afghanistan.

JBM is organized into four business components: Information Operations; Software Development, Integration and Configuration Management; Logistics Support Services; and Systems Engineering and Integration. A field service representative (FSR) capability is generic to each component of our business.

It also has developed and licensed the Common Message Processor[®] (CMP), a Java[®] based, user-friendly application used to process formatted military messages. It also has developed a Web-Messaging Tool (WebMT) that includes the functionality of CMP into a net-centric, Web-based application. Having achieved a CMMI Level 3 rating in software development, JBM personnel approach every endeavor in all facets of its business with a commitment to quality. Its team consistently creates imaginative, innovative solutions, while maintaining a constant focus on customer mission and requirements.

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JT3, LLC is a joint venture company combining the management expertise, military experience and technical knowledge of defense contractors EG&G and Raytheon. Headquartered in Las Vegas, NV, JT3 is dedicated to Joint Range Technical Services (J-Tech) contract execution. JT3 provides engineering and technical expertise to four western military ranges (AFFTC, NTTR, UTTR and China Lake ECR) for the testing of new and modified weapons systems, new tactics development and ongoing military training – all in realistic air and surface combat-like environments.



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Keragis Corporation specializes in producing custom and production High Power RF amplifiers and broadband subsystems.

Founded in 1993, Keragis is a spin-off of 12-year-old MAR Associates, a leader in the design and manufacturing of commercial multi-channel wireless cable television systems. Mitec Telecom purchased the company in 2007.

Keragis provides military and commercial high performance solid-state RF and microwave products such as: 1. Extremely broadband medium and high power amplifiers; 2. Very high power microwave amplifiers (in the ranges of 2-20 GHz and up to 1000s of watts) using our unique (patent pending) octahedrons and dodecahedrons. These amplifiers can be used as TWT replacements; 3. Rack mounted High Power Solid State amplifiers; 4. Radar subsystems

KOR ELECTRONICS

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KOR Electronics is a recognized authority in the exploitation of the digital RF and information domains. Leveraging its analog-to-digital and digital-to-analog technologies, KOR delivers innovative solutions to the defense and intelligence communities. These engineering-based solutions support both tactical and national missions. KOR serves the ISR, EW and radar markets.

Its capabilities include quick-reaction engineering capabilities, unique hardware solutions and mission software analysis services.

KOR Electronics' hardware solutions are enabled by its extremely fast coherent data conversion technology, agile RF, FPGA implementations, high-fidelity frequency synthesis and wide-bandwidth waveform recording/generating technologies.

KOR Electronics' software solutions provide software and mission engineering for clients. It specializes in systems design, architecture integration, real-time software development and implementation, mission operations, analysis and data support.

KOR products are found in a variety of environments, ranging from sophisticated laboratory applications to manned and unmanned airborne platforms. During its 23-year history, KOR hardware has logged thousands of operational hours on most fast craft in the DOD arsenal and is now onboard flying in unmanned applications.



L-3 COMMUNICATIONS

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Headquartered in New York City, L-3 Communications is a leading provider of ISR systems, secure communications systems, aircraft modernization, training and government services. The company is a leading merchant supplier of a broad array of high technology products, including guidance and navigation, sensors, scanners, fuses, data links, propulsion systems, simulators, avionics, electro-optics, satellite communications, electrical power equipment, encryption, SIGINT, antennas and microwave components. L-3 also supports a variety of homeland security initiatives with products and services. Its customers include the DOD, the Department of Homeland Security, selected US government intelligence agencies and aerospace prime contractors.

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L-3 Communications, Applied Signal & Image Technology (L-3 ASIT) has been a provider of innovative signal and image processing solutions for use by the US military and intelligence community since 1992. L-3 ASIT has extensive proven

experience in tactical Radio Frequency (RF) Direction Finding (DF) and geo-location missions from a variety of platforms including ground fixed, ground mobile, manned aircraft and unmanned aircraft platforms. L-3 ASIT provides both system and product level solutions to the communications intelligence (COMINT) direction finding (DF) customers.

The primary system solutions provided by the company include manned and unmanned airborne COMINT/DF payloads on a diverse variety of aircraft types including ATR-42, Blackhawk UH-60, C-26 Metroliner, Cessna Caravan, DeHaviland Dash 8, GNAT, King Air (B200, B300, B350 and RC-12), Predator, Tiger Shark and Vector P. Payloads for both pressurized and unpressurized applications have been successfully delivered to a variety of users with special tactical missions in locations around the world. The company strives to produce affordable payloads that require minimum special modifications or specific accommodations so that these payloads require less time and expense to integrate on to the hosting aircraft.

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L-3 Communications Cincinnati Electronics is a sophisticated engineering, development and production company engaged in the design and manufacture of highly advanced electronics equipment used for defense, aerospace and commercial applications. The company is world-renowned for its expertise in the areas of high-resolution infrared imaging, launch vehicle and missile avionics, spacecraft transmitters, receivers and aircraft missile warning systems.

L-3 Communications Cincinnati Electronics Infrared Systems Strategic Business Unit (SBU) offers leadership in the design and production of innovative infrared sensors and infrared warning systems for situational awareness, missile threat warning and hostile fire indication. The Infrared Systems SBU produces advanced missile warning systems that provide 360-degree coverage for simultaneous multi-threat missile detection on aircraft such as the C-130. Remote-controlled surveillance systems also are available for border patrol, remote area surveillance, target acquisition and recognition. L-3 Communications Cincinnati Electronics is a vertically-integrated company that produces infrared focal plane arrays, long-life vacuum dewars, high reliability cryogenic coolers, hybrid microelectronics, video electronics, image processing, specialized target detection algorithms and infrared systems for the defense market.

L-3 RANDTRON ANTENNA SYSTEMS

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L-3 Randtron Antenna Systems designs, manufactures, tests and supports high-performance antennas and antenna systems for defense and aerospace applications, including AEW, RWR, ESM, ECM and CNI for airborne, ship, ground and missile platforms. As a subcontractor, the division specializes in projects for the DOD, select US government intelligence agencies, foreign governments and aerospace and defense prime contractors. Randtron has been a leading supplier of antennas and systems for more than 30 years. It is the designer and supplier of the Navy's E-2D Hawkeye AEW antenna and numerous broadband EW antennas for tactical fighter aircraft.

Randtron's products include broadband spiral and dual-polarized sinuous elements, interferometers, LO designs, conformal arrays, high-power transmit/receive arrays, electronically and mechanically scanned arrays, integrated active and passive subsystems and multi-channel low-loss rotary couplers. Randtron typically works in the UHF to millimeter-wave frequency range. Many of its products are custom, integrated designs developed to meet unique customer requirements. Its multi-disciplined technical group frequently teams with customer engineers to enhance total system performance and cost.

LOCKHEED MARTIN ACULIGHT CORPORATION

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Lockheed Martin Aculight is a leader in providing quality, innovative and cost-effective laser solutions for customers' needs in national defense, aerospace, scientific and medical applications. Offering both off-the-shelf and custom-designed products, Lockheed Martin Aculight is an ideal partner for laser system development. The company understands its clients' laser needs and supplies solutions tailored to their performance, packaging and service requirements.

The company's technology portfolio includes Aculight® brand fiber lasers, diode-pumped solid-state lasers, mid-IR lasers, nonlinear optics and optical parametric oscillators. Used in applications ranging from infrared countermeasures and directed energy to medical, Lockheed Martin Aculight lasers provide customers with value at every level from expert advice and pioneering research to solid

prototyping, unique products and flexible manufacturing.

Based in Bothell, Washington, Lockheed Martin Aculight operates in a 47,000-square foot facility dedicated to state-of-the-art laser research, development and manufacturing. The facility is equipped with Class 1,000 clean rooms and Class 100 assembly work stations. Lockheed Martin Aculight leverages more than 15 years' advanced laser technology experience to help customers meet goals for overall system performance, cost and time to market or deployment.

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Lockheed Martin MS2 provides capabilities spanning domains from the depths of the oceans to the stratosphere. Our solutions are found on nearly 500 programs for US and international customers, both government and civilian, in nearly 50 nations.

MS2's sensor systems provide maritime, battlefield, and air surveillance; undersea mine and submarine detection; missile detection and tracking; and advanced early warning. Focus areas include: Maritime Electronic Warfare, Advanced Platforms, Integrated Defense Technologies, Counter IED Technologies, Network-Centric Warfare and Systems Integration. Programs of interest include:

Surface Electronic Warfare Improvement Program (SEWIP) – SEWIP is a spiral-development upgrade and replacement program for the AN/SLQ-32 EW system spanning multiple classes of Naval combatant ships. SEWIP Block 1 High Gain, High Sensitivity (HGHS) Subsystem enhances detection capabilities to assist Navy sailors in defending ships from emerging threats. SEWIP Block 2 and beyond will focus on replacing the legacy AN/SLQ-32 (V) altogether with advanced hardware and software improvements, as well as a new combat system interface.

Lockheed Martin MS2 headquarters are located in: Akron, OH; Baltimore, MD; Eagan, MN; Manassas, VA; Marion, MA; Moorestown, NJ; Syracuse, NY; and Kanata, Ontario, Canada.

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Lorch Microwave, a Smiths Group PLC company and a division of Smiths Interconnect, is a leading supplier of custom-designed RF and microwave components and systems to leading military, industrial and commercial manufacturers worldwide. Founded in 1966, the company has developed a strong reputation for quality products and rapid order fulfillment through more than 40 years of dedicated service. Lorch Microwave's broad range of products includes cavity filters, discrete components, ceramic filters, integrated assemblies, switch filter banks, tunable filters, tubular filters, wireless products and RF components.

As a result of its history of design expertise, Lorch has established a robust library of highly engineered designs that provide the company with the ability to achieve log engineering and development costs. As a result of this knowledge base, Lorch Microwave has the ability to support custom specifications to 40 GHz with minimal nonrecurring engineering expenses and rapid turnaround times.

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LNX Corporation is an ISO 9001:2000-certified leading manufacturer of high-reliability, cost-effective RF/microwave and millimeter-wave products, ranging in frequencies from 20 MHz to more than 60 GHz for key domestic and international defense system applications such as surveillance; satellite communication; missile guidance; and naval, airborne and ground-based EW and ECM.

Its product offerings include microwave control components and subsystems; MMIC-based transceivers, converters and amplifiers; and digital products (digital receivers, low-cost digital RF memories and DIFMs/IFMs).

Led by its senior RF/MW and digital engineering staff, LNX has a strong legacy of successfully teaming with its customers to develop and adapt customer project requirements to its automated manufacturing processes.

Located off of Route 93, Exit 2, at 8B Industrial Way, Salem, NH, LNX is convenient to both Boston's Logan and Manchester airports.

LS TELCOM

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Founded in 1992, LS telcom is today a leading supplier of advanced systems for radio spectrum management and high-end wireless network analysis, planning and engineering. The company's specialist expertise is based on almost two decades of global experience supported by massive R&D both in-house and with partners.

The company's product and services portfolio for electronic warfare and homeland security covers complete software systems for spectrum management, software and integration services for Electronic Support and partially for Electronic Countermeasures. This comprises strategic consulting services, training and engineering as well.

LS telcom is committed to enabling its military customers to increase the efficiency of strategic frequency assignment, scenario analysis and pre-mission planning for RF communications and signalling. With its solutions for control of recognisance systems it supports both the strategic and tactical operation level. On the tactical level the offerings range from RF-Scenario Analyzers for field use up to integration of complete ECM systems.

M

MACAULAY-BROWN INC.

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MacAulay-Brown Inc. (MacB) is a technical and management services company founded in 1979 and headquartered in Dayton, OH. MacB is a woman-owned small business with 950 employees and \$130 million in annual sales. The company has operating locations in San Antonio, TX; Hampton, VA; Warner Robins, GA; Ft. Walton Beach, FL; Albuquerque, NM; Colorado Springs, CO; Fredericksburg, VA; and Charleston, SC.

MacB has a 29-year heritage of supporting the development, testing, and evaluation of RF/EO EW systems. In recent years, it has expanded its capabilities to include information warfare and operations (IW/IO), SIGINT, MASINT and ISR systems. MacB provides engineering expertise and technical support in the areas of modeling and simulation, hardware-in-the-loop (HITL) system design and operation, foreign equipment exploitation, threat assessment and system effectiveness analysis. It offers DOD customers a wide range of support services, including acquisition management,

program and technology planning, system requirements definition, test and evaluation, analysis of alternatives (AOA) and cost-benefit studies.

MASS CONSULTANTS LIMITED

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MASS is an independent systems house with a strong defense focus, particularly in Electronic Warfare Operational Support (EWOS). EWOS can be considered to be the intellectual and data support required by front-line platforms and EW systems for successful operational employment. It is the amalgamation of software and hardware tools required to create an EWOS capability including the necessity for the management of EW data and intelligence, the development of platform protection countermeasures and the production and testing of mission data.

As the leading UK supplier of EWOS products and services, MASS can offer its customers:

THURBON, an advanced EW Data Management System that provides a scalable EW Database capability and which can be readily integrated with third party tools including mission data production and support tools.

Specialist EW training that provides an in-depth knowledge of EW, how to set up and operate EW Support centers and how to develop effective platform protection countermeasures.

Countermeasures development (training, skills transfer or ready-to-use countermeasures) the transfer of skills and knowledge vital for the development of an indigenous countermeasures development capability.

MASS is part of the Cohort Group.

MC COUNTERMEASURES INC.

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In 2010 MC Countermeasures Inc. (MCCM) celebrates 15 years offering quality products and services designed specifically for EW applications. Our hardware products include: EW Training systems, DRFM-based radar jammers, radar target generators (RTG), radar environment simulators (RES), situation awareness receivers (ESM), data collection/instrumentation and performance enhancing sub-systems such as radar PRI and RF Agility predictors. MCCM also offers consulting services such as ECM technique development and technology/threat analysis. Predictors

enhance the ECM effectiveness of jammers (VCO or DRFM-based) against (PRI and RF) agile-agile radars. A unique aspect of these products is the ability to perform real-time signal de-interleaving allowing jammers and receivers alike to work with multiple emitters simultaneously in dense signal environments. Predictors are easily upgradeable since they are based on FPGA (Field Programmable Gate Array) technology. Systems are available in ATR or 19" rack mount versions and predictor products are available in a number of form factors including VME and a (two-chip) chipset that OEMs can mount on their own boards. Integration with the host system is straight forward and an Evaluation Station is available to help integrators and evaluators. ISO9000:2000 procedures are in place to ensure high quality products. At MCCM we know that technology moves fast – but we move faster.

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MegaPhase is an ISO 9001:2000-certified, privately held company that designs, manufactures and sells RF/microwave coaxial cable, cable assemblies, connectors and RF components. Located in Stroudsburg, PA, MegaPhase customers include OEMs in instrumentation, broadband networking, wireless communications, semiconductors, advanced microwave and optical electronic systems, space and defense. MegaPhase products include GrooveTube® test cables, semi-rigid and flexible coaxial cables for advanced systems, test adapters and coaxial connectors. MegaPhase's broadband and high-frequency interconnect technologies include coaxial cables through 67 GHz that have been used reliably to test Sprint-Nextel cell phones, the US Navy's new AWACS E-2D Hawkeye, Agilent's new FireFox handheld analyzers and many other high-profile projects.

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For more than 40 years, Micro-Coax has been serving the defense, telecommunications and test/measurement

marketplace, earning a reputation for excellent customer service and unmatched quality with its high-performance product line. Throughout its history, the company has never deviated from doing what it does best – manufacturing high-performance RF transmission products.

UTIFLEX™ flexible cable assemblies are found in high-reliability applications on space, military and airframe systems. Several Micro-Coax UT™ semi-rigid cables are found on the MIL-DTL-17 QPL. The company's extensive application of process control drives industry-leading reliability not only in its high-performance products, but also in its commercial UT™ semi-rigid cables, M-FLEX™ low-cost flexible cables and UTIFORM™-conformable cable products.

ARACON® metal-clad fiber is the most recent addition to Micro-Coax's growing line of RF and transmission-line products. This lightweight, high-strength fiber is an alternative to conventional metal wire and is ideal for military and aerospace applications where weight and reliability are critical. The company's spaceflight-qualified ultra-light UTIFLEX™ cables use ARACON® fiber braid for a weight savings of up to 25 percent.

Micro-Coax is located in a 90,000-square-foot facility in Pottstown, PA. Its facility incorporates a high degree of vertical integration, enabling a price/performance ratio unequalled in the industry

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Microsemi Corporation, with corporate headquarters in Irvine, California, is a leading designer, manufacturer and marketer of high performance analog and mixed signal integrated circuits and high reliability semiconductors. The company's military/aerospace history spans nearly a half century. Typical defense and aircraft system applications include motor controls for wings, flaps, fuel pumps, generators, radar switching, fire control, avionic and flight control.

For more information: <http://www.microsemi.com/hi-rel.asp>

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Micro Systems Inc., a Herley Industries company, provides the broadest range of RF simulation systems in the industry. Our Multi-Spectral stimulation capabilities encompass Radar Threat/EW, Electronic Counter-measures, UV/IR, and complex Radar Target/Clutter/ECM generation

for Radar and EW system testing and operator training. We're the only company that integrates EW threat simulation, Radar/Target/Clutter/ECM generation, Communications Simulation, Real-Time RF recording, and UV/IR simulation in a single turnkey system. We provide our domestic and foreign clients with customized test solutions for radar warning receivers, radars, ELINT/SIGINT/COMMINT receivers, UV/IR systems, and jamming systems.

Micro Systems produces a wide variety of Digital RF Memories (DRFMs) that deliver advanced capabilities and proven performance utilizing leading-edge technology. Our latest developments in Digital Signal Processing (DSP) provide signals with advanced modulations and characteristics required by modern radars and electronic countermeasure (ECM) systems. These modulations include amplitude, Doppler, phase, Jet Engine Modulation, Helicopter Blade Modulation, Radar Cross Section, Scintillation/Glint, wide and narrowband noise, multi-point scattering, and the widest range of ECM techniques available.

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Established in 1987, MiKES is the "electronic warfare specialist of Turkey," with 100 percent Turkish-owned shares, of which 72 percent belong to ASELSAN.

MiKES is a value-oriented engineering and manufacturing house focusing on defense programs, with nearly 300 high-caliber personnel experienced in the design, development, procurement, manufacturing, testing and logistic support of EW equipment and systems in both hardware and software. More than 50 percent of the company workforce consists of engineers from various disciplines.

Since 1989, MiKES has successfully completed various programs for the Turkish Armed Forces (TAF), the Turkish Ministry of National Defense (TMND) and international companies.

MiKES' major products include the MiKES Integrated Defense Aid System (MiDAS), an integrated radar warning receiver and RF jammer ECM system; and the Self-Protection Expendables Airborne Dispenser (SPREAD), a countermeasures dispensing system.

Major programs completed by MiKES are the Turkish Air Force (TUAF) F-16 (Block 30-40) Aircraft Self-Protection EW System (SPEWS), the TUAF F-4E 2020 Modernization Program RWR system and the Turkish Naval Forces Dogan Class Fast Patrol Boat Modernization Program ELDES-21 ESM system.

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Microwave Information Transmission Equipment (MITEQ) is a leading supplier of RF and microwave components, assemblies and systems for the military and commercial markets. The company's products include satellite- and ground-based communication systems; missile guidance; military electronic countermeasures; radar warning and surveillance systems; land, sea and airborne radar; air traffic control radar; radio astronomy; assorted spaceborne applications; and research and development efforts.

Since its inception more than 50 years ago, MITEQ has been manufacturing a complete line of high-performance microwave components and subsystems. MITEQ remains an employee-owned company, housing separate engineering and manufacturing groups dedicated to achieving technical excellence while producing quality products and satisfying customers' needs.

MITEQ maintains in-house capability in MIC construction, automated surface mount assembly and numerically-controlled machining. These tools, along with the company's engineering talents, have resulted in advanced products and technologies in excess of 60 GHz.

The company's products are divided into two major areas: RF and microwave components and assemblies, and satellite communications and earth station equipment.

THE MITRE CORPORATION

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The MITRE Corporation is a not-for-profit organization chartered to work in the public interest. As a national resource, it applies its expertise in systems engineering, information technology, operational concepts and enterprise modernization to address its sponsors' critical needs.

MITRE manages four Federally Funded Research and Development Centers (FFRDCs) – one for the Department of Defense (DOD) (known as the DOD Command, Control, Communications and Intelligence (C3I) FFRDC), one for the Federal Aviation Administration (the Center for Advanced Aviation System Development), one for the Internal Revenue Service and US Department of Veterans Affairs (the Center for

Enterprise Modernization), and one for the Department of Homeland Security (the Homeland Security Systems Engineering and Development Center).

MITRE's C3I FFRDC supports a broad and diverse set of sponsors and clients within the DOD and the Intelligence Community. These include the military departments, defense and intelligence agencies, the combatant commands and elements of both the Office of the Secretary of Defense and the Office of the Joint Chiefs of Staff. The systems engineering activities in support of these organizations reach from concept development and experimentation through the acquisition and fielding of advanced capabilities to assistance with cross cutting operational issues.

MRSL

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ManTech Real-Time Systems Laboratory (MRSL), a ManTech SRS Space and Intelligence Division (SID) business unit, has more than 13 years of experience in signal processing application and common services development for the national agencies of the intelligence community (IC) and the DOD. SID and MRSL develop and deploy multiple applications and system infrastructures for use in client mission operations.

They specialize in the development of mission-oriented, SIGINT and IMINT signal processing algorithms, applications and associated services for IC customers. Their signal processing applications are designed as a service within the customer's larger enterprise architectures, conforming to the chosen hardware and interfacing to other, appropriate common services. MRSL creates and evolves processing algorithms for target geolocation, signal structure characterization, information extraction and interference cancellation.

It excels in the design, development and deployment of SIGINT applications using the X-Midas signal processing software framework, and has a unique and intimate knowledge of the X-Midas framework, since it evolves and sustain this framework for the entire IC community and all contractors. MRSL also handles the full life-cycle support of signal processing applications, including prototype development, iterative product enhancement, field deployment, factory and field-testing, training, documentation and continuing maintenance support.

MULTICONSULT SRL

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This company provides UHF, VHF and HF detection and identification radio monitoring. Its focus areas are passive EW systems, satellite communications, surveillance systems, EW and mission planning.

MY-KONSULT

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My-konsult is a Swedish company specializing in the design, development and manufacturing of cost-effective EW support and simulation systems.

The company is focusing on the development and production of industrial-standard EW products and includes test and evaluation, airborne, ground and naval applications.

Astor III is an example of a COTS product that contains digital-based ECM, ESM and TES functions in one system and utilizes subsystems like DRFM, Predictor, Mode-editor and built-in GPS-Map.

My-konsult's product range is described on its website.



NEW WORLD SOLUTIONS INC.

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New World Solutions (NWS) is a service-disabled, veteran-owned small business (SDVOSB) whose team members bring technical, analytical, administrative and special security support across many engineering and operations disciplines. The company was founded in 2002 to provide the US government and industry with highly educated, skilled and experienced engineers and analysts to solve hard problems confronting the United States in the post-September 11, 2001, environment.

NWS has broad experience in measurement and signatures intelligence (MASINT) with a focus in RF MASINT, SIGINT, geospatial intelligence (GEOINT) and advanced geospatial intelligence (AGI). Its core competencies include intelligence analysis and operations across the major intelligence disciplines, support to military operations, systems engineering, systems integration and program management. Through considerable real-world experience, it has a firm understanding of leading-edge, multi-discipline intelligence and joint military operations and the transformational roles of MASINT and AGI in context with the military and intelligence agencies and systems supporting such operations. Its team members have substantial experience in maximizing the contributions of intelligence systems for a myriad of real-world, real-time applications, including combat operations of all scales, conflicts at all levels of intensity, high current interest (HCI) events, military exercises and wargames.

NOVA DEFENCE

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Nova Defence's mission is to be the pre-eminent supplier of Independent and Professional complex Electronic Warfare Systems Engineering, T&E and Certification Services for Australia and South East Asia. Nova employs more qualified and experienced EW operators and engineers than any other independent Australian professional service provider and is one of the largest suppliers to the ADF in this field.

Nova's diverse specialist workforce includes professional engineers, experienced operators, logisticians and para-professional personnel with Navy, Army and Air Force backgrounds from Australia, UK, US, Canada, New Zealand and Singapore. The EW engineering and design capability is a significant enabler to Nova's expertise in T&E; when combined with Nova's subject matter experts in Platform Certification, Safety Engineering and Systems Engineering.

Nova can provide specialist training on all aspects of EW. This includes the ability to develop specific courseware to enable customers to target the requirements of EW acquisition, integration and support. Nova prides itself on being a Registered Training Organisation and provides comprehensive training courses conducted by experienced practitioners with real world experience.



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Ophir RF is an ISO 9001:2000-certified company that has been designing and manufacturing high-power, solid-state, broadband and band-specific amplifiers since 1992. The knowledge and design experience gained through the years has allowed Ophir RF to supply radio and microwave frequency amplifiers to domestic and international high technology markets, including wireless and satellite communications; cellular and PCS instrumentation; defense, electromagnetic compatibility (EMC) testing; medical testing; and NMR systems. Its design pedigree makes it a major provider for defense applications, with experience in such diverse fields as EW/ECM systems, radar, TWT replacement programs, high-power testing, satellite tracking stations, radio transmission and an extensive production history with jamming programs. Its accomplishments include SPAWAR, NAVAIR and DEEPWATER.

ORION INTERNATIONAL TECHNOLOGIES, INC.

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ORION International Technologies (ORION), Inc. is a small business specializing in Research and Development, Engineering, Test and Evaluation support services and Information Technology.

ORION International Technologies, Inc. was founded in 1985 by Dr. Miguel Rios, Jr, Chief Executive Officer. Dr. Rios has had a distinguished career, with over 30 years of experience in the field of High Technology that includes Fundamental Research, Systems Analysis, Engineering, Design and Fabrication, Test and Evaluation, Modeling and Simulation, Program Planning and Executive Management

Under Dr. Rios' leadership, ORION has grown into a thriving company with its corporate office in Albuquerque and operations in Santa Fe, NM, Washington, DC, Eglin AFB, FL, and for National Laboratories (Stanford Linear Accelerator Center and Lawrence Berkeley) in California. ORION currently provides Research and Development and Technical and Engineering support to the DoD, DOE, DOT, the National Laboratories, and large DoD prime contractors in diverse areas such as Directed-Energy Technologies, Space Technologies, Electronic Warfare Countermeasures Systems, Information Technologies, Test and Evaluation, Modeling and Simulation, Nuclear Weapons and Counter proliferation, and Staff Augmentation.

OVERWATCH

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Overwatch®, an operating unit of Textron Systems, is a widely recognized market leader in multi-source intelligence, geospatial analysis, satellite communication solutions and intelligence services and applications. Our products and solutions are being used in US intelligence agencies, unified and combatant commands, armed services, and military intelligence centers. All operational mission areas from Intelligence-Surveillance-Reconnaissance (ISR), cyber-warfare, precision targeting

and strike, to tactical direct action rely on our products, solutions, services and training. To ensure that we provide the most innovative solutions available, our highly skilled team of professionals use current technology and domain expertise to develop solutions and services that set a new standard for the future of warfighter analysis and engagement.

Overwatch is driven by a relentless passion for what we do, a commitment for operational excellence, and a desire to provide meaningful solutions and intelligence services and applications that facilitate onsite consulting, improved situational understanding, interoperability, and mission execution within and across commands, services and intelligence agencies. Overwatch's drive and commitment consistently results in the production of timely and technologically advanced products and solutions focused on the intelligence and analysis requirements of tomorrow's warfighter.

P**PHOENIX INTERNATIONAL SYSTEMS INC.**

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Phoenix International Systems has been designing and building rugged commercial off-the-shelf (COTS) mass data storage systems for military/aerospace, telecommunications, utilities and process control industries since 1993. An ISO AS9100-certified manufacturer, SBA HUBZone service-disabled, veteran-owned small business (SDVOSB), Phoenix enjoys a worldwide reputation for quality products and excellence in customer service and support.

Phoenix is recognized as a manufacturer of high-quality data storage products and provider of data storage solutions tailored to unique customer applications and specific usage requirements. Its data storage products are found in such demanding applications as Joint STARS, the US Air Force/Army program in which Phoenix's disk array products are integral to the acquisition and distribution of real-time mission data; the A-RCI submarine program, where Phoenix's VME plug-in storage modules provide rugged, high-capacity COTS storage for targeting data; NAVSSI RAID navigation data systems; the US Marine/Air Force GTACS program, which exploits Phoenix's unique hot-swap VME technology, allowing storage data modules to be removed and replaced while continuing to perform aircraft detection and identification tasks; and the US Air Force Laser (ABL) aircraft in which Phoenix's latest RAID system, the RPC12, is used in its laser beam control/fire control system.

PLATH GMBH

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PLATH is internationally operating and specializes in RF intelligence for ambitious customers in strategic and tactical missions. Its systems are configured in close cooperation with each customer to ensure that the systems are optimally complying with specific mission requirements and working procedures.

The company's core competence lies in the effective, transparent and reliable automation of sophisticated intelligence-gathering processes. It focuses on intelligent evaluation algorithms to extract the maximum amount of information out of the huge quantity of data produced by broadband sensors.

PLATH provides innovative solutions for radio reconnaissance, including detection, location, analysis, interception, recording and identification of comms and non-comms signals, as well as for evaluation and decision support. PLATH designs and develops complete turnkey COMINT and EW systems, including accurate DF antennas for stationary and mobile applications and antenna matrixes; leading-edge DF receivers using different direction-finding methods for stationary and mobile applications; highly sensitive tuners; accurate and reliable location systems; fast and reliable operating monitoring systems with integrated recording functions; and efficient data recording, archiving, editing and evaluation systems.

PROTIUM TECHNOLOGIES, INC.

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Protium Technologies, Inc. specializes in design, development, and manufacture of custom RF and microwave communications equipment. The company's product line covers HF to 60 GHz and includes SDR platforms for cellular telephony applications, DF equipment, microwave modems, and wideband SIGINT digital receivers. Customers include domestic and foreign companies and military organizations.

Protium Technologies, Inc., located in Northborough, Massachusetts, is ISO 9001:2008 certified and qualifies as a small business.

Q**QINETIQ NORTH AMERICA**

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The Technology Solutions Group (TSG) of QinetiQ North America, headquartered in Waltham, MA, delivers high technology research services and development of defense and security related products to the defense, civilian government, and commercial markets. TSG invents and markets unmanned vehicle, warfighter, security, C4ISR, biomedical and commercial products. TSG works in the following specific technical areas: Unmanned Systems, Survivability, Managed Technical Services, Human and Intelligent Systems, C4ISR, Platform Systems. Spectro Products.

TSG has an international reputation for developing and delivering innovative products and systems that perform under the most demanding conditions. Its TALON® robots are widely used in Iraq and Afghanistan to disable roadside bombs and its LAST® Armor has been used to up-armor thousands of combat air and land vehicles since its debut in Operation Desert Storm in 1991.

QUALCOMM

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Next-generation wireless communications is emerging as the most important technology of this millennium. To ensure that the entire wireless industry is inspired and continues to evolve, innovate and experience success, QUALCOMM develops its technologies and solutions for the purpose of enabling key participants in the wireless value chain: network operators, manufacturers, consumers, application developers, content providers, and enterprise and government professionals.

By partnering with and acting as an enabler to the business activities of these participants, QUALCOMM ultimately enables consumers, professionals and government entities – the end users who benefit from the success of the wireless industry today and into tomorrow.

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Rafael Advanced Defense Systems Ltd. was founded in 1948. Over the years, it has developed systems for every branch of the Israel Defense Forces (IDF) and armed forces worldwide.

Tailored to its customers' specific needs, Rafael provides state-of-the-art yet cost-effective systems and weapons in the fields of missiles, air defense, naval systems, target acquisition, EW, C4ISR, communication networks, data links, electro-optic payloads, IED defeat systems, armor and active protection, combat vehicle upgrading, mine field breaching, border and coastal protection systems, UAVs and much more.

Rafael has proven to be a sound partner in joint ventures and complicated technology transfer programs with organizations all around the world.

Rafael aspires to strengthen its position even further in the international defense market, while maintaining its special contact with the IDF. It will continue to predict the needs of future combat forces worldwide and provide the technologies and systems required by these forces.

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RAS is a small business working in EW, ELINT, ESM, and related fields. RAS conducts studies; develops algorithms; develops hardware and software prototypes; and provides technical training for signal detection, characterization, identification, geo-location and tracking.

RAS collects and exploits modern signals (including conventional radar, Low Probability of Intercept (LPI) and RF MASINT emitters), and has developed an extensive digital library of collected signals. RAS developed robust real-time equalization techniques to mitigate receiver distortion, processes for real-time specific emitter tracking (SET) and multi-technique specific emitter identification (SEI), and for intercepting and characterizing LPI and wideband signals.

The company provided integration and test support for a USAF ISR platform. For the US Army, a real-time specific emitter tracking was developed,

integrated and tested with a prototype ESM digital channelizer. For the US Navy, RAS developed high performance Intentional Modulation on Pulse (IMOP) characterization algorithms for FPGA cores. Algorithms are being ported to FPGA implementations for real-time broadband spectral monitoring to be transitioned to developmental and production systems for operational use.

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RISING EDGE TECHNOLOGIES

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Rising Edge Technologies develops high-performance data systems to fulfill the specialized needs of the defense and intelligence communities. These systems range from small, man-portable wideband data recorders to large, multi-terabyte archival storage systems. The company combines its custom engineering skills with proven commercial technologies to deliver innovative, practical solutions to complex technical challenges.

Rising Edge offers an array of data recorders to support the capture, playback and analysis of high-speed electronic signals. Its standard DR products range from a two-drive lightweight portable unit to an eight-drive rackmount system. All Rising Edge recorders offer the following features: wideband recording; long record times; real-time playback; removable drive modules; choice of I/O module; user-friendly GUI; FTP offload capability; and rugged, ground-mobile operation.

Rising Edge also provides custom design and development services to customers with unique requirements. From product customization to software applications and hardware modules to complete turn-key systems, its talented engineering staff delivers mission-critical solutions that exceed expectations, including requirements definition; system architecture and analysis; digital and analog circuits; real-time OS and embedded systems; FPGAs/PLDs; graphical and command line user interfaces; device drivers; PCB layout, fab, assy and test; and manufacturing, maintenance and support.

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Rohde & Schwarz is the leading European company for Test and Measurement, Sound and TV Broadcasting, Information/Communications and Radio Monitoring/Radiolocation for governmental authorities. Radiomonitoring and radiolocation includes EW and COMINT/CESM equipment and systems. Rohde & Schwarz's Radiomonitoring and Radiolocation division enables military forces to detect, analyze and monitor radio traffic in order to gather intelligence on the size, location, movements and intentions of adversaries. Law enforcement agencies rely on Rohde & Schwarz equipment when searching for radio activity coming from criminal operations such as smuggling and theft or from terrorist activities. Rohde & Schwarz seeks long-standing relationships with satisfied customers and sustains a sales and service-network in more than 70 countries worldwide.

RUAG AVIATION

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The RUAG technology group is an international Aerospace and Defense company. RUAG has six divisions: Space, Aviation and Technology in the Aerospace market segment, and Electronics, Land Systems and Ammotec in the Defense market segment. The group's holding company is located in Berne (Switzerland).

RUAG Aviation offers a vast range of capabilities for the military and civil market. Technical support and the full range of MRO for engine, aircraft, aircraft components, helicopters and systems as well as self-protection solutions are among the core competences. The company provides the complete Electronic Warfare range from simulation, integration, qualification certification, equipment maintenance up to individual training. The Integrated Self Protection Solution (ISSYS), recently developed in a POD version, is a highly versatile airborne EW solution that can be used on different helicopter platforms. RUAG's MISSile SIMulation (mIssIm) flight-line tester provides radar, laser and guided missile signatures for testing most EW systems in the market.

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Science Applications International Corporation (SAIC) is a leading provider of scientific, engineering and systems integration and technical services and solutions to all US military branches, DOD agencies, intelligence communities, the US Department of Homeland Security and other US government civil agencies, as well as to customers in selected commercial markets. With more than 44,000 employees in more than 150 cities worldwide, SAIC engineers and scientists solve complex technical challenges requiring innovative solutions for customers' mission-critical functions.

SCIENTIFIC RESEARCH CORP.

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Scientific Research Corporation (SRC) is an advanced engineering company that was founded in 1988 to provide innovative solutions to the US government, private industries and international markets. SRC's business activities are focused on a broad range of information, communications, intelligence, EW, simulation, training and instrumentation systems. With corporate headquarters in Atlanta, GA, and engineering offices located across the US, SRC is dedicated to a full range of engineering, integration, testing, support and research and development activities. SRC laboratories and test facilities reflect state-of-the-art technology and mirror both commercial and defense operational environments.

SRC has expert resources and facilities in place to provide complex electronic systems; custom hardware/software product research, design and development; and engineering services that span analysis, design and development through integration, installation and support.

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SELEX Galileo Inc., the US subsidiary of SELEX Galileo, is a leader in defense electronics and is part of the Finmeccanica group of companies. It provides world class capabilities in avionics, surveillance, protection, tracking, targeting, navigation

and control, and imaging systems across land, sea, air and space.

SELEX Galileo Inc is incorporated in the state of Delaware. The corporate headquarters is based in Arlington, VA with regional offices in Long Island, NY, Melbourne, FL, and operations in Huntsville, AL, Atlanta, GA, Stennis MS, and the USAFB in Hurlburt Field, FL.

Key technologies include: Avionics, Electro optical and Electronic Warfare Systems, Airborne radar, Military lasers, Simulators and Unmanned Aerial Systems.

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Siemens has been a qualified partner for answers to questions related to security since 1885. Siemens Civil and National Security, based in Switzerland, is the centre of competence for Siemens worldwide in the fields of defense, intelligence and professional mobile radio.

For a good reason: Siemens Civil and National Security offers security in Swiss quality. Added to this there is the possibility of being able to rely on the know-how of a global employee network at any time for specific projects. Excellent qualifications, discretion and longterm customer relationships guarantee competence and the highest level of professionalism. Siemens Civil and National Security is your partner when it's about security. In cooperation with the local Siemens national companies, Siemens Civil and National Security offer security in Swiss quality around the world: military, rescue and security forces, intelligence services and administrations in many countries have placed their trust in our military and civil systems.

Siemens Civil and National Security develop comprehensive solutions in the fields of Command Control and Information, Intelligence, Mission Planning, Public Private Partnership, Secure Networks as well as Simulation and Training, IT Engineering, Identity Management and Biometrics.

SIERRA NEVADA CORPORATION

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SNC is a world-class prime systems integrator and electronic systems provider known for its rapid, innovative, and agile technology solutions. Fast-growing and widely diversified, SNC is a

high-tech electronics, engineering, and manufacturing corporation that continues to expand its impressive portfolio of capabilities, products and services.

SNC has a 45 year tradition of developing and providing high technology Electronics, Avionics, and Communications systems. Investing heavily over the years in people, processes, modern facilities, and the state-of-the-art equipment, SNC continues to enhance our technical advantage to provide innovative and cost-effective solutions to our customer's requirements. With numerous successful and diverse acquisitions, SNC continues to acquire new capabilities as we expand our tradition of excellence into the areas of Space, Telemedicine, Nanotechnology, Energy, and Net-Centric Operations

Headquartered in Sparks, Nevada, SNC is considered the Top Woman Owned Federal Contractor in the United States. SNC employs an extremely talented workforce of approximately 2000 people most of whom are scientists, engineers, or technical personnel with college or advanced degrees, and all of whom are dedicated to satisfying our customer's needs. Our seven different business areas operate from 35 locations in 20 states along with numerous customer support sites located throughout the world.

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Sivers IMA is a 9001:2000 certified company and one of the leading independent European manufacturers of advanced tuneable microwave oscillator products. Its specifications outperform competitors. The company has been in the industry since 1951 and its corporate facility is located in Kista, Sweden, with a sales office in the United States. Fifteen distributors and agents around the world represent the company.

Sivers IMAs customers primarily use its microwave products for military, industrial, test and measurement and telecom applications. Its strengths are unique skills in complex design and high-end frequencies. Sivers IMA offers customized microwave products in addition to its standard products.

The company's core products can be divided in three areas: signal sources such as different kinds of VCOs and PLLs ranging from 2 to 25.5 GHz; sensors products FMCW microwave front-ends (10 GHz and 24 GHz); and millimeter-wave products. Products for different applications range from 35 GHz to more than 100 GHz. The first released products in this area are state-of-the-art linear converters for 60 GHz.

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Founded in 1988, SprayCool® is a recognized leader in liquid-cooled, environmentally-sealed enclosure products for defense, aerospace and industrial applications. From ground-mobile to unmanned aerial vehicles (UAVs) in unpressurized environments to industrial real-time field computing environments, SprayCool solutions have revolutionized how electronics are deployed in harsh environments. The company's uniquely designed enclosures, rack solutions and cooling modules and kits have met the some of the industry's most stringent requirements.

Using its patented two-phase cooling technology, SprayCool products revolutionize how electronics are deployed for use in harsh environments. The company works through leading integrators to meet the most demanding requirements for military and industrial applications and, through its products, accelerates and facilitates the development and delivery of electronic system solutions for environments challenged by heat, size, weight and power restrictions.

SprayCool-patented technology uses a fine mist of non-corrosive, non-conductive liquid sprayed in a thin layer, which evaporates and cools electronics. The process continuously cycles within a sealed, closed loop system. In doing so, SprayCool products isolate the electronics from dirty, corrosive environments found in military and industrial applications, resulting in cooler, higher performance and more durable electronic devices.

SRCTEC

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SRCTec is an ISO 9001-registered company that provides manufacturing and logistics support for complex electronics systems. SRC, our parent organization, is a research and development company with more than 50 years of experience in defense, environment and intelligence. Together, through innovation in science, technology and information, we are *redefining possible™*. We work with the customer for the best solution – not the bottom line – resulting in nationally significant, next generation solutions that are supported throughout their full lifecycle.

SRC and SRCTec employ more than 1,000 people in 14 offices throughout Alabama, Colorado, Maine, Maryland, New York, Ohio, Texas and Virginia. There are more than 100 positions currently available nationwide. For more information, visit www.srctecinc.com.

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SRI International, one of the world's leading independent research and technology development organizations, performs research and development for government, commercial and foundation clients in information technology, engineering, pharmaceuticals, physical sciences and public policy. SRI also licenses its technologies and spins off companies.

SRI has conducted more than \$2 billion in client-sponsored research and development in the last decade alone. Clients include the DOD and all branches of the US Armed Forces. From the Cold War to today's global war on terrorism, government agencies have relied on SRI since its founding in 1946.

SRI technologies and programs for the military include video surveillance and intelligence programs, chemical and biological weapons detection and defense, IR countermeasures and sensors, IED neutralization, portable speech-to-speech language translation and programs to enhance combat training.

For a variety of clients, SRI's Intelligence & Information Systems (I2S) offers EW support for countermeasure effectiveness, C4I, Guardrail Common Sensor (GRCS) and precision GPS applications. Capabilities include systems engineering, requirements analysis, hardware and software development, systems integration, field support and on-site technical support.

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Sunshine Aero Industries (SAI) is a privately-owned small business located at the Bob Sikes Airport in Crestview, FL. Additional facilities are located at Florala, AL. Established in April 1980, SAI is a growing firm dedicated to providing high-tech support for the development of advanced aircraft and aircraft systems. In addition, SAI has a fixed-base operation and is fully certified by the FAA to conduct air taxi/charter operations under FAR Part 135, including the transport of hazardous materials. SAI is a corporate member of the Society of Experimental Test Pilots and the AOC.

The 8,000-foot, hard surface runway and associated facilities at the Bob Sikes Airport can support most private, commercial and military aircraft. From its Crestview base, SAI has supported test operations at every national test range, with extensive experience at the Eglin AFB Test Range. Here, SAI offers complete engineering, fabrication, aircraft modification, training and maintenance facilities. SAI's facilities include 16,000 square feet of hangar and maintenance space, a 900-square-foot classroom and 800 square feet of avionics and engine shops. Many customers often choose to use SAI's facilities in preference to their own for payload integration because SAI has all of the necessary equipment and resources collocated with the aircraft to simplify the task.

SURVICE ENGINEERING

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A nationally recognized specialist in combat system survivability, weapon system effectiveness and system safety, the SURVICE Engineering Company is a small business that's been providing DOD and industry customers with high-quality analytical products and services for more than 25 years. During this time, it has continued to grow in size and capability, as well as in national recognition for its leadership in the field. However, it's never lost touch with its original mission – to provide safe, survivable and effective

combat systems for US military personnel at home and abroad.

Its skilled workforce has participated in studies and T&E of various DOD systems – munitions, aircraft platforms, combat vehicles and support equipment – and provided technical expertise in a wide-range of effectiveness and survivability disciplines, including ballistic vulnerability and survivability, ballistic lethality, electromagnetic environmental effects and EW.

SURVICE supports the Air Force, Army, Marine Corps, Navy and industry with expertise that includes modeling and simulation, EO/IR and RF susceptibility, directed energy weapons (DEWs) and C-IED systems. SURVICE is headquartered in Belcamp, MD, with offices in Huntsville, AL; Niceville, FL; Washington, DC; Patuxent River, MD; Dayton, OH; and Ridgecrest, CA.

SYMETRICS INDUSTRIES

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Symetrics Industries has been designing, manufacturing, testing and delivering high reliability electronic assemblies and sophisticated EW and Communication systems to the US Government and major prime contractors for nearly 50 years. We are an AS9100 and ISO9001-2000 registered small business and have three main business sectors: electronic warfare (EW), digital communications, and electronic manufacturing services.

Our EW products include the AN/ALE-47 Countermeasures Dispenser System (CMDS), which is a self-protection system that provides combat aircrews with enhanced survivability against surface-to-air and air-to-air missile threats. We also manufacture the AN/ALM-295 Countermeasures Dispenser Test Set, and the AN/USQ-131 Memory Loader Verifier Set (MLVS), which loads EW software.

Our Improved Data Modems (IDM), include the IDM-304, IDM-304B, IDM-302, IDM-501, Mini-IDM, and the Weapons Data Link. The different versions of IDMs provide many choices of form factors. Our IDM capability is also available in a software only solution. Imagery transmission can be added to the IDMs utilizing PRISM technology.

We also offer the production of circuit card assemblies for use in rugged airborne environments for numerous prime contractors' subassemblies. Symetrics offers a wide range of electronics manufacturing services and solutions, from initial design to mass production.

SYPRIS DATA SYSTEMS

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Sypris Data Systems designs, manufactures and provides timely support of high-performance data acquisition and storage systems, and COMINT receivers for governments and industry applications worldwide.

Sypris Data Systems' products, systems and software are used to gather data in the following applications: submarine and surface ship sonar, flight testing, post-flight evaluation, telemetry, satellite down-links, laboratory data analysis, electronic intelligence, acoustical intelligence, communications intelligence, space shuttle and space station operations, synthetic aperture radar image recording, digital video images, ordnance and weapon system testing.

These products and technologies enable real-time capturing of uninterrupted and uncorrupted data across multiple channels. Sypris Data Systems continues to meet customers' needs with an extensive line of digital, analog and network-centric products.

SYRACUSE RESEARCH CORP. (SRC)

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SRC, formerly Syracuse Research Corporation) is a research and development company with more than 50 years of experience in defense, environment and intelligence. SRCtec, an SRC company, provides manufacturing and logistics support for complex electronics systems. Together, through innovation in science, technology and information, we are *redefining possible™*. We work with the customer for the best solution – not the bottom line – resulting in nationally significant, next generation products and services.

SRC and SRCtec employ more than 1,000 people in 14 offices throughout Alabama, Colorado, Maine, Maryland, New York, Ohio, Texas and Virginia. There are more than 100 positions currently available nationwide. For more information, visit www.srcinc.com.

SYSTEMATIC SOFTWARE ENGINEERING

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Systematic is an independent software and systems company that focuses on complex and critical IT solutions and EW data management systems. Its corporate headquarters are in Denmark, with subsidiaries in both the UK and the US.

The company's EW business is managed from the UK.

The company's EW Training and Support Group is staffed by specialists with wide-ranging knowledge of EW and who have had extensive experience as both front-line users and also in EW support roles. The UK Royal Navy, Royal Air Force and Army are all represented by the EW staff at Systematic.

Systematic focuses on the quality of its extensive EW training services and is the provider of training to Pfp/NATO nations, the Air Warfare Centre at RAF Waddington, the Royal Naval EW School and specific EW squadrons of the Royal Air Force, to mention just a few.

The company's software, or EWare, is an EW database management solution that has been designed to provide an Electronic Warfare Operational Support Centre (EWOSC) with a means of inputting and processing EW data into a master database. The key elements of this database are descriptions of emitters, intercepts, platforms and weapons and the relationships that exist between them.

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With 23+ years of defense systems development experience, SPEC has fielded a variety of air, land, sea, missile and space systems. SPEC personnel, some with over 40 years of experience, research, design, develop, fab, test and deliver advanced technology systems, including: Agile Digital Effects Processor (ADEP™) for advanced coherent Digital RF Memory (DRFM) and other applications, RF/EO/IR countermeasure systems, Solid State Recorders for ISR platforms. Customers include all three US military services, DOD agencies, international companies and major primes. SPEC is a veteran-owned small business, ISO 9001 certified and approved for classified operations.

SPEC's EW activities are primarily focused on ADEP™ applications – COTS/MOSA-based ADEP™ architecture offers next generation state-of-the-art performance, including: Continuous Instantaneous Bandwidth (IBW): 1.3GHz (single block, non-channelized) and the ability to generate multiple, simultaneous, overlapping, coherent waveforms.

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Founded in 1988, SystemWare is the industry leader in data acquisition and signal analysis technologies. Using

proprietary technologies and advanced design methodologies, SystemWare designs and develops complete hardware and software applications for the test and measurement, signal frequency management, signal intelligence and communication device-monitoring market.

The company's diverse product portfolio includes solutions for signal acquisition and analysis, TSCM, SIGINT, TEMPEST, carrier-signal monitoring, image and data rastering, hardware control and monitor and signal frequency management. Its systems are well-received by the US, NATO and other countries.

The company has developed a number of patent-pending technologies in the areas of digital signal rastering, signal measurement, amplitude modulation recovery and time interval recovery.

SystemWare incorporates an object-oriented design philosophy, configuration control and total quality management for every product or requirement. The company has developed robust libraries of unique software objects, which provide the basis for all of its products and allow for extremely fast development of new applications, all featuring the ability for the user to change objects at run-time.

T

TACTICAL TECHNOLOGIES INC.

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Tactical Technologies has spent over 10 years developing a family of Tactical Engagement Simulation Software (TESS) products. TESS is designed as commercial-off-the-shelf (COTS) software uniquely targeted at working on electronic attack and protection issues related to radar and infrared guided weapons.

TESS products are turn-key "integrated engagement simulations" which support surface-to-air, air-to-air, anti-ship and anti-tank engagements and perform "target and threat-centric analysis" for the user. They describe the threat, target, environment and geometry of an electronic combat engagement and analyze the system interactions and end-game results that occur.

In analytical applications TESS uses Simulink's scopes to help the user analyze the causal behavior that occurs between systems as they interact throughout an engagement while also providing end-game metrics like miss-distance and probability of kill. In training and hardware-in-the-loop requirements TESS can be easily compiled to provide real-time simulation performance using exactly the same system models and infrastructure.

High-fidelity physics-based system models built in MATLAB & Simulink and

available complete with documented source code allow the user to validate or modify TESS models, while being first principles-based and traceable, making them suitable for operational support, intelligence, research and engineering and "realistic training" applications.

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Tadiran Electronic Systems, a member of the Elisra Group, offers a full range of integrated C4I and EW solutions that assure accurate information any time, any place and under any conditions. The company's military systems incorporate advanced commercial off-the-shelf information technology products, PC platforms, Windows NT, IP communication protocols and more. Tadiran Electronic Systems also is a major supplier of commercial electromagnetic spectrum control monitoring and management systems.

TCI INTERNATIONAL, INC.

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TCI International is the leading global provider of innovative radio frequency (RF) solutions for spectrum monitoring and antenna applications. Headquartered in the Silicon Valley, TCI specializes in Spectrum Monitoring, Communications Intelligence (COMINT), HF/MF Broadcasting & Communication antenna systems, and custom engineering services.

With an unmatched 40 years of commercial field experience, TCI's global team is uniquely qualified to deliver leading-edge antenna and spectrum monitoring solutions. With R&D and manufacturing facilities in the US, TCI offers world-class service, installation, and training in more than 100 countries.

TECH RESOURCES INC.

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Established in 1979, Tech Resources is a leading supplier of EW test and support equipment for the US Navy, Air Force and Foreign Military Sales customers. Offering complete EW RF test solutions, Tech Resources provides products, services and expertise in operational and maintenance EW RF flight line test systems, antenna coupler sets and test program design and development. Products and engineering

support are provided for more than 50 types of combat platforms, including the F/A-18, the F-16, the F-15 and the AC-130 platforms, with current and advanced internal and external sophisticated EW RF system installations. The advanced "Check Six" family of test systems provides complete end-to-end operational testing, maintenance fault isolation and testing techniques. The Check Six test sets/systems also can aid in profiling weapons platforms with sophisticated EW RF system installations to achieve antenna coupler characterization, assist in the generation of test program sets and provide supporting utilities.

TECOM INDUSTRIES INC.

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TECOM Industries designs and builds antenna systems for the defense, commercial wireless and satellite communications markets. TECOM specializes in solving unique problems through custom designs, modifying standard products to meet special requirements and providing build-to-print capabilities for sophisticated antenna systems. For more than three decades, TECOM has produced hundreds of thousands of complex antennas and antenna systems, developing a comprehensive array of proven products and engineering expertise. Today, TECOM customers around the world benefit from a team of highly skilled engineers who respond to difficult challenges with innovative solutions and years of experience; a broad catalog of systems and components, available either for off-the-shelf delivery or as components of a custom system design; and product designs covering direction-finding, telemetry, communication and EW applications.

Every product is designed and built to the most exacting standards for both commercial and high-reliability military specifications. These standards are regularly confirmed through rigorous in-process inspections. TECOM is ISO 9001:2000-, AS-9100 Rev B- and ISO-14001:2004-registered.

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Teledyne Technologies Incorporated is a leading provider of sophisticated electronic components and subsystems, instrumentation and communication products, engineered systems, aerospace engines, and energy and power generation systems. Teledyne brings precision, performance, innovation and reliability to every program.

Teledyne Defence Ltd. (TDL), is a world leader in the design, development and manufacture of EW and Radar sub-systems, integrated assemblies, adaptive filters and components for compact military payloads and homeland security applications. Formally Filtronic, TDL has been supplying the needs of the electronic defence market for over 30 years.

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Teligy, a small business founded in 2002, is a provider of custom software and hardware design, development, and testing services. The company has built a reputation as an outsourcing partner, providing customized development solutions for both commercial and defense hardware systems. Our development services are specialized in the communications and networking industries. Some of the custom services we offer include developing device drivers, firmware, embedded applications, DSP algorithms, protocol stacks, board support packages, custom interfaces, embedded systems and testing and test plans. Teligy's development model includes time-tested procedures and coding standards that ensure consistent delivery of professionally engineered products.

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Terma develops and markets high-tech solutions, systems and products for civilian and military applications. Terma's headquarters is located in Lystrup near Århus, Denmark. The company is 100 percent Danish-owned.

Terma's high-tech solutions and products are developed and designed for use in extreme mission-critical environments and situations where human lives and valuable material assets are at stake. Terma's business areas cover aerostructures for aircraft; airborne systems, including self-protection systems for aircraft, audio systems solutions, reconnaissance systems for fighter aircraft and electronic manufacturing; integrated systems, including self-protection systems for ships and command and control systems for navy, army and air force applications; radar surveillance systems; and solutions, services and products for space applications.

In Denmark, Terma's facilities are located at Lystrup, Grenaa, Herlev and Skive. Abroad, Terma's locations include Leiden, the Netherlands; Darmstadt (near Frankfurt), Germany; Singapore and Washington, DC; and Warner Robins, GA.

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Thales is a world leader in the manufacture of TWTs for military telecommunications, including Tri-band, Ka-band and EHF-band. It also produces klystrons, magnetrons and other microwave vacuum electron devices for radar, countermeasures and related applications, as well as X-ray source tubes and detectors for cargo and baggage security inspection. Thales Components Corporation, based in New Jersey, is committed to offering Thales' high-quality products and services to US customers.

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Times Microwave Systems' cables and connectors have always been the solutions of choice for aircraft, helicopter and shipboard protection systems. The company's products have been used for decades to protect service men and women from a variety of ground, sea and airborne threats, and also as key communication systems to allow service members to talk and coordinate with one another.

Recently, as new types of threats have emerged, Times' products have become the solution for many companies designing and producing systems that protect US troops from IEDs.

Teamed with companies that provide these systems, Times has provided more than 30,000 assemblies and even more commercial bulk products to other companies to make these systems more agile and more effective in protecting US troops. Using commercial off-the-shelf (COTS) products and designing new armors to protect these links, Times has become the supplier of choice for cables and connectors for these new and evolving protection systems.

At Times Microwave Systems, it is a privilege to provide the expertise necessary to help protect US troops. The company looks forward to continuing this work in the future.

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TINEX, founded in 1991, is active within Defense, Security and Communications and Railway technology. Our activity includes customer advisory, development, delivery, set in operation, maintenance and training. In Norway, TINEX represents important international suppliers, which have achieved broad acknowledgement from customers all over the world. The strategy of TINEX is to make our customers even more competitive by offering optimal solutions. We cooperate with different partners depending on the nature of the

projects, in order to achieve optimal use of resources, maximize efficiency and increase the efficiency potential.

TINEX is a system house representing international companies and is a partner within public and defense projects in the following technologies: EW systems, Radars, Other sensors (active and passive), Communications, Security systems and Maintenance.

TINEX carries out design, installation and integration of C4I in various armored and unarmored vehicles.

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EW, radar and communications for the defense market.

TMD provides a wide range of products for the EW market for air, land and naval platforms. This product range includes power amplifiers and transmitter subsystems, microwave power modules (MPMs), microwave tubes and high voltage switched mode power supplies. The company also designs and manufactures instrumentation TWTAs for EW and radar simulation, training and calibration in less demanding laboratory environments.

TMD has established an international reputation for product reliability and innovation, particularly in the area of ultra low noise power supply design. The company is an expert in tube/power supply integration and has a track record of developing high power, high reliability products to difficult specifications. The latest development is a range of compact, lightweight MPMs (available in both pulsed and CW versions) – particularly suitable for airborne EW applications.

The company operates and is audited against the rigorous quality management system BS EN ISO9001:2000. It has won two UK Queen's Awards for Enterprise for International Trade in 2004 and for Innovation in 2005 (for ultra low-noise power supply design).

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TRAK Microwave is a world class supplier of high reliability microwave and RF components and sub-systems for the world's most demanding applications and environments. Our almost 50 years of experience in defense, space and wireless markets led us to become a major global supplier to manufacturers of military electronics, satellite, navigation and communication systems around the world. Our product lines consist of Integrated Microwave assemblies, Frequency Source products, Signal Control products, RF and microwave components, Ferrites, and Time and Frequency Systems.

TRAK Microwave defense products are found in airborne communications equipment, electronic warfare equipment, radar and missile applications. Space applications include components for communication, television broadcast, meteorological, earth resource, and intelligence gathering satellites. Our commercial products are used in point-to-point radio, wireless communications, base stations, collision avoidance systems, distance measuring equipment and airborne weather radar.

TRAK is specifically structured to provide customers with close technical

support and rapid product development and prototyping. Our philosophy provides a consistent and controlled evolution of applied RF technology and product development, which guarantees excellent performance and price benefits to our customers.

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TriaSys Technologies Corporation is a provider of innovative signal processing solutions for use in ISR and ES applications.

TriaSys provides individual software products, integrated systems and custom software engineering to support its customers' requirements. TriaSys product lines include telecommunications signal processing software, signal collection systems, tactical RF monitoring and ES systems, as well as wireless infrastructure systems for use in cellular and WiFi test beds.

Headquartered in Massachusetts, along with domestic and international sales representatives, TriaSys works closely with its customers to provide long-term solutions and on-site service and support.

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Tri Star Engineering is a Woman Owned, HUBZone Small Business which strives to continually innovate ourselves as a ready resource of expertise in acquisition logistics and Systems Engineering related to shipboard sensors and combat systems. Tri Star dramatically integrates ethical methods of empowerment which set us apart from the competition in providing services in a timely, affordable, and highly professional manner while sustaining the local, regional and national growth of our clients, our company, and our team members.

Tri Star Engineering supports primarily radio frequency (RF) systems such as the AN/SPS-48 Radar as well as active countermeasures systems such as NULKA, and the AN/SLQ-32 but also we support millimeter wave, and infrared (IR) systems. Tri Star employs experts in countermeasure capabilities currently being used by the Fleet for both shipboard and airborne applications, Tri Star has senior Electronic Warfare Technicians on staff, Tri Star personnel have performed threat analysis, system analysis, system design and development, system test and evaluation, data collection and analysis, computer simulation design

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TRU Corporation has been pioneering custom RF/microwave cable assemblies and interconnect solutions for more than 55 years. TRU Corporation manufactures interconnect assemblies and systems for complex, demanding applications in military, aerospace, telecom, semiconductor, medical and other commercial industries.

TRU Corporation focuses on creative design approaches to solve RF/microwave connectivity challenges, working closely with customers through its applications engineering team and providing thorough technical responses to project specifications. TRU's cable and cable assemblies are qualified on a number of airborne, shipborne and ground-based communications systems; ECM/EW platforms; and radar and missile applications.

TRU Corporation's products include broadband BMMA; BMA blindmate designs; 2.4 mm, 3.5 mm, SMA, N, HN, SC, TNC and EIA solutions; and quick disconnect QDS, QRM, SQS and MEIA connectors.

High-power, high-voltage, low-PIM RF/microwave applications up to 50 KW, 25 KV, are the company's specialty. TRU Corporation is ISO 9001:2000-certified.

U

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Ultra Electronics Telemus is a recognized industry leader in SIGINT and EW products, producing effective and advanced surveillance and countermeasure systems and suites for airborne, ground and naval applications. Ultra Electronics Telemus produces an elite line of Network-Centric Integrated Electronic Warfare Systems for use across all crucial domains from the frontlines of conflict to border and harbor security.

Based in Canada, Ultra Electronics Telemus has a 25-year history of design, development and manufacture of SIGINT and countermeasure systems. Ultra Electronics Telemus has developed a worldwide reputation for supplying vertically integrated advanced EW systems from its full breadth EW technology base. This includes the EAGLE family of integrated Surveillance Receiver and DF systems that has been designed for ELINT, COMINT and SIGINT applications.

The EAGLE is one of the most highly integrated digital electronic support receiver systems available in the world today for Intelligence, Surveillance and Reconnaissance missions and for the rapid and effective intercept, collection and analysis of communications and radar signals. The EAGLE has been designed to perform a variety of Electronic Support (ES) roles including Electronic Support Measures (ESM), Signals Intelligence (SIGINT).

W

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RF and photonics applications. Areas of expertise include electronic warfare (EW) system engineering and development, geolocation algorithm development, electromagnetic analysis, antenna design and analysis, signal processing for EW and communication applications, and RF/Microwave radiation hazard assessment.

Electromagnetic modeling projects include RF component design for antennas and filters. Pattern distortion analyses due to antenna mounting structures and mutual coupling between antenna arrays are conducted using finite element and method of moments tools such as the Numerical Electromagnetics Code (NEC).

Wavepoint Research performs systems analyses for electronic warfare (EW) applications involving high-speed digital receivers and post-processing as well as capability assessment. Applications include electronic intelligence (ELINT) signal processing, signal detection, parameter measurement, specific emitter identification (SEI), measurements of intentional modulation on pulse (IMOP) and other feature extraction. Systems studies involve the functional design, requirement allocation and performance characterization of signal processing algorithms for EW and other digital receiver applications. Additional EW projects include support of top-level assessment of threat-based requirements from a multi-spectral, multi-domain, and multi-mission perspective.

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Headquartered near Washington, DC in Reston, Virginia, X-COM Systems designs, manufactures, and sells advanced products and solutions to all branches of the Department of Defense (DOD) and to commercial technology companies worldwide.

At X-COM, we strive to bring advanced technologies and innovative solutions to our customers in the fields of RF test

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Through its key alliances with the world's top Fortune 500 RF test equipment manufacturers, X-COM has developed product lines that revolutionize the way RF data is captured, analyzed and utilized, bringing unprecedented capabilities to engineers and product developers in a myriad of industries. X-COM has also developed product lines that bring leading-edge digital waveform generation technology to deployable and niche applications not serviced by today's COTS waveform generator solutions.



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Zeta Associates is a world-class provider of Signals Intelligence (SIGINT) systems for the Military and Intelligence Communities. For more than 25 years, Zeta has been the provider of choice to solve some of the most pressing signal processing challenges for our customers.

Zeta develops SIGINT applications using the X-Midas software framework. This software-based approach enables multiple applications to be hosted on a single hardware suite, providing mission flexibility to engage multiple SOIs.

Zeta-developed applications focus on legacy and emerging military and commercial communication standards. If there is a signal of interest to the SIGINT analyst, odds are that Zeta has an application for it. Zeta also develops technology for performing precise, real-time geolocation of emitters of interest.

Zeta has extensive experience in dealing with challenging RF environments via advanced signal processing technology. Zeta's SIGINT applications are adept at handling multipath, co-channel interference, high-noise environments, and signals that don't perfectly follow their corresponding specifications.

Zeta SIGINT systems make extensive use of COTS/GOTS hardware technology tailored to the host platform, both in terms of SWAP as well as vibration and thermal requirements, and range from large rack-mount units down to six inch cubes optimized for UAVs and aerostats.

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association news

PT. MUGU CROW ROBERT L. NIELSON PASSES

Robert L. Nielson, a charter member of the Pt. Mugu Chapter, passed away in late December.

Bob was born August 3, 1933, to Dr. Lester R. Nielson M.D. and Lorraine Nielson. He grew up in Fresno and served his country in the Marine Corps during the Korean War. He graduated from Fresno State College with an electrical engineering degree. He worked in EW at Pt. Mugu for 28 years and was a 49 year resident of Ventura County.

He was a charter member of the Pt. Mugu AOC chapter and belonged to IEEE, Veterans of Foreign Wars, American Legion, NRA and NARFE. Family always came first, but he was an avid football fan and loved to do wood working. He always lived by the Marine Corps motto: Semper Fidelis, "Always Faithful."

Bob is survived by his wife of 52 years, Marvelle; son, Lester R. Nielson II; daughter, Melinda Bandler (David); grandsons, Jesse Nielson, Aaron and Alec Bandler; granddaughter, Chelsea Winn (Austin); great-granddaughter, Penelope Nielson.

The family asks that contributions be made to the Robert L. Nielson Memorial Engineering Scholarship. Checks should be made to Mugu Crows, Robert Nielson Scholarship; address: Mugu Crows, P.O. Box 4221, Port Hueneme, CA 93044-4221.

REGISTER FOR DIXIE CROW 35

The 35th Annual EW Dixie Crow Symposium, "Moving EW Technology to the Forefront," is March 21-25 at the Museum of Aviation in Warner Robins, GA. The registration Packet is now available at www.dixiecrow.org. There is no conference fee for registration; so please get your registration form completed and returned today. Details on registration, events and more can all be found at www.dixiecrow.org.

The newly remodeled Ramada Inn on Watson Blvd. has been announced as the 2010 Host Hotel. Make your reservations now via the Dixie Crow website or by phone. Please remember to reference either DC10 or Dixie Crow when making reservations to receive the reduced room rate.

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- Training Award

Nominations will need to include recommended award, justification/contribution for award and a proposed citation. Nominations are due by April 19. Visit www.crows.org to download a nomination form. ✍

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