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The

Electronic  
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# JED

*The Journal of Electronic Defense*



## CHARTING THE COURSE OF INDIAN EW

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# NEW PROGRAMS, NEW CHALLENGES

**T**he US EW community is going through an exciting period at the moment, as several EW development programs are currently in competition. Not only will these programs deliver critically needed EW capabilities to the operational community, the outcomes of these competitions also will help to shape the market landscape for the next decade.

In the IR arena, companies are chasing the Joint and Allied Threat Awareness System (JATAS) for US Navy and US Marine Corps aircraft. The US Air Force has selected a new two-color IR missile warner under its NexGen program, and the Army is considering a new XM-216 flare acquisition that may replace a number of flare types.

In the RF arena, the Navy is moving forward with its NextGen Jammer program, which will upgrade or replace the ALQ-99. It is pursuing a receiver upgrade for the SLQ-32 under Block 2 of the Surface Ship EW Improvement Program (SEWIP). The Navy also is soliciting proposals for development of new IED jammers under the CREW 3.3 program. Collectively, this is a lot of activity (and a lot of proposal writing for the EW industry).

About 15 years ago, the EW industry was enthusiastically pursuing a similar flood of opportunities. Programs like Common Missile Warning System (CMWS)/Advanced Threat Infrared Countermeasures (ATIRCM), the various components of the Navy's Integrated Defensive Electronic Countermeasures (IDECM) suite, the Army's Suite of Integrated RF Countermeasures (SIRFC) and the Navy's Advanced Integrated EW System (AIEWS) all come to mind. Industry and the services learned many tough but useful lessons from these acquisition programs - lessons that I see being applied to the new crop of programs.

In terms of acquisition policy, the United States (as well as many other countries) does not develop and buy EW systems in the same manner as it buys most other defense electronics systems like radars and radios. When it comes to acquiring EW, the customer typically is comfortable extending development schedules and then cutting or limiting production - at least until a major operation begins (consider the fate of those EW programs from 15 years ago if you don't believe me). When the shooting begins, however, the warfighter then wants new EW capabilities yesterday and cannot wait 12-18 months for production to ramp up.

While the DOD has learned many lessons about managing EW programs, it also is entering a period of budget uncertainty if not budget reductions. As with most DOD acquisition programs, these future EW programs will be under intense review even before many of them have entered the technology demonstration phase. Proving their value to senior decision-makers outside the EW community will be a challenge. This is a time when advocacy counts, but it also is a time when we should try to break the pattern under which the military customer typically buys EW equipment. The military acquisition system needs to buy EW the way it buys radars and radios - with steady, unwavering support. EW is not ancillary equipment that can be bought later. Too often, "later" means too late.

- John Knowles



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## PRODUCTION STAFF

**Layout & Design:** Barry Senyk  
**Advertising Art:** Melanie Meilleur  
**Contact the Editor:** (978) 509-1450, editor@crows.org  
**Contact the Sales Team Leader:**  
(800) 369-6220, ext. 3385, or (352) 333-3385  
sales@crows.org

**Subscription Information:** Please contact Glorianne O'Neillin at (703) 549-1600 or e-mail onellin@crows.org.

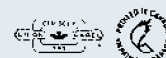
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New Delhi, Delhi  
www.defexpo.com

**IDEX 2009**

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www.idex2009.com

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February 25-26  
Washington, DC  
www.myaoc.org

**Air Warfare Symposium**

February 26-27  
Orlando, FL  
www.afa.org

**MARCH**

**Avalon 2009**

March 10-15  
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www.airshow.net.au/avalon2009

**Dixie Crow Symposium**

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**APRIL**

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www.myaoc.org

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www.laadexpo.com

**FiestaCrow 2009**

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San Antonio, TX  
www.bmcaoc.org

**InfowarCon 2009**

April 23-24  
Washington, DC  
www.infowarcon.com

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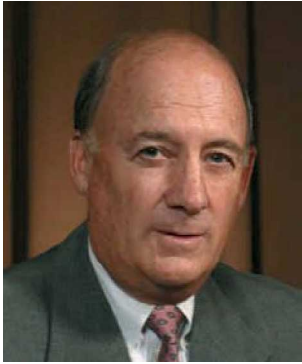
Stew Taylor  
*Director, Marketing*  
taylor@crowns.org

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*Manager, Meeting Services*  
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# SHAPING POLICY FOR THE EW DISCIPLINE

**A**s the AOC moves into 2009, I see changes on the horizon for our discipline in the United States; there is a new White House administration, a significantly different focus on Capitol Hill and thus a changing direction for the DOD. It is therefore vital that the AOC initiates contact with the Pentagon and Congress to advocate an agenda to keep EW moving in the right direction. In this vein, the AOC will go to the US Congress this month and present our newly developed EW policy agenda.

Our 2009 Policy Agenda has four basic positions. They are:

1. Improve EW leadership and organization in the DOD.
2. Strengthen investment in critical EW technologies.
3. Modernize legacy platform self-protection systems and aircraft survivability equipment (ASE).
4. Provide for next-generation EW systems.

The AOC's Government, Industry and Public Relations (GIPR) Committee believes that the agenda items listed above are the cornerstones of EW. These items must be pursued by the United States and allied governments around the world to ensure our discipline continues to provide the decisive capabilities needed by our combat forces in places like Afghanistan and Iraq, as well as in future areas of interest.

Among the United States and its allies, there are far too few senior military and civilian leaders who understand EW requirements, system sustainment and future investment strategy. And beyond leadership, without revamped organizational structures for EW and a greater focus on modernizing legacy systems for the short term, there will be gaps created in our EW architectures that will make it difficult to provide EW programs to support military operations and field commanders' requirements.

I did not list the items above in order of priority, but I believe that if our military services and defense ministries do not implement plans to develop strong career paths for EW leaders, the other agenda items will be difficult to implement. EW needs a corps of strong military and civilian leaders dedicated to ensure that it is not forgotten as funds are distributed for military programs.

We all must advocate for EW to ensure that EW programs are at the top of our military priority lists. For those in the United States, join the AOC this month in Washington, DC, as we advocate the AOC's policy agenda to lawmakers on Capitol Hill – it could be a critical time for EW and our voice must be heard by those who make financial decisions.

– Kermit Quick

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### US NAVY RELEASES RFP FOR NEW MISSILE WARNER

Naval Air Systems Command (NAVAIR) released the final request for proposals (RFP) January 13 for the development of the Joint and Allied Threat Awareness System (JATAS), a new missile warning system for Marine Corps and Navy rotary-wing aircraft. Industry bids are due March 12. NAVAIR anticipates awarding a 16-month Technology Development contract to each of two companies August 31 for JATAS requirements analysis, preliminary design and delivery of three prototypes for testing slated to occur 11 months after the contract award. NAVAIR subsequently plans to select a single company for an Engineering and Manufacturing Development phase in FY2011. The lead platform for JATAS is the Marine Corps' MV-22 Osprey tilt-rotor aircraft.

JATAS is expected to use either one- or two-color imaging infrared (IR) sensors instead of the ultraviolet sensors used on the existing AAR-47, AAR-54 and AAR-57 missile warning systems. JATAS would detect incoming IR-guided missiles, particularly those launched by shoulder-fired, man-portable air defense systems, and cue the aircraft's flare decoy dispenser and/or

laser-based directed IR countermeasures (DIRCM) system to defeat the attacking missiles. JATAS also would provide warning of enemy laser range finders, illuminators and beam riders.

An additional capability for hostile-fire indication (HFI) of small arms and rocket-propelled grenades is not currently part of the JATAS baseline. However, the JATAS Technology Development contracts will include tasking to try to mature the HFI capability to a Technology Readiness Level 6 for subsequent insertion into the JATAS baseline. (Four companies – Alliant Techsystems, BAE Systems, Lockheed Martin and Northrop Grumman – conducted live-fire tests of HFI processor prototypes for the Naval Research Lab last fall.) Another potential JATAS capability upgrade calls for improving situational awareness in visually degraded environments.

BAE Systems (Nashua, NH) told reporters January 19 that it had made significant progress recently in developing hostile-fire indication (HFI) technology that would protect low-flying military helicopters. Most helicopters have missile-warning and IR countermeasures systems, but they are vulnerable to small-arms fire, which is difficult to detect. BAE Systems said

its HFI prototype combines noise reduction, acoustic data and location algorithms to alert the air crew of hostile fire and the direction from which it is coming on a cockpit display so the helicopter can take evasive maneuvers. Program manager Bill Ashe said BAE's HFI system had measured acoustic data with its microphones and detected multiple-caliber small-arms fire from different locations with 100 percent accuracy during a dozen live-fire tests. The acoustic sensor tests were funded by BAE and were separate from the NRL contract. Ashe said BAE's HFI sensor is not designed to be a stand-alone system but to be integrated with other aircraft survivability equipment as part of a "blended" solution.

The JATAS program is managed by the Advanced Tactical Aircraft Protection Systems Program Office (PMA-272) within the Program Executive Office for Tactical Aircraft Programs at NAVAIR (NAS Patuxent River, MD). The RFP is posted on the NAVAIR website ([www.navair.navy.mil](http://www.navair.navy.mil)) under "Doing Business with Us" and "Open Solicitations." The JATAS solicitation number is N00019-08-R-0043; the NAVAIR point of contact is Tanis Meldrum at (301) 757-7079, e-mail [tanis.meldrum@navy.mil](mailto:tanis.meldrum@navy.mil). – G. Goodman

### USMC HELICOPTERS OUTFITTED WITH DIRCM

The CH-53D helicopter is slated to become the third US Marine Corps rotary-wing aircraft that will be equipped with Northrop Grumman's laser-based Directional IRCM (DIRCM) system for protection against shoulder-launched IR-guided missiles. Early last month, NAVAIR awarded a contract to the company's Defensive Systems Division (Rolling Meadows, IL) for DIRCM integration design, trial installation and flight tests leading to a production program enabling the CH-53D fleet to be outfitted with the system. NAVAIR awarded Northrop Grumman similar contracts last June for the Marine Corps' CH-53E and CH-46E helicopters. The company received a production contract in October for CH-53E DIRCM kits, which were delivered beginning in November. The first CH-53Es outfitted with the DIRCM system (installed by the Marines)



subsequently deployed overseas. In early January, NAVAIR also awarded Northrop Grumman a contract to finalize the DIRCM integration on the CH-46E; at the conclusion of this effort, later this year. NAVAIR expects to award the company a production contract for DIRCM kits for the CH-46E fleet.

Northrop Grumman's AAQ-24 DIRCM system was installed previously on US Air Force C-17 and C-130 transport aircraft as the Large Aircraft IR Countermeasures (LAIRCM) system, which uses

the company's AAR-54 imaging ultra-violet missile warning sensor. The Air Force funded development by Northrop Grumman of a LAIRCM Phase II system with a smaller and lighter laser pointer-tracker, or jam head, called Guardian, as well as a new two-color IR missile warning sensor called the Next-Generation Missile Warning System (NexGen MWS). LAIRCM Phase II will ultimately replace the existing LAIRCM systems on C-17s and C-130s and also could be installed on C-5 transports.

LAIRCM Phase II, with some differences in software and aircraft integration, is the DIRCM system being installed on the Marine Corps' CH-53 and CH-46 helicopters. NAVAIR refers to it as the AAQ-24(V)25 Department of the Navy (DON) LAIRCM system, and the Navy prefers to call the NexGen MWS simply the "Two-color IR MWS." The DON LAIRCM system going on the CH-53s and CH-46s features two laser jam heads, one on each side of the aircraft, and five warning sensors.

NAVAIR's planned JATAS MWS (see above news item), which will ultimately replace the two-color IR sensor on the CH-53s and CH-46s, is slated to be installed first on the Marine Corps' new MV-22 tilt-rotor aircraft. However, CAPT Paul Overstreet, the program manager for Advanced Tactical Aircraft Protection Systems (PMA-272) at NAVAIR, told *JED* that, under current plans, the MV-22s will not be fitted with the DON LAIRCM system but will wait for NAVAIR's planned new Assault DIRCM system. Development of Assault DIRCM,



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**BOEING BUYS SIGINT RECEIVER COMPANY**

Boeing (St. Louis, MO) announced in late December that it completed its acquisition of Digital Receiver Technology (DRT) (Germantown, MD), a purchase first announced in November 2008. A 27-year-old company formerly called Utica Systems, Inc., DRT develops and manufactures high-performance receivers and transceivers with signals-intelligence (SIGINT) applications for customers such as the Department of Defense, Department of Homeland Security and US intelligence agencies. DRT brings with it 370 employees and will operate under the umbrella of Boeing Integrated Defense Systems' Network & Space Systems unit in St. Louis. The acquisition marks Boeing's first activity in the EW/SIGINT systems manufacturing market since its sale of ARGO Systems, Inc., a defense electronics manufacturer that is now part of ITT (Clifton, NJ), more than 10 years ago. — M. Kunkel



which also will fit on smaller USMC and Navy helicopters, has not yet begun.

Northrop Grumman and the Air Force reached an agreement in December under which the company will move its LAIRCM system maintenance hub from Fort Walton Beach, FL, to the Robins AFB area in Georgia and will share future LAIRCM support work with the service's Warner Robins Air Logistics Center. This work, expected to ramp up substantially by FY2011, will encompass maintenance of not only Air Force LAIRCM systems but those on other services' aircraft, such as the Marine Corps helicopters. — G. Goodman

### STAND-IN JAMMER ADVANCES

The US Air Force's Air Armament Center at Eglin AFB, FL, awarded Raytheon Missile Systems (Tucson, AZ) a \$12.2 million contract modification last month to conduct a 14-month Block II "concept refinement study for data link and increased effective radiated power" for the jamming variant of the Miniature Air-Launched Decoy (MALD-J). The Air Force previously awarded Raytheon a two-year, \$80 million risk-reduction contract last April for MALD-J.

The basic MALD entered low-rate initial production last June and will become operational in the fourth quarter of this year. It is a cruise missile-like, turbojet-powered, expendable maneuvering decoy that is 9.5-foot long and 9 inches in diameter and weighs less than 300 pounds. Its range is about 500 nautical miles. MALD is launched by fighter and bomber aircraft (the F-16 and B-52 initially) and flies a preprogrammed flight

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path into hostile air space. It mimics the combat flight profiles and radar signatures of US strike aircraft to distract and confuse enemy air defenses. The decoy successfully completed 33 of 35 flight tests. Its target cost is \$150,000.

MALD-J adds a small, low-power, radar-jamming payload to MALD. MALD-J

figures prominently in the DOD's planned airborne electronic attack "system of systems" as a "stand-in" jammer that would fly close to enemy air defenses.

A data link capability for MALD and MALD-J was demonstrated last August in captive-carry flights on a T-39 Sabreliner aircraft during the Exercise Empire Challenge at the Naval Air Weapons Station, China Lake, CA. With a data link, the decoy could report its position and remaining flight time and potentially receive mission reprogramming while in flight. It also would allow operators of

MALD-J to know when the decoy's jamming of a particular enemy radar was about to run out. MALD-J's planned in-service date is FY2012. – G. Goodman

## NAVY HARM SUCCESSOR IN PRODUCTION

US Naval Air Systems Command awarded Alliant Techsystems a \$55.1 million contract December 23 for low-rate initial production of the AGM-88E Advanced Anti-Radiation Guided Missile (AARGM). Most of the work will be performed in Woodland Hills, CA, at the company's Mission Systems Group, Advanced Weapons Division. AARGM is the Navy's planned successor to its Raytheon Missile Systems-built AGM-88B/C High-Speed Anti-Radiation Missile (HARM). The Navy jointly developed AARGM with the Italian Air Force (Aeronautica Militare). The supersonic stand-off missile is slated for fielding beginning in FY2010 on Navy F/A-18C/D Hornets, F/A-18E/F Super Hornets, EA-18G Growlers and F-35 Joint Strike Fighters, as well as Italian Tornado IDS/ECR aircraft.

AARGM reuses the HARM's warhead, wings, fins and rocket motor and adds a new multi-mode seeker section and a GPS/inertial navigation system (INS). The new seeker section is designed to improve lethality against hostile radars that shut down to foil HARMs. It has a more sensitive digital anti-radiation homing receiver for passive detection, tracking and location of threat emitter systems and an active millimeter-wave (MMW) radar, which is used after a launch for terminal guidance when a target radar shuts down. The GPS/INS keeps the missile headed toward the radar's last known position, and the MMW radar actively searches to find the target. AARGM successfully completed 11 live-fire tests. – G. Goodman

## IN BRIEF

**Argon ST Inc.** (Fairfax, VA) announced that Kerry M. Rowe has been appointed President and Chief Operating Officer. Rowe, a member of the JED Editorial Advisory Board, joined the company in 2000, after 16 years at E-Systems and Raytheon.

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**BAE Systems** (Nashua, NH), **ITT** (Clifton, NJ), **Northrop Grumman** (Bethpage, NY) and **Raytheon** (Goleta, CA) were each awarded a \$5.5 to \$6 million contract by Naval Air Systems Command on January 16 for "research support in developing innovative concept solutions at the system level that address Next-Generation Jammer requirements." Contracts were solicited under a Broad Agency Announcement and four offers were received. Work is to be completed in July.



**Raytheon Missile Systems** (Tucson, AZ) was awarded a \$16.3 million US Air Force contract to conduct a High-Speed Anti-Radiation Missile (HARM) Targeting Systems Software Upgrade Program.



**Alloy Surfaces Co.** (Chester Township, PA), a subsidiary of the UK Chemring Group PLC, was awarded an indefinite-delivery/indefinite-quantity



**Johns Hopkins University's Applied Physics Lab** (Laurel, MD) was awarded a \$24 million ID/IQ contract by the US Air Force Aeronautical Systems Center (Wright-Patterson AFB, OH) for EW Capability Development Analyses and Support.




**Innovative Signals Technology (IsigTech)** (Scottsboro, AL), a provider of SIGINT products, and **Pikewerks Corp.** (Madison, AL), a leading provider of computer security products, announced last month that their joint team was awarded research and development funding from the DOD to provide secure SIGINT capabilities in support of border security and counter-terrorism initiatives.



**The Office of Naval Research** issued a Broad Agency Announcement (BAA) January 8 seeking white papers with proposals for next-generation EW technologies and techniques that will detect and defeat advanced threat systems, such as imaging IR sensor systems, active and passive tracking systems and missiles. The program point of contact is Lynn L. Christian at (703) 696-1575, e-mail christl@onr.navy.mil.



**Spectrum Signal Processing** (Burnaby, British Columbia), a sector of Vecima Networks Inc., announced January 9 that it has named Douglas Fast to the position of president. Spectrum Signal Processing manufactures software-defined radios and radio products for EW and SIGINT applications. Fast previously served 15 years as executive vice president of Vecima, a manufacturer of broadband-accessible products for cable, wireless and telephone networks that acquired Spectrum Signal Processing in 2007. 



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# w a s h i n g t o n

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## report

### 2010 DEFENSE BUDGET REQUEST DELAYED

The Defense Department's FY2010 budget request will not be submitted to Congress until April 2009 instead of early February as is customary, according to various published reports, because officials from the new Obama administration want an opportunity to review it and make minor changes before it is sent to Congress. The DOD plans to send only a summary budget outline to Congress February 2, and then it will draft the final detailed FY2010 budget request over a period of two months after receiving fiscal and policy guidance from the incoming Administration, particularly in regard to the wars in Iraq and Afghanistan. In related news, the DOD's Quadrennial Defense Review (QDR) has been advanced to February. The QDR, a congressionally mandated examination of the national defense strategy and the military services' force structure, modernization plans and infrastructure, typically takes up to 10 months to complete.

Robert Gates, who remains the Secretary of Defense under the new Administration, directed an early and quick start to the QDR to allow its initial findings to be implemented in shaping the new FY2010 defense budget request by April, according to *Inside the Pentagon*. The publication also reported last month that Gates intends to direct major changes in the DOD's weapon system investment plans this spring. — G. Goodman

### NEW ARMY OFFICER EW QUALIFICATION COURSE

The US Army is moving ahead with its plans to make EW a core competency at all levels, from service component commands to battalion level in its active component, Army National Guard and Army Reserve. The second pilot iteration of the service's new EW Officer Qualification Course (FA29), part of the creation of an EW Officer Functional Area for commissioned officers, began January 12 at Fort Sill, OK.

The 10-week-long course, together with a third pilot iteration scheduled for June 1, offers more EW training than the Army's previous Additional Skill Identifier (ASI) 1J course and upon completion of the courses, officers will have the option to request a career field transfer. Later this year, the Army will offer courses for a second career track, the military occupational specialty (MOS) for sergeants, warrant officers and commissioned officers.

"The new graduates will man positions in Army operations sections, not in intelligence sections, where our electronic warfare types have served in the past," said COL Laurie Buckhout, chief of the Army's EW Division, a branch created in 2006 as part of Army Headquarters.

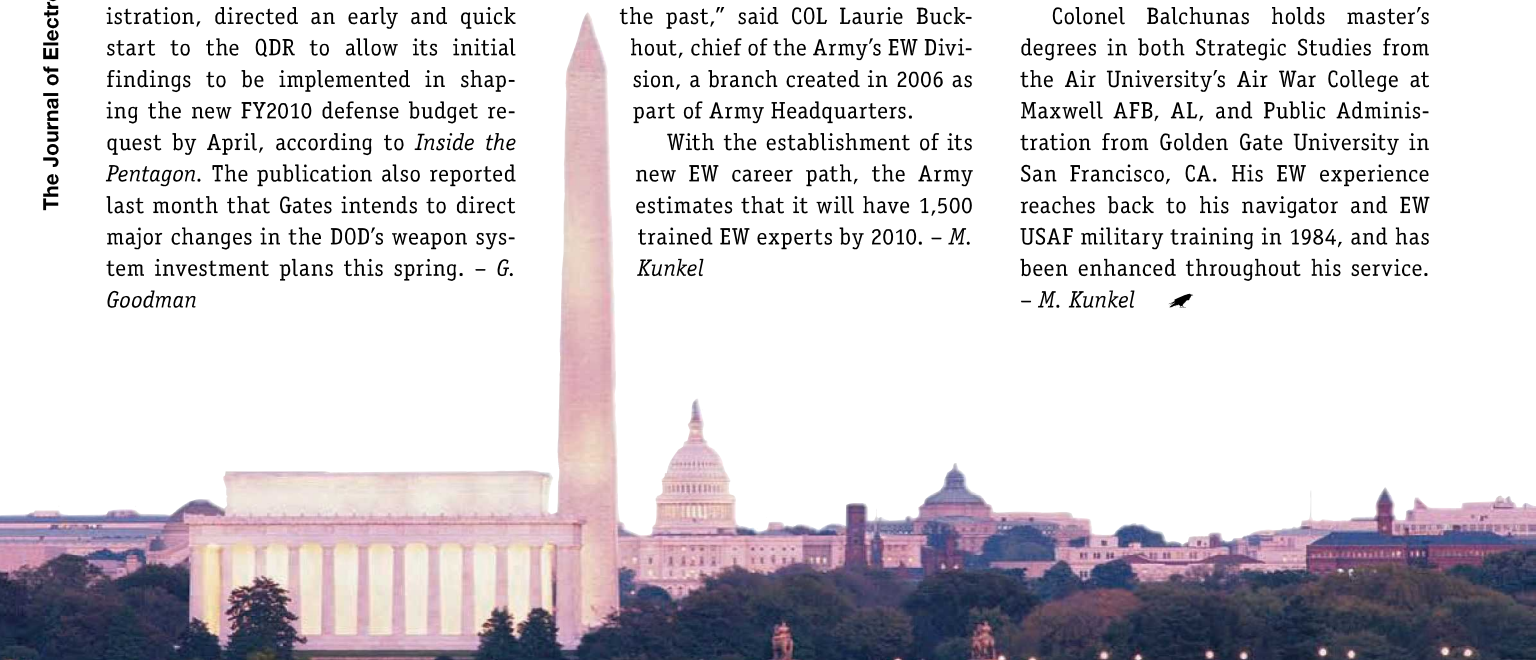
With the establishment of its new EW career path, the Army estimates that it will have 1,500 trained EW experts by 2010. — M. Kunkel

### AOC HIRES NEW DIRECTOR OF OPERATIONS

Colonel Norman J. Balchunas, USAF (Ret), will join the Association of Old Crows (AOC) February 15 as its new Director of Operations. Colonel Balchunas enters the AOC having retired from the US Air Force February 1 after a period of service that spanned 25 years and included such responsibilities as commanding B-52 operations in Operations Enduring and Iraqi Freedom, supervising the world's largest aerospace education program for more than 100,000 students and instructors, performing oversight of international cyber activities and integrating the Joint Warfare Analysis Center and Information Operations into combat operations.

Colonel Balchunas' responsibilities within the AOC will capitalize on his extensive EW expertise. He primarily will lend assistance in planning all future AOC conferences, including support to the AOC's IO Institute and InfowarCon, as well as overseeing the AOC's education program and acting as managing editor of the Every Crow Workbook and certification.

Colonel Balchunas holds master's degrees in both Strategic Studies from the Air University's Air War College at Maxwell AFB, AL, and Public Administration from Golden Gate University in San Francisco, CA. His EW experience reaches back to his navigator and EW USAF military training in 1984, and has been enhanced throughout his service. — M. Kunkel





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# w o r l d report

## INDIA BUYS SAAB EW SUITE FOR ITS HELICOPTERS

India awarded Saab Avitronics (Järfällä, Sweden) full-rate production orders in late December for the company's Integrated Defensive Aids Suite (IDAS), which will be installed on Dhruv Advanced Light Helicopters to provide them with EW self-protection. The combined value of the orders from Hindustan Aeronautics Limited (HAL) was about \$24 million. Production will occur at Saab Avitronics facilities in Centurion, Pretoria, South Africa.

IDAS features radar, laser and ultraviolet missile approach warning sensors and can trigger the dispensing of expendable countermeasure decoys. It is fully integrated into the Dhruv's digital "glass" cockpit. India's Dhruv (Pole Star) multi-role helicopter is manufac-

tured by HAL, and is in service with a number of militaries around the world in different variants. HAL has delivered about 80 of the helicopters to the Indian armed forces and another 235 are on order. IDAS will be installed on armed versions of the Dhruv. A "weapon system-integrated" version of the Dhruv is under development by HAL that will be equipped with a forward-looking in-

fared (IR) sensor turret and stub wings that can carry eight anti-tank missiles, four air-to-air missiles or four 70mm and 68mm rocket pods.

IDAS was previously selected for installation on a number of other military helicopters, including Denel of South Africa's Rooivalk and Oryx, NH Industries' NH-90, Agusta Westland's Super Lynx 300 and A109, Boeing's CH-47 Chinook and Eurocopter's Cougar and Super Puma. – G. Goodman

## INDIA ORDERS MARITIME PATROL AIRCRAFT

India's defense ministry, in what will be its largest defense purchase to date from the United States, signed a \$2.1 billion deal with Boeing to buy eight P-8I maritime patrol and reconnaissance/anti-submarine warfare aircraft for the Indian Navy. The long-range P-8I will be a customized variant of the P-8A Poseidon Multi-mission Maritime Aircraft being developed by Boeing for the US Navy to replace the service's aging P-3C Orions. The P-8A Poseidon is a militarized version of the Boeing 737 commercial airliner. The first P-8I is to be delivered to India in late 2012 or early 2013 and the other seven by 2015. The aircraft will be used to patrol India's 4,700-mile coastline and will replace the Indian navy's eight aging Russian turboprop Tupolev-142M maritime patrol aircraft. The contract with Boeing, still subject to final US government approval, includes an option for India to order four to eight additional P8Is. India is the first international customer for the P-8. The US Navy plans to purchase 108 P-8As; an initial operational capability is slated for 2013. The first test aircraft has been assembled and will soon move to Boeing Field in Seattle, WA, for pre-flight systems integration and testing. – G. Goodman

## IN BRIEF

- **Australia's** Department of Defense in Melbourne released a request for proposals (RFP) soliciting industry interest in providing capability options and demonstrations for evaluating the prospects for integrating a defensive aids suite on its army's Australia Light Armored Vehicle (ASLAV) to improve its survivability and situational awareness. The point of contact is Jason Tait at (03) 9282-6603, e-mail jason.tait2@defence.gov.au.
- **India's** Defense Research and Development Organization (DRDO) announced last month that its Defense Avionics Research Establishment (DARE) laboratory in Bangalore had developed an indoor antenna test range facility, the first of its kind in India, to characterize both electronic support measures (ESM) and electronic countermeasures (ECM) antennas. DRDO said the facility covers a wide range for pattern characterization and also can measure direction-finding accuracy. The DARE lab has recently been upgrading the avionics of India's Russian-built MiG-27 fighter aircraft. ✎

## TERMA IRCM POD SELECTED FOR TORNADO GR4

Terma (Lystrup, Denmark) was awarded a contract by BAE Systems last month to supply its Modular Countermeasures Pod (MCP) for the Royal Air Force's (RAF) Tornado GR4 ground attack aircraft under an accelerated program. The RAF wants to improve the IR countermeasures capability of these aircraft as they assume a greater role in NATO air operations in Afghanistan this summer and require improved self-protection against man-portable shoulder-launched IR-guided missiles. Deliveries of the MCP will occur this spring. The pod for the Tornado GR4 is a derivative of the Terma's MCP that includes missile approach warning sensors and flare dispensers and is designed to work at the high speeds and low altitudes flown by the Tornado GR4. The MCP is operational on several other aircraft in the UK, Germany and The Netherlands. – G. Goodman



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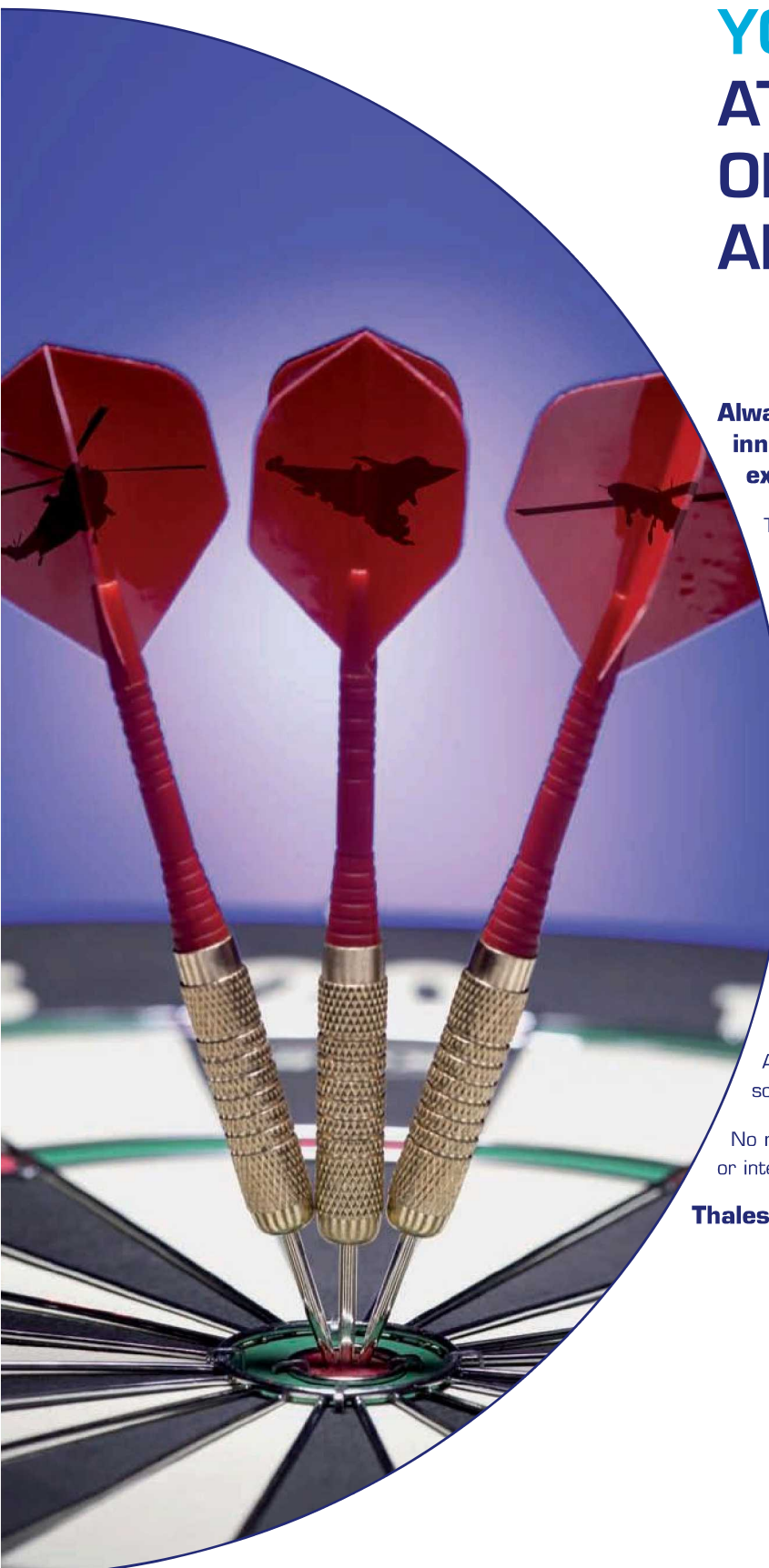
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# Charting the Course

By John Knowles

Throughout its long history, India has seen many ideas, cultures and conquerors flow across its borders. As a nation, it has always found a way to adapt to these changes and absorb them until eventually they became part of India itself. Today, India once again is facing an influx of ideas and money. Its economy is growing rapidly, and foreign companies are keen to get a foothold in India's technology markets. The country's defense technology sector is no different. In fact, India has gradually evolved its defense industrial policy over the past decade with an eye toward drawing foreign companies into its market.

This policy is working. More than 200 foreign companies are expected to exhibit at Aero India this month. Among these are the world's leading electronic warfare (EW) manufacturers from Israel, Europe and the United States. These companies are not merely "testing the waters." Most of them have already established joint ventures and partnerships with several Indian defense companies and government laboratories. For India's EW community, the coming decade promises to be exciting, as decades of internal EW development and progress are combined with new ideas and technologies from around the world. For foreign EW companies, the question is not so much about opportunities. Rather, it is about how much technology and know-how they can afford to transfer to India, whose companies are undoubtedly poised to become major players (and competitors) in the global EW market.

## SELF-RELIANCE

Over many decades, India has developed a well-organized defense re-

search and production capability with the stated goal of making the nation self-sufficient in defense. In realizing this policy, India created more than 50 laboratories under the Defence Research and Development Organization (DRDO). These labs, which collectively employ about 30,000 personnel, cover all aspects of the military's needs, from clothing and ammunition to major weapons systems development. On the production end, the government's 40 "Ordnance Factories" and eight Defence Public Sector Undertakings (DPSUs) are tasked with manufacturing the equipment developed by DRDO's labs. Among these DPSUs, Bharat Electronics Ltd. (BEL) has grown to become the country's leading EW systems manufacturer, supplying most of the EW systems bought by India's armed forces.

At the same time that India was becoming more self-reliant in defense production, it did not entirely shun defense imports. For many decades, it turned to the Soviet Union (and later Russia) to supply aircraft, ships and ground vehicles, some of which were built under license by government-owned defense manufacturers like Hindustan Aeronautics Ltd. (HAL). Occasionally, India has bought Western weapons systems, such as the Jaguar IT/IM (locally known as Shamsher) and Mirage 2000 fighters from France, both of which were procured in the 1980s. Sometimes, India has bought Western avionics and EW systems and integrated them onto Soviet/Russian-sourced platforms. However, the Indian government is frequently reminded that the EW capabilities it needs sometimes may not be available on the international market, may not be releasable to India or may not be affordable. As a result, India has always continued

to support its domestic defense production policy, and its government-owned companies still manufacture the bulk of the Indian Armed Forces' EW equipment.

## A NEW ERA

Although India's self-reliance policy has met the government's goals and supplied most of the military's needs, the country's armed forces are increasingly aware that government-owned companies have struggled to develop state-of-the-art technology in some specialized defense areas, such as EW. India's main rival, Pakistan, is buying advanced US and European weapon systems, such as Block 50/52 F-16 aircraft and French Agosta-90B submarines. China also is buying and manufacturing advanced Russian-designed weapons systems, such as S-300PMU1/PMU2 air defense systems. In order to keep pace with these weapons systems, India has taken incremental steps to supplement its domestic defense technology base. In 1997, the government identified its two leading DPSUs, HAL and BEL, and gave them Navratna status. This allowed them to act more like private companies, establishing partnerships with defense companies outside India and selling defense products and services to foreign governments. While this strategy helped deliver some advanced technology into the hands of India's Armed Forces, it still left DRDO and manufacturing giants like HAL and BEL in a noncompetitive market.

In 2001, the Indian Government took another firm step toward privatization when it announced that it would allow private companies in key technology sectors to develop and manufacture equipment for the Indian Armed Forces. These com-



# of Indian EW



in which DLRL is currently concentrating is the development of electronic support measures (ESM) receivers and jammers for unmanned aerial vehicles (UAVs), such as the Air Force's Gagan and Rustam UAVs. It also has developed a family of vehicle-mounted communications jammers to defeat improvised explosive devices (IEDs).

DARE is among DRDO's newest labs. It was established in 1986 as a smaller project laboratory and achieved full DRDO lab status in 2001. It concentrates on airborne EW systems and mission avionics. It has delivered several RWR and jamming systems to the Indian Air Force, and it has aggressively pursued partnerships with foreign EW manufacturers. In 2006, it inked a deal with EADS Defence and Security (Munich, Germany) to work together on development of a missile warning system. DARE also has launched a partnership with Elisra of Israel to develop a range of EW systems technology for Israeli and Indian aircraft. Last year, DARE opened a new campus in Bangalore, as well as a new indoor antenna test range.

## MANUFACTURED IN INDIA

Just as DARE has established itself as a new EW developer alongside DLRL, the dynamics of India's EW manufacturing base also is poised to change.

Most of the EW systems developed by DLRL and DARE historically have been manufactured by a government-owned company, such as BEL or Electronics Corporation of India Ltd. (ECIL). BEL is the undisputed giant within India's EW industry. Its product range extends beyond EW and includes communications systems, ground-based and naval radars, night vision systems and networked C4I systems. In the EW market, it has been involved in most of India's major EW programs since the 1980s. Last summer, it opened a new facility for the production

panies were allowed to establish joint ventures with foreign companies, who were limited to 26 percent ownership. This enabled newer players, such as Tata Power, to enter the EW market.

India's decision to broaden its EW acquisition base to the private sector was not a repudiation of the self-reliance policy or organizations like DRDO or BEL. Rather, it was an effort to make them more efficient and competitive and to create vehicles in which foreign investment and technology could enter India. India's armed forces are certainly pleased with the situation, as they can buy from a wider range of sources. These reforms are the beginning of an ongoing privatization process that will evolve over many more years, if not decades.

## DESIGNED IN INDIA

India has for decades built up its homegrown EW infrastructure. Within DRDO, this includes the Defence Electronics Research Lab (DLRL) in Hyderabad, which has been in operation since

1956, and the Defence Avionics Research Establishment (DARE) in Bangalore. These two labs have been the starting point for many of India's major EW programs, and they still are playing this role today.

DLRL was the first DRDO lab to pursue EW programs, and it is still the main EW developer decades later. Among its more recent initiatives, DLRL has developed a family of airborne, shipboard and submarine EW systems for the Indian Navy under the Sangraha project. It also has collaborated with the Indian Army's Corps of Signals to develop the Samyukta family of electronics intelligence (ELINT) and communications intelligence (COMINT) systems, as well as radar- and communications-jamming systems. India's Air Force uses DLRL-developed EW systems, such as the Tranquil Radar Warning Receiver (RWR) and Tempest jammer, on several of its combat aircraft. DLRL also maintains a large test and evaluation facility, its Electronic System Engineering Centre (ELSEC). One of the areas

of land-based EW systems, such as the Samyukta. It also has built systems for the Navy's Sangraha program and the Air Force's Tarang and Tranquil RWRs, as well as the Tempest jammer. Although BEL is well-established in the domestic EW market, it has taken advantage of the government's recent policy changes by establishing partnerships with companies such as Northrop Grumman, IAI and Elisra.

ECIL was started in 1967 with the aim of producing a wide range of electronic components and systems, such as computers and communications systems. Within its defense sector, the Communications Division manufactures fixed and mobile HF/VHF/UHF COMINT systems, vehicle-mounted VHF/UHF jammers and compact IED jammers. It also is partnered with BEL for the manufacturing phase of the Army's Samyukta EW system. ECIL's Telecom Division makes the EC PGSM-16, a GSM monitoring system used by the security forces. Unlike BEL, ECIL has not aggressively pursued EW-based partnerships with private companies.

Manufacturers, such as BEL and ECIL, manufacture many of the microwave components they need for their EW and signals-intelligence (SIGINT) systems. However, India also is home to a growing industry of small and medium-sized microwave component manufacturers. The birth of the telecoms market in the 1990s certainly accounts for many of the radio frequency (RF) components manufacturers in India today. During the 1990s, India (as well as Pakistan) was subject to an embargo of US-sourced defense electronics components due to its nuclear weapons program. Shut off from many of the components it needed for EW, radar and communications systems, India's defense labs and manufacturing companies redesigned systems, sought new components sources abroad and, more importantly, grew their microwave components industry at home. As a result, it largely deflected the impact of the arms embargo and, some would say, came out of the decade stronger and more self-reliant than before.

Companies such as Astra Microwave in Hyderabad were launched at this

time. Astra designs and manufactures a range of EW components and subsystems, including a 2- to 18-GHz Digital IFM receiver, an 8- to 18-GHz superhet receiver, front-end amplifiers, 0.5- to 18-GHz spiral antennas and a family of COMINT receivers covering the 30-MHz to 1-GHz range. Astra is not merely selling to domestic defense manufacturers. In late 2008, for example, Elta of Israel awarded a US\$11.5 million contract to Astra to supply components in support of the multi-mode radar program for the Tejas light combat aircraft. Many foreign EW companies are expected to turn to Astra and other domestic components suppliers to help meet their offset requirements in future EW programs.

### NEW PLAYERS, NEW PARTNERS

In general, India's government-owned EW organizations have successfully delivered the EW capabilities needed by the armed forces. While DRDO has been criticized for slow delivery or failing to complete some EW programs, this is typically due to changing needs within the Indian Armed Forces. In fairness, this

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is typical of many EW development programs across the globe. It also is not surprising in a market with little competition.

Government labs, such as DLRL and DARE, and manufacturing companies, such as BEL and ECIL, historically have dominated India's EW industry. Over the past decade, however, the Indian government has initiated several reforms aimed at opening up India's defense market (including EW) without undermining the long-standing policy of self-reliance. The goal of these reforms is not to take revenue away from DRDO and DP-SUs like BEL. Rather, the objective is to create a vehicle for foreign technology transfer and investment in India. This largely is being accomplished by allowing more private Indian corporations to compete in the growing defense sector.

Part of this new policy includes technology transfer and offset requirements between 30 and 50 percent, depending on the program. With as much as \$5 billion in offsets expected over the next five years alone, it is no surprise that India's large and small companies, such as Tata, Larsen & Toubro, Alpha Design Technologies and Shoghi Communications, have entered the EW market.

Tata has two divisions that serve the EW market. Tata Power's Strategic Electronics Division in Bangalore has been in the defense market for many years and is a production partner with BEL on the Army's Samyukta EW system. Tata Advanced Systems is relatively new to the defense market, but it has staked out EW as one of its core markets. Advanced Systems also has been the main Tata business unit to establish defense-oriented joint ventures with foreign partners, such as EADS, Boeing, Sikorsky, IAI and Raytheon.

While Tata has been the most aggressive of the new players, other Indian companies have allied with some of the largest EW companies in Europe, Israel and the United States. Alpha Design Technologies of Bangalore has partnered with Elettronica S.p.A. of Italy to pursue a range of EW programs. Rolta India Ltd. has teamed with French-Anglo defense giant Thales to create Rolta Thales Ltd., which will focus on C4ISTAR op-

portunities, including SIGINT.

The scope of these partnerships is sometimes broad and sometimes limited to specific programs or opportunities. One such opportunity is the biggest defense program in India's history.

### THE RIGHT PROGRAM AT THE RIGHT TIME

Indian defense procurement policy continues to evolve, and so far the changes seem to be working. While the Indian defense market has captured the general attention of the global defense industry, the country's high-profile fighter program has brought many unprecedented investment and technology transfer opportunities to its industry. The Medium Multi-Role Combat Aircraft (MMRCA) program calls for the procurement of 126 aircraft to replace the Indian Air Force's aging MiG-21/23/27 aircraft. Delays in programs such as the Tejas light combat aircraft could mean additional orders beyond the 126 aircraft.

The MMRCA program is worth more than Rs 42,000 crore (US\$10 billion), with another \$5.5 billion on the table if India decides to exercise options for 74 additional aircraft. India clearly understands the program's value to foreign defense suppliers, as well as its domestic industry. It has shaped the terms of the program accordingly, with a 50 percent offset requirement.

At present, six aircraft are in contention. Saab and BAE Systems are bidding the JAS 39IN Gripen, Dassault is bidding its Rafale and Mikoyan is offering the MiG-35, which made its first international appearance at Aero India in 2007. The Eurofighter Consortium is offering its Typhoon, while Lockheed Martin is bidding its F-16IN (similar to the Block 60) and Boeing is competing with its F-18IN (similar to its F-18E/F).


Much has been said about the proposal and transfer of Active Electronically Scanned Array (AESA) radar technology in the MMRCA program. What is equally

valuable to India is the EW technology in these aircraft. The winning bid almost certainly will

feature a digital RWR, as well as state-of-the-art RF countermeasures technology, possibly including towed decoys. Saab Avionics is supplying an updated version of the EWS39 system for the Gripen bid. Thales and MBDA are offering the Spectra EW suite for the Rafale. Mikoyan could use EW as one of its major offsets and ask DARE and BEL to build the RWR for its MiG-35 bid, which also features a new Optical Locator System (OLS). The Typhoon bid is expected to feature the Praetorian Defensive Aids Subsystem (DASS) from the Selex/Elettronica/Indra/EADS team that developed it. The F-18IN bid includes the aircraft's Integrated Defensive Electronic Countermeasures (IDECM) suite from Raytheon and ITT Electronic Systems. Finally, the F-16IN bid is believed to include an EW suite developed by Northrop Grumman.

EW is not likely to be the deciding factor in the MMRCA program, but it will be important, as India wants state-of-the-art EW capabilities and technology transfer. India has taken a patient approach to the program (the initial RFI was released in 2001 and the RFP did not follow until 2007). It is expected to stretch out for several more years, which should enable bidders to negotiate offsets with Indian companies. With the EW portion of the program estimated at nearly \$500 million, it is a very attractive opportunity that also is well-timed to match evolving defense production policy.

### A LONG JOURNEY

India has built a successful EW industry that has met the country's strategy of self-reliance while delivering EW capabilities that have matched the threat systems of Pakistan and China. In recent years, the government has found ways to present itself as an attractive market for foreign EW companies without losing sight of its overarching industrial goals. As India strives to develop its influence in the region and in the world, foreign defense suppliers are certain to play a part in its growth. 





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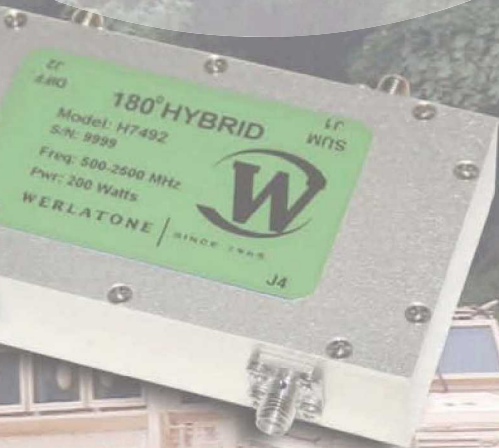
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# What's Next in Data Recorders?

As technology and customer requirements pick up steam, data recorder manufacturers charge full speed ahead

By Marianne Kunkel

**T**here is one basic rule to follow in the data recorder industry – always stay one step ahead. Fueled by lessons from the Gulf War and, more recently, the Global War on Terror (GWOT), the market for data recorders with electronic warfare (EW) and signals intelligence (SIGINT) applications has grown steadily over the past 20 years. Major advances in digital sensor technology, combined with the military user's ever-growing appetite for information, have driven strong demand for a wide variety of data recording solutions.

Without a doubt, the most significant trend has been the shift from analog to digital or, more specifically, from tape-based memory to magnetic disk and solid-state media. At the same time, however, military users want smaller recorders that offer sharper recording quality and increased versatility. Manufacturers are doing their best to stay competitive. Some offer cutting-edge technology and innovation, while others advertise their specialization and product knowledge. In truth, the industry is thriving because its customers' EW needs are as diverse as their missions, and are only growing more diverse every day.

In this month's article, *JED* spotlights the EW and SIGINT data recorder market and asks, what's next on the horizon? What is the current state of data recorder technology and what does this tell us about its direction for the future?



*L-3 Communications Systems' RM-3000F solid-state recorder, the standard data recording tool for F-16 podded reconnaissance missions.*

## TRIM IT DOWN, PLEASE

The desire for smaller, lighter technology is not exclusive to buyers of commercial gadgets such as iPods

and laptops. In fact, size, weight and power (SWAP) are three concerns that have shaped the data recorder industry since its birth. Companies like DRS

Technologies, for example, have improved from earlier, bulky “black box” recorders capable of capturing 100 MHz of signal bandwidth to recorders with 500 MHz of signal bandwidth (its removable disk/solid-state Eagle Xpress Recorder) to its newest release in late 2008 – a 3x1.5x6-inch, solid-state Scout SSR Recorder that weighs less than 2 pounds and consumes 8 watts. What this product might lack in signal bandwidth – only 40 MHz, compared to DRS’s other 100- and 500-MHz recorders – it makes up for in power consumption and convenience, especially for post-event analysis applications.

Explained Kerry Rye, business development/sales director at DRS Technologies, “Unless you’re dealing with a large SIGINT aircraft such as the Rivet Joint platform, there’s not much space to accommodate a recorder in most mission environments and when a recorder is present, it’s strictly used for prosecuting real time. DRS has tackled this problem with the SWAP design of the Scout Recorder, which addresses space limitations while offering technology for missions that haven’t previously incorporated SIGINT recording capability. For instance, for counter-IED applications, the Scout offers ways to evaluate missions and answer questions such as, ‘Why weren’t we able to jam that signal and why did the event occur?’ With a number of Scouts installed on various convoys, you can look back in time and ask, ‘What happened?’ This was never before possible because a 40-pound, 200-Watt recorder wouldn’t be placed in a convoy that was already overweight and didn’t have enough power.”

Fitting the highest possible performance into the smallest possible space was what Avalon Electronics Ltd., a British company that has been in the data recorder business for more than 25 years, had in mind when it switched from tape to disk recording technology about 10 years ago. It adopted disk drive-based data recorders as its primary product to keep up with the ever wider bandwidths that the SIGINT community wanted to record, and it now offers IF and baseband data recorders at up to 500 MHz of bandwidth. Its bestselling SIGINT data recorder, however, remains the 80-100 MHz



*The File Server System (FSS) by L-3 Communications Systems was developed for the USAF/Boeing B-52H CONECT program. It features removable solid-state memory drives.*

multi-channel AE8400 series, designed for use in laboratory, ground vehicle, ship, submarine and aircraft platform environments. “Luckily, with the capacity of the disk drives that we can buy these days,” said Avalon’s Marketing Director John Howard, “we can get a vast amount of recording time into a package that occupies only 7 inches of rack space.”

TEK Microsystems’ unique corner on the data recorder market is its Field Programmable Gate Array (FPGA)-centric data acquisition technology, meaning that it imports all of its data recorder software and firmware – usually in the form of a 6U VME/VXS card – inside an FPGA to achieve an extremely high channel count in an extremely small space. Designed specifically for radar, EW, SIGINT and ELINT applications, the company’s QuiXilica V5 digitizer boards are configured for analog and run on three Xilinx Virtex-5 FPGAs, each with two banks of DDR3 SDRAM of 512 MB each. Tekmicro has found success in providing a recording option that is not processor-oriented, and thus smaller and faster – for the QuiXilica architecture, 4 Gigasamples per second and beyond – for airborne, ground and even laboratory-type systems.

But rather than branch out from processor-oriented architectures, data recorder manufacturers such as L-3 Communications counter SWAP-related obstacles by turning to commercial off-the-shelf (COTS) technology. L-3 incorporates this technology into its data recorders, and then ruggedizes it so that it can withstand military environments. “One of our challenges is to figure out how to get a tremendous amount of data in a small space, and then dissipate all of

the heat that those boxes generate in a very tough airborne environment where sometimes they’re in a pod and there’s not a whole lot of air,” said David Micha, Director of Intelligence, Surveillance and Reconnaissance (ISR) Systems at L-3 Communication Systems-East (Camden, NJ). “What we’ve done over the last 15 or 20 years is develop some very proprietary technology where we can basically buy commercial memory – the same as digital camera manufacturers use – and we’ve developed ways of packaging it so that we get a lot of packaging density.” L-3 Communications has supplied its S/TAR™ product line of solid-state and magnetic disk recorders since 1998 to a mix of domestic and international government programs, such as the US Navy’s F-18E/F Shared Reconnaissance Pod (SHARP), the US Air Force’s F-16 Tactical Airborne Reconnaissance Systems (TARS) and Sweden’s JAS 39 Modular Reconnaissance Pod.

## FLEX THOSE MUSCLES

With the ever-increasing number and variety of EW and SIGINT missions in today’s world, data recorder manufacturers have learned that it pays to offer flexibility. John Hardy, business development manager for Naval and Maritime Systems at Ampex Data Systems, explained it this way: “One of my Navy customers recently said, ‘You know, I really like this control panel, but I’d sure like to have it so that if we’re running a built-in test sequence, once that sequence is finished, I get a little green light that flashes, and then I get a reset button.’ I said, ‘OK, you’re getting a signal now and it’s in a text format.’ And

he said, 'Yeah, I know.' So I said, 'OK, we can do that. Anything's possible.'"

Going forward, Hardy said, Ampex Data Systems' continued success will hinge on whether it is able to effectively keep its ear low to the ground for changing requirements and customer demands. Because the funding for US government programs is currently very limited, some organizations are approaching Ampex for a data recorder product having already settled on or configured a specific recording platform or format. This past November, Ampex announced that it had signed an agreement with Boeing to incorporate the latter's IntelliBus data acquisition technology into the Ampex data recorder product line, first as a Network Interface Control (NIC) module on its miniR700 solid-state recorder (Ampex's bestselling product, with 14 to

be adapted to various input devices very quickly. In its 10-plus years of making data recorders, VMETRO has grown to rely heavily on COTS products, said Tom Bohman, vice president of business development. "I'd say 90 percent of our products are COTS, and it's really a matter of targeting a product with an appropriate input and driver and a relatively small amount of NRE [non-recurring engineering] to connect it to the recording engine," Bohman said. "I think this really makes us stand out in terms of the flexibility and cost-effectiveness that we bring to what otherwise might be considered a custom recorder." Curtiss-Wright's Vortex Ultra Wideband (UWB) data recorder, designed for SIGINT and radar applications, offers 1-GHz analog bandwidth, with dual-channel 8-bit 1-GHz ADC and 2 Gigasamples/second recording speed.

this unit using processor-based software for long-term storage on low-cost RAID technology. DRS Technologies produces the RDA-100 Signal Library System, part of its RDA product line for SIGINT signal library, training and system validation applications, which transfers files to disk at 430 Megabytes/second, network at 100 Megabytes/second or linear tape open (LTO)-3 tape at 60 Megabytes/second.

L-3 Communications is stretching its neck even further into the data storage business by developing embedded storage solutions for UAVs. For an aircraft such as the United States' Predator UAV, for example, removable memory is not nearly as essential as it is for manned aircraft because the data that a UAV captures is automatically datalinked during its flight; however, this datalinking process has its problems. As Micha explained, "Often, the sensor data rate that a [UAV's] sensors are collecting at is much faster than the datalink can send down to the ground, so there needs to be a kind of buffering system between the sensor and the datalink. What we've started to do with a couple of customers is, instead of a removable recorder, we'll put an embedded storage system onboard – a card or a couple of circuit cards – that actually acts as a big buffer. All the data comes into the aircraft very quickly from the sensor, and it goes into our storage system and we buffer it and then send it out of our storage system to the datalink at the rate that the datalink can output it."

Dan Simard, vice president of business development at EONIC B.V., a Netherlands-based company that specializes in high-performance wideband recorders, said his customers rely on LTO magnetic tape to offload data for archival, but suggested that this 10-year-old technology has its limitations in terms of speed and capacity. "I expect a lot of advances in the archive market down the road, and we can see some of these with LTO-5 imminent and LTO-6 on the roadmap," he said.

#### WHAT DOES THE FUTURE HOLD?

EONIC produces a variety of wideband recorders, ranging from those that



*The Vortex Ultra Wideband Recorder, a product of Curtiss-Wright Controls Embedded Computing, is a dual-channel, 8-bit analog input recording system.*

448 Gigabytes of removable memory). More and more customers want data recorder units that meet certain format conditions, or what Hardy calls standard-compliant systems, which explains why Ampex currently is undergoing an IRIG 106 Chapter 10 compliance process. (Type 1, NSA-certified data encryption capability also is a popular customer request, according to Micha at L-3 Communications, and in development at the company.)

It is a lesson other data recorder manufacturers have learned along the way as well – the former data recorder manufacturer VMETRO, now under the umbrella of Curtiss-Wright Controls Embedded Computing, believes that its biggest asset to the EW and SIGINT community is its open data recording systems that can

#### FINDING STORAGE SPACE

Perhaps one of the most consistently underestimated problems by end users of data recorders is data archival. For EW and SIGINT missions that call on a warfighter to record data multiple times a day for a month or longer, organizing and figuring out a way to access such large amounts of data can be a problem. Although data archival is a fairly sophisticated challenge, data recorder manufacturers are doing their part to offer solutions and work toward engineering better technology. Curtiss-Wright Controls Embedded Computing manufactures a rugged, six-disk JBOD (Just a Bunch of Disks) storage system called SANbric™ for short-term data storage for SIGINT, ELINT and COMINT missions, and data is later drained from

capture 100 KHz-140 MHz of bandwidth for COMINT applications to those, such as the SR-7100, that capture 500 MHz of bandwidth at intermediate frequencies of up to 1 GHz for ELINT applications. The company also offers solutions that simplify the fingerprinting of complex SIGINT scenarios by recording multiple signal types simultaneously. The SR-5124 is an “all-in-one” recorder with COMINT, foreign instrumentation signals intelligence (FISINT) and ELINT capability and loaded with one broadband channel, two narrowband channels, four video baseband channels and two digital-to-analog output channels. Key to EONIC’s continuing success, said Simard, is significant investment in research and development, expanded business partnerships and, most importantly, an acute awareness of customer needs. “This is where we see the trend going in the future – with shortening the cycle from detection of a signal through recording, analysis and response, and a likely convergence of the signals collection and the analysis roles,” Simard said. “And at the end of the day for us, this means delivering better performance, tighter integration, broader networking, increased automation and more powerful real-time analysis capability.”

Wilder trends are astir in the intelligence, surveillance and reconnaissance (ISR) world – namely, the use of full motion video (FMV) for intelligence gathering and targeting. L-3 Communications has developed and is delivering high-definition, multi-Terabyte, multi-sensor, full-motion video recorders for various platforms, said Micha. With the popularity of full-motion video sensors on UAV and fixed-wing platforms, soldiers on the ground can see on their handheld terminals what a UAV sees in the air. In addition, image analysts are getting better intelligence from the new high-definition sensors that require high-definition video recorders like the type L-3 Communications is producing. Holographic memory also is on the company’s radar as a memory technology alternative even to solid-state media – due to the advances in packaging technology over the last 10 years, said Micha, holographic memory could potentially give users 10 times the storage



*Curtiss-Wright Controls Embedded Computing’s SANbric™ is a 2.7-Terabyte storage system designed for SIGINT, ELINT and COMINT missions.*

capacity in the equivalent amount of space as either magnetic disk or solid-state memory.

But solid-state memory will be the engine driving the future of data recorders for at least the next five to 10 years, most data recorder manufacturers agree. Said Hardy of Ampex Data Systems, a company with 75-percent solid-state-based products, “There’s an old adage in the data acquisition business – it can never be too fast and it can never have too much storage. The commercial databuses are what’s driving the speed because computing power is getting faster and faster, and the capacity is getting driven by the density and speed of solid-state memory.”

TEK Microsystems also projects a substantial shift to solid-state memory. CTO/CEO Andy Reddig explained, “Today, solid-state media still has a pretty significant cost disadvantage versus magnetic media and it doesn’t quite have the high throughput as high-performance magnetic media, but there’s a lot of pressure and impetus in the commercial world to try to make solid-state better and faster, and solid-state is riding the semiconductor innovation curve, which is a faster curve than the magnetic media curve. I expect within five years the standard way to build the data recorder, even if it’s not rugged, will be

to use solid-state media. And then, of course, once it’s solid-state, it becomes much simpler to ruggedize it.”

The benefits of the steadily falling price of solid-state memory are so obvious to manufacturers of EW and SIGINT data recorders, it is unlikely that many will not ultimately incorporate solid-state memory into part or all of their product lines. Increased storage capacity will likely result from the flood of solid-state media into the data recorder market, creating an entire product makeover in the industry. Yet in the meantime, the continuing transition to solid-state technology will not happen without its share of complications. Customers and manufacturers alike should be wary of buying inexpensive and overly glamorized solid-state drives and other equipment, warned Cory Grosklags of Curtiss-Wright Controls Embedded Computing. “Not all solid-state devices are created equally – a lot of vendors are not looking at the military and aerospace marketplace for solid-state. They’re looking at the very low-cost laptop world. Unfortunately, you get quite a compromise there. But I do see that changing in the next five years. We’ll have some good players in the solid-state market that can really deliver quality for the MILCOMS industry.”



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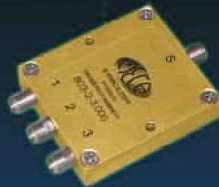
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# TECHNOLOGY SURVEY

## SAMPLING OF RWR/ESM SYSTEMS

By Ollie Holt

In June 2007, *JED* conducted a survey on radar warning receivers (RWRs) and electronic support measures (ESM) and electronic intelligence (ELINT) systems. This month's survey limited the scope to only RWRs and radar ESM systems. Even though the functionality of these three types of systems has merged somewhat over the last few years, each receiver type has its place. The RWR is a warning device for pilots to make them aware of an imminent threat to their aircraft, while the ESM system was designed more for collecting information about the battlespace and making this information available for all users. ELINT systems collect information on specific signals and bring back data for the SIGINT experts to analyze.

Because each of these receiver systems does a different job, their modes of operation are different. The RWR needs to scan the RF spectrum and spatial environment around the aircraft in a quick manner and warn the pilot of any immediate danger, which usually means he is being tracked by a tracking radar system. Early versions of these systems paid little attention to early warning radars or other signals because they were not lethal to the aircraft. These RWRs only needed to give the pilot a warning that he was being tracked and a rough line of bearing (LOB) to where the tracking radar was located. The pilot could then choose to plan his maneuvers to stay out of harm's way or employ his jamming system. To create a useful LOB, all that was needed was four channels of receiver system. Each channel connected to an antenna in one of each of the four platform quadrants or sectors. The four channels would make an amplitude measurement on the signal at the same time, the amplitudes would be compared and a rough LOB could be determined within about 10 degrees, depending on the accuracy of the amplitude measurements and prior knowledge of each antenna's performance. The 10-degree accuracy was plenty for the pilot to make his maneuvering decisions.

The ESM system is usually a more capable system that collects data on more than tracking radars and is useful in instances when a 10-degree LOB performance is not accurate enough to fuse with other sensors and provide a good situational awareness picture of the battlespace. The ELINT system serves a completely different function – it does not need a quick response to warn a pilot or need to search a wide frequency or spatial region. The ELINT system usually has a very high performance in terms of sensitivity and is either preprogrammed or cued by another system to collect large quantities of signal data on a specific emitter and then store this data for subsequent analysis by SIGINT experts.

Typically, ESM and ELINT systems are rather large and are designed for stand-off platforms that can stay out of the actual battlespace and collect data, while the RWR needs to be small enough to fit in the cramped spaces of tactical platforms and provide the operator with enough information to make real-time decisions. Because of the performance and size differences in these three systems, *JED* decided to feature in this month's survey only RWR and ESM systems, realizing that it would not be fair or useful to compare the performance of a small lightweight RWR system to a large multi-channel ELINT system. *JED* will publish a survey of dedicated ELINT systems in its November issue.

### TECHNOLOGY TRENDS

If you compare the results of the 2007 survey with the current survey, you will see that the receiver technology of choice is slowly changing from analog IFMs and superhet receivers to digital IFMs and digital channelizers. This trend could easily have been predicted given the availability of high-speed analog-to-digital converters (ADCs) and high-density Field Programmable Gate Arrays (FPGAs). Multiple vendors are currently producing both 6U- and 3U-form-factor boards with single- and dual-channel ADCs and the current Virtex-5 FPGA. Put an RF tuner in front of one of these modules and a single board computer (SBC) after the ADC/FPGA module and you have all the hardware you need to build a single- or dual-channel RWR. Just add some signal processing firmware to the FPGA to digitally simulate a channelizer or a superhet receiver and some sorting and ID software to the SBC and you have a one- or two-channel RWR. Most applications use four channels (one per sector or quadrant), so a four-channel architecture utilizing these commercially available modules would complete a low-power, lightweight RWR system.

### RWR/ESM SAMPLING

The survey was sent to suppliers that list RWR and ESM systems in their product line. Responses were received from 13 suppliers and their products are listed in the survey results on the next pages. Only information provided by the companies was used in the survey compilation.

### NEXT SURVEY

The next survey will be in the June 2009 issue of *JED* and will cover IR expendables, decoys and dispensers. E-mail [editor@crowds.org](mailto:editor@crowds.org) to request a survey questionnaire.

# TECHNOLOGY SURVEY: RWR/ESM SYSTEMS

| MODEL  | REC TYPE                              | OP FREQ  | INST BW  | TYP INST SENS                    | DYN RANGE                   | INST DYN RANGE   |
|--|---------------------------------------|--|--|----------------------------------|-----------------------------|--|
| <b>Aeronix, Inc.; Melbourne, FL; +1-321-984-1671; www.aeronix.com</b>        |                                       |  |  |                                  |                             |  |
| FinderPlus   | hybrid                                | 2-18 GHz   | 2-18 GHz   | *                                | >100 dB                     | >40 dB   |
| Copperfield II   | hybrid                                | 0.5-40 GHz   | 8 GHz  | *                                | >70 dB                      | >30 dB   |
| <b>Applied Signal Technology; Allen, TX; +1-214-547-4754; www.appsig.com</b> |                                       |  |  |                                  |                             |  |
| Pegasus ESM  | superhet and digital channelizer      | 2-18 GHz, 500 MHz-18 GHz, 500 MHz-40 GHz and 100 MHz-40 GHz. | 1 GHz and 500 MHz  | Better than -85 dBm              | >60 dB                      | 60 dB  |
| <b>Argon ST; Fairfax, VA; +1-703-550-7000; www.argonst.com</b>               |                                       |  |  |                                  |                             |  |
| WBR-3000 ESM and ELINT System  | combined wband IFM and nband superhet | 2-18 GHz standard, 0.5-2 GHz and 18-40 GHz opt.              | Wband: 16-GHz standard and 39.5-GHz opt. Nband: 80 MHz and 500 MHz channels. | Wband: -65 dBm. Nband: <-75 dBm. | Wband: 60 dB. Nband: 90 dB. | Wband: 60 dB. Nband: 80 dB (80 MHz BW) and 60 dB (500 MHz BW). |
| WBR-2000 ESM System  | IFM                                   | 2-18 GHz standard, 0.5-2 GHz and 18-40 GHz opt.              | 16-GHz standard. 39.5-GHz opt.   | -65 dBm                          | 60 dB                       | 60 dB  |
| <b>EADS Defence &amp; Security; Germany; +49-731-392-3681; www.eads.com</b>  |                                       |  |  |                                  |                             |  |
| ASIS - A, - N and - G  | wband digital                         | full radar spectrum  | GHz range  | -80 dBmi                         | class of 100 dB             | class of 60 dB   |
| <b>ELETTRONICA S.p.A.; Rome, Italy; +39-06-41541; www.elt.it</b>             |                                       |  |  |                                  |                             |  |
| ALR_733 family   | IFM                                   | C-J  | wide open  | high                             | double                      | *  |
| SEAL (ELT/800 families)  | superhet, digital and IFM             | C-J  | Wide open and many selectable superhet BW.                                   | high                             | double                      | *  |
| ELT/160 family   | IFM                                   | E-J and K  | wide open  | medium                           | simple                      | *  |
| ELT/750 family   | superhet and IFM                      | C-J  | Wide open and 2 selectable BW.   | high                             | double                      | *  |
| ELT/888 family   | wband superhet                        | B-J  | Many selectable superhet BW.   | very high                        | double                      | *  |
| <b>Elisra; Bene Beraq, Israel; +972-3-6175522; www.elisra.com</b>            |                                       |  |  |                                  |                             |  |
| Spectrolite SPS-65 V5  | superhet, digital IFM and channelizer | 0.5-18 GHz   | *  | *                                | *                           | *  |
| ASPS SPS-3000  | superhet and digital IFM              | 0.5-18 GHz   | *  | *                                | *                           | *  |
| SPS-1000V-5  | superhet, digital IFM and CVR         | 0.5-18 GHz   | *  | *                                | *                           | *  |
| AES-210/E  | superhet, IFM and CVR                 | 0.5-18 GHz, plus opts  | *  | *                                | *                           | *  |
| NS-9003A-V2  | superhet, IFM and channelizer         | 1-18 GHz, plus opts  | *  | *                                | *                           | *  |



| SUPPORT DF  | # REC CHANNELS   | PWR (in W)             | SIZE (in in.)   | PLATFORM        | WEIGHT                    | FEATURES   |
|---|--|------------------------|---|-----------------|---------------------------|--|
| multiple  | 1  | <400 W                 | 15.75 x 17.25 x 22  | air/grd         | <115 lbs                  | Includes analysis tools to assist with identification of exotic signals.   |
| multiple  | varies   | <175 W                 | 7.5 x 10.1 x 12.7   | air/grd/shp/spc | <25 lbs                   | Includes AIS receivers for maritime surveillance and anti-spoof detection.   |
| phase interferometer (<2 deg RMS)   | Dep on antenna/array config. Digital RxR up to 128 channels per panel.                           | 750-1,500 W            | dep on arrays and options   | air/grd         | 70-200 lbs, dep on config | Accurate DF (<2 deg over entire freq/FoV). Wband digital channelized RxR.  |
| Circular amplitude DF standard. Circular phase/amplitude, linear interferometer and spinning antenna opt. | 1 RF path for detection, 6 IF paths for DF (standard). 3 RF paths, 9 IF paths (freq and DF opt). | <500 W standard config | Wband processor: 6U, 19-inch rack mount chassis. Nband processor: 3U, 19-inch rack mount chassis. Superhet receivers: 1U and 2U 19-inch rack mount units. Standard antenna: 14.6 D, 12.1 H. | grd/shp/sub     | <200 lbs standard config  | ELINT channels provide sensitivity search, spectrum displays and analysis functions for signal verification.                   |
| Circular amplitude DF standard. Circular phase/amplitude, linear interferometer and spinning antenna opt. | 1 RF path for detection, 6 IF paths for DF (standard). 3 RF paths, 9 IF paths (freq and DF opt). | <350 W standard config | Processor: 6U, 19-inch rack mount chassis. Standard antenna: 14.6 D, 12.1 H.  | grd/shp/sub     | <100 lbs standard config  | Large ESM library. Fast response time. Automated operator alarms. Combat system interfaces. Open architecture.                 |
| high accurate DF, phase comparison  | 4  | <700 W, dep on config  | *   | air/grd/shp     | *                         | Modular architecture. Different front-ends supported. High-precision DF and fast geolocation. Extended ELINT capabilities opt. |
| amplitude monopulse (4-8 antennas)  | 3 min  | *                      | 2 ATR   | air             | 46-71 kg                  | ESM with ELINT and DF capability   |
| amplitude monopulse (4-8 antennas). TDOA.   | 5 min  | *                      | *   | air/shp         | dep on config             | ESM with ELINT, DF and localization capability   |
| amplitude monopulse (4 antennas)  | 1  | *                      | 1 ATR   | air             | 15-20 kg                  | Wband RWR with unknown threat and recording.   |
| amplitude monopulse (4 antennas)  | 2 min  | *                      | 2 ATR   | air             | 55 kg                     | Threat alarm and situation awareness ESM.  |
| spinning parabolic dish and TDOA  | 4  | *                      | *   | grd/shp         | shelterized               | surveillance and ELINT   |
| amplitude, phase and time   | multiple   | *                      | *   | air             | 10 kg                     | includes laser warner  |
| amplitude, phase and time   | multiple   | *                      | *   | air             | 25 kg                     | ECM add-on   |
| amplitude   | multiple   | *                      | *   | air             | 25 kg                     | *  |
| amplitude and time  | multiple   | *                      | *   | air             | 40 kg                     | *  |
| amplitude and phase   | multiple   | *                      | *   | shp             | *                         | ECM add-on   |

# TECHNOLOGY SURVEY: RWR/ESM SYSTEMS

| MODEL  | REC TYPE                          | OP FREQ                      | INST BW                 | TYP INST SENS                      | DYN RANGE                    | INST DYN RANGE |
|--|-----------------------------------|------------------------------|-------------------------|------------------------------------|------------------------------|----------------|
| <b>IAI Elta Systems Ltd.; Israel; (972)8-857-2312/2410; www.elta-iai.com</b>                                   |                                   |                              |                         |                                    |                              |                |
| EL/L-8388 3D Ground-Based Multi-Mission ESM/ELINT  | channelizer and digital           | 0.5-18 GHz                   | *                       | *                                  | *                            | *              |
| EL/L-8385 ESM/ELINT UAV Payload  | digital                           | 2-18 GHz                     | *                       | *                                  | *                            | *              |
| EL/L-8382N 3D Naval ESM/ELINT  | channelizer and digital           | 0.5-18 GHz                   | *                       | *                                  | *                            | *              |
| EL/L-8265 RWL- Radar Warning & Threat Location   | digital                           | 2-18 GHz                     | *                       | *                                  | *                            | *              |
| EL/L-8382 MPA ESM/ELINT for Maritime Patrol Aircraft   | channelizer, superhet and digital | 0.5-18 GHz                   | *                       | *                                  | *                            | *              |
| <b>INDRA; Madrid, Spain; +34-914-806-032; www.indra.es</b>   |                                   |                              |                         |                                    |                              |                |
| ALR-400 RWR  | digital                           | 0.5-42 GHz, dep on config    | 4 GHz                   | -65 dBm                            | 60 dB                        | 60 dB          |
| AMES-C ESM/ELINT   | digital IFM/superhet              | 0.5-18 GHz and opt 18-40 GHz | 16 GHz                  | -90 dBm                            | 60 dB                        | 60 dB          |
| AMES-800 ESM/ELINT   | digital                           | 0.5-42 GHz, dep on config    | 4-16 GHz, dep on config | better than -90 dBm, dep on config | *                            | *              |
| MRSR-800 MRGR-800 ESM  | digital                           | 0.5-18 GHz and opt 18-40 GHz | 17.5 GHz                | -85 dBm                            | 60 dB                        | 60 dB          |
| MRGR-ELINT-FD  | digital/superhet                  | 0.5-18 GHz and opt 18-40 GHz | >500 MHz                | -90 dBm, dep on config             | 55 dB and 40 dB (attenuator) | 55 dB          |
| <b>ITT Integrated Electronic Warfare Systems; Clifton, NJ; +1-973-284-4543; www.itt.com</b>                    |                                   |                              |                         |                                    |                              |                |
| ALQ-211 (V) 8 AIDEWS Radar Warning Receiver  | digital                           | *                            | *                       | *                                  | *                            | *              |
| ALQ-211 (V) 10 Radar Warning Receiver  | digital                           | *                            | *                       | *                                  | *                            | *              |
| ALQ-211 (V) 4 AIDEWS Radar Warning Receiver  | digital                           | *                            | *                       | *                                  | *                            | *              |
| ALQ-211 (V) 5 Radar Warning and ESM Receiver   | digital                           | *                            | *                       | *                                  | *                            | *              |
| <b>MiKES Microwave Electronic Systems Inc.; Ankara, Turkey; +90-312-847-51-00, ext. 2141; www.mikes.com.tr</b> |                                   |                              |                         |                                    |                              |                |
| AN/ALQ 178 V(5)+ (jointly developed with BAE Systems)  | *                                 | RWR: C-J. ECM: H-J.          | *                       | *                                  | *                            | *              |
| AN/ALQ 178 V(3) (jointly developed with Loral)   | *                                 | RWR: C-J. ECM: E-J.          | *                       | *                                  | *                            | *              |

| SUPPORT DF  | # REC CHANNELS    | PWR (in W)               | SIZE (in in.)   | PLATFORM | WEIGHT                        | FEATURES  |
|---|-------------------|--------------------------|---|----------|-------------------------------|---|
| 3D DTOA   | *                 | *                        | *   | grd      | *                             | 3D passive radar for air defense  |
| interferometer  | *                 | *                        | *   | air      | *                             | ISTAR   |
| 3D DTOA   | *                 | *                        | *   | shp      | *                             | 3D  |
| differential Doppler and monopulse amplitude                            | *                 | *                        | *   | air      | *                             | threat location on surface  |
| DTOA  | *                 | *                        | *   | air      | *                             | maritime surveillance and ISTAR   |
| amplitude monopulse adjusted with pulse freq                            | 4                 | 200 W (min config)       | *   | air      | 10.2 kg (min config)          | LPI capability. Wband digital reception. EW suite controller embedded capability.                                 |
| amplitude   | 6                 | 1,000 W                  | Processor: 15 x 10 x 25.  | air      | 90 kg                         | Detailed intrapulse analysis capability. Multi-CW and jamming signals process with no degradation.                |
| amplitude monopulse and digital interferometer                          | 2 (min config)    | 200-800 W, dep on config | Processor: 15 x 10 x 25.  | air      | 25 kg (min config)            | 360-deg instantaneous coverage. High-accuracy DF measurement. Modular design and flexible architecture.           |
| amplitude monopulse adjusted with pulse freq and digital interferometer | 7                 | <3,500 W                 | Min config: processor: 19 x 23.6 x 12.2; antenna: 21.5 x 22.5.          | shp/grd  | 70-195 kg, dep on config      | Enhanced. BITE.   |
| amplitude   | 2                 | 2,000 W                  | Receiver: 23 x 11.4 x 9.4. Processor: 15 x 25 x 10. Antenna: 37 x 52.5. | shp/grd  | 178 kg                        | FLAT-DF antenna with high rotation speed (maximizing POI). High-accuracy freq measurement. Intrapulse analysis.   |
| yes   | multiple channels | *                        | varies according to config  | air      | varies according to config    | Provides radar warning and opt integrated radar jamming for VIP and HOS platform self-protection.                 |
| yes, standard or precision accuracy                                     | multiple channels | *                        | varies according to config  | air      | 16-28 lbs according to config | Provides ID performance and ambiguity resolution. Incorporates embedded ASE suite integrated controller function. |
| yes   | multiple channels | *                        | varies according to config  | air      | varies according to config    | Provides radar warning and opt integrated radar jamming for fighter attack self-protection.                       |
| supports precision accuracy and ESM                                     | multiple channels | *                        | varies according to config  | air      | 92 lbs (including ESM)        | Provides maritime patrol ESM performance and precision accuracy radar warning with geolocation.                   |
| *   | *                 | ~4 kW                    | *   | air      | *                             | *   |
| *   | *                 | ~5 kW                    | *   | air      | *                             | *   |

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| MODEL  | REC TYPE   | OP FREQ  | INST BW  | TYP INST SENS  | DYN RANGE   | INST DYN RANGE                                      |
|--|--|--|--|--|---|---|
| <b>Raytheon; Goleta, CA; +1-805-879-2041; www.raytheon.com/ew</b>            |  |  |  |  |   |   |
| ALR-67(V)3 Radar Warning Receiver  | superhet and channelizer (digital, analog and SAW) – cued digital receiver.  | <2-40 GHz  | *  | *  | *   | *   |
| ALR-69A Radar Warning Receiver   | digital channelizer  | C-J  | *  | *  | *   | *   |
| <b>Saab Avitronics; Järfälla, Sweden; +46-8-580-85114; www.saabgroup.com</b> |  |  |  |  |   |   |
| HES-21   | digital FFT channelizer, superhet and IFM  | Channelizer: 2-18 GHz. Superhet and IFM: 0.7-40 GHz. | Channelizer: 500 MHz. Superhet: 100 MHz. IFM: wide open.                               | Channelizer: -75 dBmi. Superhet: -70 dBmi. IFM: -55 dBmi.  | Channelizer: >85 dB. Superhet: >70 dB. IFM: >65 dB. | Channelizer: 55 dB. Superhet: 55 dB. IFM: 50 dB.    |
| BOW  | superhet and IFM   | Superhet: 0.7-40 GHz. IFM: 2-40 GHz.                 | Superhet: 100 MHz. IFM: wide open.   | Superhet: -70 dBmi. IFM: -55 dBmi.   | Superhet: >70 dB. IFM: >65 dB.                      | Superhet: 55 dB. IFM: 50 dB.                        |
| <b>Saab Avitronics; South Africa; +46-8-580-85114; www.saabgroup.com</b>     |  |  |  |  |   |   |
| ESP  | superhet and IFM acquisition   | Superhet: 0.5-18 GHz. IFM: 1-18 GHz.                 | Superhet: 1 GHz or 100 MHz. IFM: wide open.  | Superhet: -60 dBm or -70 dBm. IFM: -55 dBm.  | >60 dB  | 60 dB   |
| Compact Integrated Defensive Aids Suite (CIDAS)                              | CVR and IFM  | 0.7-40 GHz   | wide open or variable banding  | -55 dBm  | 55 dB   | 45 dB   |
| U-SME-200  | Hybrid includes banded digital IFM and CW immune XDLVA, scanning superhet acquisition, superhet analysis and LPI receiver. | 2-18 GHz (opt 18-40 GHz).                            | 16-GHz instantaneous ESM, with 4-GHz and 500-MHz ELINT modes operating simultaneously. | -63 dBm conventional and -80 dBm LPI.  | 80 dB   | 60 dB   |
| <b>Thales; Elancourt, France; +33 (0) 1-34-81-95-96; www.thalesgroup.com</b> |  |  |  |  |   |   |
| CATS RWR (Compact Airborne Threat Surveyor)                                  | IFM, with opt superhet and digital, intrapulse and channelizer.  | E-J, with opt K, D and CD.                           | *  | 50 dBmi class. 80 dBmi class with digital receiver opt.  | 50 dB class. 80 dB class with digital receiver opt. | 50 dB class. 80 dB class with digital receiver opt. |
| MEERKAT Family   | superhet, IFM and digital  | B/C- J with opt extension to K                       | *  | Up to -85 dBmi. Improved with nband digital receiver opt. Greater than -60 dBmi with instantaneous DF array. | *   | 60 dB   |
| Vigile ESM Family  | superhet, IFM and digital  | E-J (with opt extensions C-K)                        | 16-GHz core system   | -65 dBmi to -75 dBmi   | *   | 60 dB   |

| SUPPORT DF   | # REC CHANNELS  | PWR (in W)  | SIZE (in in.)  | PLATFORM        | WEIGHT   | FEATURES  |
|--|---|---|--|-----------------|--|---|
| Amplitude. Growth to phase/time DF planned.                      | 4   | 109   | Digital receiver: 3.7 x 11.3 x 13. Processor: 7.6 x 4.8 x 13.5. Quad receiver: 6.2 x 1.7 x 7. Integrated antenna: 4.6 x 6.8 x 9. | air             | 79 lbs   | Digital receiver, dual G4 power PC processor, fully integrated on F-18 A/B/C/D/E/F, separately loadable UDFs and EW suite controller. |
| amplitude, SSG and MSG   | 4 (expandable)  | 44  | Processor LRU: 7.63 x 5.0 x 14.6. Receiver LRU: 1.72 x 6.7 x 7.5.  | air             | 383 lbs  | NTISR   |
| Channelizer: phase. Superhet and IFM: amplitude.                 | 4   | Channelizer: 1200 VA and 150 W.                                     | *  | air             | 100 kg   | *   |
| amplitude  | 4 or 6  | superhet: 600 VA  | *  | air             | 60 kg  | *   |
| Superhet: phase. IFM: omni.                                      | 1   | 140 W   | 13.5 x 5 x 7.6   | air             | 16 kg  | Intrapulse phase comparison DF.   |
| amplitude  | 4 or 6  | 43 W per channel (not including EW control unit)                    | EW controller: 7.5 x 14 x 5. Dual front-end receiver: 7 x 1.5 x 8.7. Spiral antenna module: 4.3 x 4.3 x 2.6.                     | air             | EW controller: <10 kg. Dual front-end receiver: <5.6 kg. Spiral antenna module: <6 kg. | Part of fully integrated self-protection system.  |
| Amplitude DF in parallel to phase DF, giving 2-deg RMS accuracy. | Amplitude and phase DF using 5-element array plus separate omni path. | 350 W   | Antenna unit: 18 H x 9 D. EW receiver-processor: 16 x 17 x 10.5.   | shp/sub         | Antenna unit: 38 kg. EW receiver-processor: 45 kg.                                     | Installation on surface and subsurface. Makes use of open standards for ease of integration. Continuous throughput of 2.5 mpps.       |
| amplitude, with opt phase, time and geolocation                  | *   | 144 W for basic config  | Receiver controller unit: 7.6 x 6 x 12.5. Radar sensor unit: 4 x 4.  | air             | 10 kg  | Self-protection system controller. Simultaneous RWR, ESM and opportunity ELINT functions.   |
| amplitude comparison and spinning dish                           | varies, dep on receiver config selected                               | *   | *  | grd             | 60 kg for airborne applications to 150 kg for high-end surface ship variant.           | Situational awareness, multi-role applications, high technical performance and flexibility.   |
| amplitude and phase comparison DF                                | varies, dep on receiver config selected                               | Amplitude DF unit: <35 W per unit. Receiver processor unit: <700 W. | Antenna: 8.3 x 8.3 x 8.5 D. Receiver: 12.6 x 21 x 22 D.  | air/grd/shp/sub | 40 kg for airborne applications to 150 kg for high-end surface ship variant.           | High-resolution signal measurement/analysis using digital receivers and signal processing.  |

*The whole is far greater than the sum of its parts*



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COBHAM DEFENSE COMMUNICATIONS Ltd. [www.cobhamdcweb.com](http://www.cobhamdcweb.com) +44 0 1254 292020 CONTINENTAL MICROWAVE [www.contmicro.com](http://www.contmicro.com) 603.775.5200  
Asia / Pacific +81.44.844.8296 NURAD [www.nurad.com](http://www.nurad.com) 410.542.1700 REMEC DEFENSE & SPACE [www.remecrds.com](http://www.remecrds.com) 858.560.1301 SIVERS LAB AB [www.siverslab.se](http://www.siverslab.se) +46 8 477 6811

# Survey Key - RWR/ESM Systems

## MODEL

Product name or model number

## REC TYPE

Receiver type

- superhet = superheterodyne
- IFM = instantaneous frequency measurement
- CVR = crystal video receiver
- SAW = surface acoustic wave
- FFT = Fast Fourier transform
- XDLVA = Extended Range Detector Log Video Amplifier
- LPI = low probability of intercept

## OP FREQ

Operating frequency

## INST BW

Instantaneous bandwidth (if different from operating frequency)

- BW = bandwidth
- ELINT = electronic intelligence

## TYP INST SENS

Typical installed sensitivity

- DF = direction-finding

## DYN RANGE

Total dynamic range

## INST DYN

Instantaneous dynamic range

## SUPPORT DF

Does it support DF and with what technology?

- RMS = root mean square
- TDOA = time difference of arrival
- DTOA = differential time of arrival

## # REC CHANNELS

Number of receiver channels (RF paths) to create a complete system

- RF = radio frequency
- IF = infrared frequency

## PWR (in W)

Power dissipated in Watts per channel

- EW = electronic warfare

## SIZE (in in.)

Size by height x weight x length, or diameter, in inches

- ATR = air transport radio
- LRU = line replacement unit

## PLATFORM

Platform

- air = airborne
- grd = ground, mobile and ground, fixed
- shp = shipboard
- sub = submarine
- spc = space

## WEIGHT

Weight in lb/kg

## FEATURES

Additional features

- AIS = automatic identification system
- FoV = field of view
- CW = continuous wave
- BITE = built-in test equipment
- POI = point of interest
- VIP = virtual instrument panel
- HOS = Head of State
- ID = identification
- ASE = aircraft survivability equipment
- PC = personal computer
- UDF = ultra high frequency (UHF) direction finder

## OTHER ABBREVIATIONS USED

- opt = option/optional
- dep = dependent
- config = configuration
- wband = wideband
- nband = narrowband
- < = greater than
- > = less than
- min = minimum
- max = maximum
- deg = degree
- freq = frequency

\* Indicates answer is classified, not releasable or no answer was given.

## OTHER COMPANIES

This reference list includes websites for additional companies in the field that were unable to provide survey information due to security constraints or publication deadlines, or that declined to participate.

| Company Name                   | Website                |
|--------------------------------|------------------------|
| BAE Systems .....              | www.baesystems.com     |
| Bharat Electronics (BEL) ..... | www.bel-india.com      |
| Elbit Systems .....            | www.elbitsystems.com   |
| Era Corporation .....          | www.erabeyondradar.com |
| ITT RSS.....                   | www.itt.com            |
| Lockheed Martin .....          | www.lockheedmartin.com |
| MRCM .....                     | www.mrcm.net           |
| Northrop Grumman.....          | www.ngc.com            |
| RAFAEL .....                   | www.rafael.co.il       |
| Selex Galileo .....            | www.selex-sas.com      |
| Sierra Nevada Corp. ....       | www.sncorp.com         |

## June 2009 Product Survey: IR Expendables, Decoys and Dispensers

This survey will cover infrared (IR) expendables, decoy and dispenser systems. Please e-mail editor@crowds.org by March 15 to request a survey questionnaire.





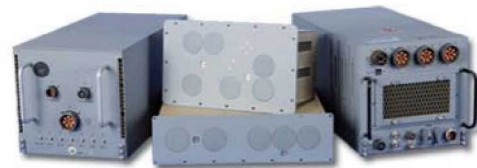
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# Communication Jamming *(continued)*

By Dave Adamy

This month, we will consider various situations in which jamming is performed against hostile communications. The situations are chosen to illustrate the impact of the different propagation models.

## High-altitude Communication Jammer

Consider the jamming situation shown in **Figure 1**. A fixed-wing aircraft flying at 3,000 meters altitude jams a 250-MHz communication net with stations 5 km apart. All stations in the target net are transceivers with 2-meter-high whip antennas (2 dB gain). The output power from each transceiver's transmitter is 1 Watt. The jamming aircraft is 50 km from the area over which the target net is operating. The jammer outputs 100 Watts into a 3-dBi antenna. What J/S is achieved?

$$\begin{aligned} \text{LOSS}_j &= 32.4 + 20 \log(\text{dist}) + 20 \log(\text{frequency}) \\ &= 32.4 + 20 \log(50) + 20 \log(250) \\ &= 32.4 + 34 + 48 = 114.4 \text{ dB} \end{aligned}$$

The ERP of the target link transmitters is 30 dBm (i.e., 1 Watt) + 2 dBi = 32 dBm

The ERP of the jammer is 50 dBm (i.e., 100 Watts) + 3 dBi = 53 dBm

The J/S ratio (from the December 2008 EW 101) is:

$$\begin{aligned} \text{J/S} &= \text{ERP}_j - \text{ERP}_s - \text{LOSS}_j + \text{LOSS}_s \\ &= 53 - 32 - 114.4 + 136 \\ &= 42.6 \text{ dB} \end{aligned}$$

The fact that the airborne jammer link has line of sight loss allows it to generate very high J/S against the target net that has two-ray loss.

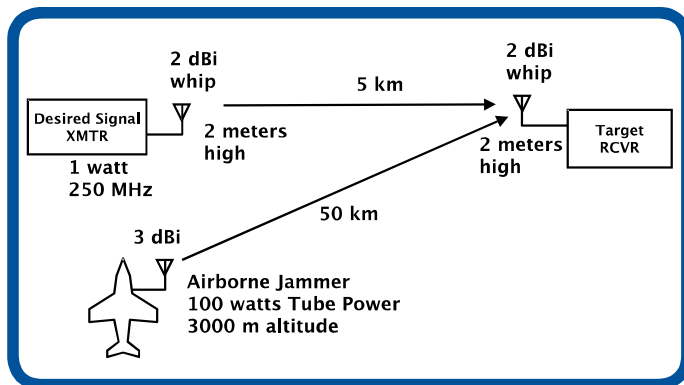


Figure 1: Significant J/S can be achieved from a high altitude airborne jammer.

First we must determine the appropriate propagation models for each link. The target link Fresnel zone distance (from the August 2007 EW 101) is:

$$\text{FZ} = (2 \times 2 \times 250)/24,000 = .0417 \text{ km} = 41.7 \text{ meters}$$

This is far less than the 5-km transmission path, so two-ray propagation is appropriate for the target link. The target link loss is thus:

$$\begin{aligned} \text{LOSS}_s &= 120 + 40 \log(\text{dist}) - 20 \log(h_t) - 20 \log(h_r) \\ &= 120 + 40 \log(5) - 20 \log(2) - 20 \log(2) \\ &= 120 + 28 - 6 - 6 \\ &= 136 \text{ dB} \end{aligned}$$

The jamming link Fresnel zone distance is:

$$\text{FZ} = (3000 \times 2 \times 250)/24,000 = 62.5 \text{ km.}$$

Because the Fresnel zone distance is greater than the jamming link transmission distance, line of sight propagation applies. The loss in the jamming link is:

## Stand-in Jamming

Now we consider a “stand-in” jammer operating against the same target net described in the above problem. This is a low-power jammer that is very close to the receiver. In this case, there might be a number of low-power jammers placed throughout the area in which the target net is operating. Each jammer has 5 Watts ERP from a 0.5-meter-high whip antenna. **Figure 2** shows one such jammer located 500 meters from a receiver. We will consider this the typical jamming case, i.e., there are assumed to be stand-in jammers about 500 meters from each transceiver in the target net. What J/S is achieved?

The desired signal link as described above operates with two-ray propagation. Its ERP is 32 dBm and its link loss is 136 dB.

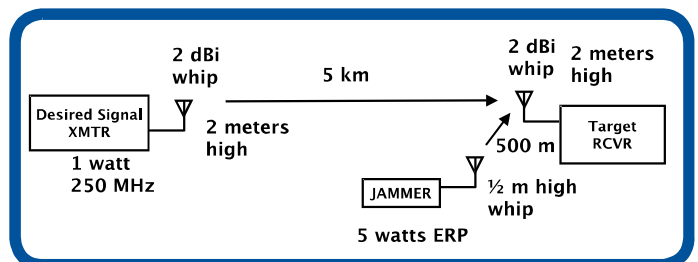


Figure 2: Stand-in jamming can provide high J/S with low jammer power.

Now calculate the FZ for the jamming link:

$$\begin{aligned} \text{FZ} &= (h_t \times h_r \times \text{freq})/24,000 \\ &= (0.5 \times 2 \times 250)/24,000 \\ &= .01 \text{ km} = 10 \text{ meters} \end{aligned}$$

This is less than the 500-meter jamming link distance, so two-ray propagation applies.

The jammer ERP is 37 dBm (5 Watts).

The jamming link loss is:

$$\begin{aligned} \text{LOSS}_j &= 120 + 40 \log(\text{dist}) - 20 \log(h_t) - 20 \log(h_r) \\ &= 120 + 40 \log(0.5) - 20 \log(0.5) - 20 \log(2) \\ &= 120 - 12 + 6 - 6 = 108 \text{ dB} \end{aligned}$$

The J/S ratio is:

$$\begin{aligned} \text{J/S} &= \text{ERP}_j - \text{ERP}_s - \text{LOSS}_j + \text{LOSS}_s \\ &= 37 - 32 - 108 + 136 \\ &= 33 \text{ dB} \end{aligned}$$

A high J/S is achieved with a low-power jammer because the jammer is very close to the target receiver.

### Jam Microwave UAV Link

Next, we consider jamming UAV links from the ground. A UAV must have a command link (uplink) from the control station and a data link (downlink) back to the control station. We will cover the jamming of each link. Both links operate at approximately 5 GHz.

**Figure 3** shows the UAV command link. The control station has a 20-dBi dish antenna that has 20-dBi gain and 15-dB side lobe isolation. That is, the average side lobe is 15 dB below the main beam boresight gain (which is the gain toward the UAV). The uplink transmitter has 1 Watt transmitter power. The UAV is 20 km from the ground station and has a 3 dBi whip antenna. The downlink transmitter (on the UAV, in **Figure 4**) outputs 1 Watt into its antenna. The jammer has a 10-dBi log periodic antenna and has 100 Watts of jamming power into its antenna.

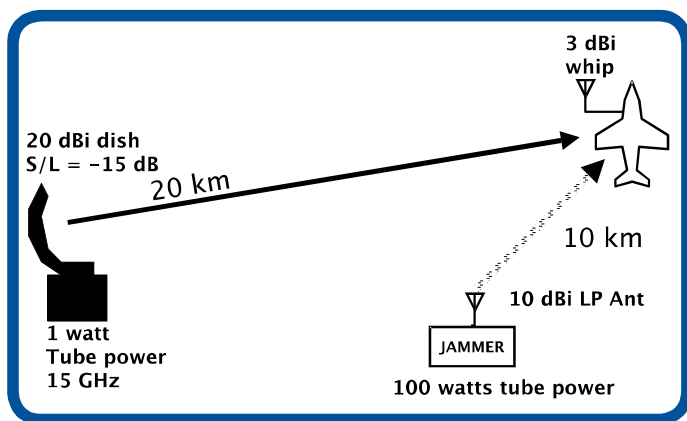


Figure 3: Jamming a UAV up link requires transmission to the UAV.

Because both links operate at microwave frequencies, line of sight propagation applies.

### Command Link

First consider jamming the command link, with the jammer antenna directed toward the UAV as shown in **Figure 3**. What J/S is achieved?

The desired signal ERP is 30 dBm (1 Watt) + 20 dB = 50 dBm

The jammer ERP = 50 dBm (100 Watts) + 10 dB = 60 dBm

Since the command station is 20 km from the UAV, the command link loss is:

$$\begin{aligned} \text{LOSS}_s &= 32.4 + 20 \log(\text{dist}) + 20 \log(\text{frequency}) \\ &= 32.4 + 20 \log(20) + 20 \log(5000) \\ &= 32.4 + 26 + 74 = 132.4 \text{ dB} \end{aligned}$$

The jammer is 10 km from the UAV, so the jamming link loss is:

$$\begin{aligned} \text{LOSS}_j &= 32.4 + 20 \log(\text{dist}) + 20 \log(\text{frequency}) \\ &= 32.4 + 20 \log(10) + 20 \log(5000) \\ &= 32.4 + 20 + 74 = 126.4 \text{ dB} \end{aligned}$$

Because the receiving antenna on the UAV is a whip, it will have equal gain toward the ground station and the jammer. Thus, the jamming-to-signal ratio is given by:

$$\begin{aligned} \text{J/S} &= \text{ERP}_j - \text{ERP}_s - \text{LOSS}_j + \text{LOSS}_s \\ &= 60 - 50 - 126.4 + 132.4 \\ &= 16 \text{ dB} \end{aligned}$$

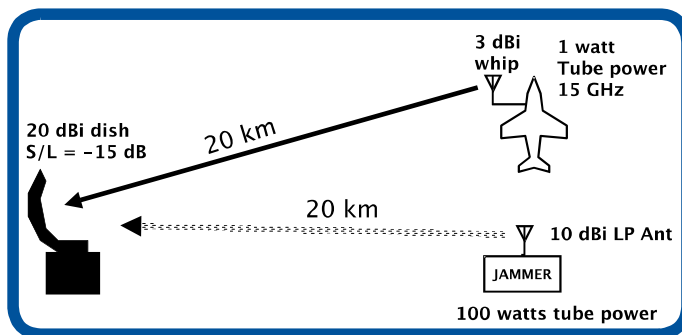


Figure 4: Jamming a UAV down link requires transmission to the ground station location.

### Data Link

Now consider jamming the data link as shown in **Figure 4**. The jammer is 20 km from the control station and its antenna is directed into a side lobe of the control station antenna. What J/S is achieved?

The data link transmitter has 1-Watt transmitter power and a 3-dBi antenna.

The desired signal link ERP is 30 dBm (1 Watt) + 3 dB = 33 dBm.

The desired signal link loss is the same as calculated for the command link, 132.4 dB.

The jammer ERP as calculated above is 60 dBm. Because the jammer is 20 km from the control station, the jamming link loss is the same as the desired signal loss (132.4 dB).

The control station antenna is directional. Its gain toward the UAV ( $G_R$ ) is 20 dBi, but its gain in the direction of the jammer ( $G_{RJ}$ ) (which is in a side lobe) is 15 dB less, or 5 dBi. Thus, the jamming-to-signal ratio is given by the formula:

$$\begin{aligned} \text{J/S} &= \text{ERP}_j - \text{ERP}_s - \text{LOSS}_j + \text{LOSS}_s + G_{RJ} - G_R \\ &= 60 - 33 - 132.4 + 132.4 + 5 - 20 \\ &= 12 \text{ dB} \end{aligned}$$

### What's Next

Next month, we will look at jamming cell phones. For your comments and suggestions, Dave Adamy can be reached at [dave@lynxpub.com](mailto:dave@lynxpub.com). 🐦

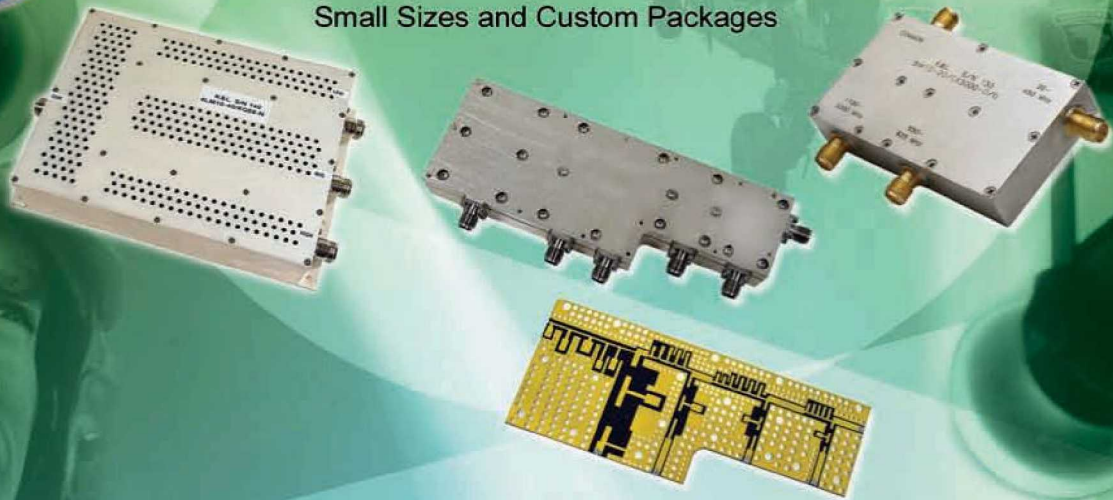


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President and CEO: Walt Havenstein

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1500 Parkway Whiteley  
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Phone: +44-1489-881880  
Fax: +44-1489-881123  
CEO: Dr. David Price  
**AOC contact:** Rik Armitage, Business Development Director  
rika@chemring.co.uk

Chemring Group is the largest producer of IR expendable countermeasure decoys. Operating through its three key companies, Alloy Surfaces Inc. (US), Chemring Countermeasures (UK) and Kilgore Flares (US), Chemring provides a full range of IR decoys to all the US armed forces, NATO and non-NATO countries. Chemring Group companies are key providers in leading advanced decoy programs.

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Fax: +1-425-882-1990  
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**To register online or for more information on both  
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ELETTRONICA collaborates at both national and international levels with other electronic companies and aerospace and shipbuilding industries.

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ELETTRONICA presently employs a workforce of 880 units at its main plant in Rome and 47 units at its subsidiary in Germany.

## G

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President: Christopher Bernhardt  
**AOC contact:** John Capeci, VP, Business Development

ITT Corporation supplies advanced technology products and services in key markets. The company plays a vital role in international security through its defense communications and electronics products, space intelligence systems and advanced engineering and related services. ITT is a global leader in the transport, treatment and control of water, wastewater and other fluids. Headquartered in White Plains, NY, the company generated \$9.4 billion in 2007 sales. In addition to the New York Stock Exchange, ITT Corporation stock is traded on the Midwest, Pacific, Paris, London and Frankfurt exchanges.

ITT Electronic Systems is a leading supplier of information and EW technologies, systems and services that enable mission success and survivability. Key technologies include integrated EW systems for a variety of aircraft, reconnaissance and surveillance systems for air- and sea-based applications, force protection and counter-IED systems, precision landing and air traffic systems for military applications and undersea systems encompassing mine defense, naval command and sonar systems and acoustic sensors. Integrated structures produce aircraft armament suspension and release equipment, electronic weapons interface systems and advanced composite structures and subsystems.

ITT's EW system solutions include the combat-proven AN/ALQ-165 for the F-14D and F-18C/D/E/F and the combat-proven AN/ALQ-172 for B-52s and Special Operations C-130s. A technology leader, ITT Industries has developed the next generation of electronic protection suites with the AN/ALQ-211 family of systems and the AN/ALQ-214 IDECM RFCM. ITT also is developing an IRCM system and support jamming solutions for the US Navy and Air Force.

Further, ITT's Reconnaissance and Surveillance is a leader in the design and manufacture of SIGINT and EW systems and projects, providing a full range of signal collection, direction finding, range monitoring and signal processing equipment to the United States and its allies.

The Under Sea Systems business area produces mine detection and neutralization systems, naval command and sonar systems and hydrophones and transducers to support submarine sensor, tracking, communication and targeting systems.

ITT's Force Protection Systems produces counter-IED systems, including the CREW 2.1 CVRJ system, now in production for US forces deployed in Middle East theaters. Also produced here are interference mitigation systems, allowing communication in jamming environments, and the Shortstop Electronic Protection System (SEPS), an innovative survivability system that is programmable and responsive to selected RF threats. SEPS is designed to pre-detonate RF proximity fused battlefield munitions, such as modern artillery shells, at a safe distance from their designated target.

Also serving the Electronic Systems market, ITT is a member of the Northrop Grumman team providing the Communications/Navigation/Identification system for the F-22 Raptor.

## N

### NORTHROP GRUMMAN CORPORATION

1840 Century Park E.  
Los Angeles, CA 90067  
www.northropgrumman.com  
Phone: +1-310-553-6262

Northrop Grumman Corporation is a \$30 billion global defense and technology company whose 120,000 employees provide innovative systems, products and solutions in information and services, electronics, aerospace and shipbuilding to government and commercial customers worldwide. Eight business sectors comprise Northrop Grumman.

As a trusted partner, Northrop Grumman develops systems and solutions that are delivered timely, enabling information where it is needed most for its military, intelligence, federal, state and local government and commercial customers. The Information & Services business is composed of the company's information technology, mission systems and technical services sectors.



Northrop Grumman is a leading developer, manufacturer, integrator and supporter of a variety of advanced electronic and maritime systems for US and international customers for national security and non-defense applications. The electronics business is composed of the company's electronic systems sector, a world-leading provider of airborne radar, navigation systems, electronic countermeasures, precision weapons, airspace management systems, space systems, marine and naval systems, communications systems and government systems.

Northrop Grumman is a premier developer, integrator, producer and supporter of manned and unmanned aircraft, spacecraft, high-energy laser systems, microelectronics and other systems and subsystems critical to maintaining the nation's security and leadership in science and technology. The aerospace business is composed of the company's integrated systems space technology sectors.

Northrop Grumman is the nation's sole industrial designer, builder and refueler of nuclear-powered aircraft carriers and one of only two companies that designs and builds nuclear-powered submarines. The company also is one of the nation's leading providers and life-cycle supporters of major surface ships for the US Navy, the US Coast Guard, international navies and commercial vessels. The ships business is composed of the company's Newport News and ship systems sectors.

## R

### **RAYTHEON CO.**

870 Winter St.  
Waltham, MA 02451-1449  
www.raytheon.com  
Phone: +1-781-552-3000  
Fax: +1-781-522-3001

Chairman and CEO: William H. Swanson, Exec. VP, Business Development, and Chairman/CEO; International: Thomas M. Culligan; Sr. VP and CFO: David C. Wajsgar  
**AOC contact:** Thomas V. Rosner Jr., Director, Business Development

Employment: 72,000  
*Integrated Defense Systems (Tewksbury, MA):*

Raytheon's leader in joint battlespace integration providing affordable, integrated solutions to a broad international and domestic customer base, including the US Missile Defense Agency, US Armed Forces and the Department of Homeland Security.

*Intelligence & Information Systems (Garland, TX):*

A leading provider of information and intelligence solutions to the government, Raytheon IIS has annual revenues of approximately \$2.6 billion and employs more than 8,000 engineering and technical professionals worldwide. Raytheon IIS recently achieved a strategic milestone in earning CMMI® (Capability Maturity Model Integration) Maturity Level 3 accreditation for the full model scope (system

engineering, software engineering, integrated product and process development and supplier sourcing) across its enterprise.

*Missile Systems (Tucson, AZ):*

Designs, develops and produces missile systems, including air-to-air, strike, surface Navy air defense and land combat, as well as guided projectiles, kinetic kill vehicles and directed energy weapons.

*Network Centric Systems (McKinney, TX):*

Develops and produces network-centric solutions that integrate sensors, systems and secure communications to manage battlespace and airspace. Specializes in automation, surveillance and runway surveillance systems, infrared thermal imaging cameras and precision opto-mechanical and electro-optical systems and subsystems.

*Raytheon Technical Services Company (Reston, VA):*

A subsidiary of Raytheon Company, RTSC provides technology solutions for defense, federal and commercial customers worldwide. RTSC specializes in mission support (including installation, integration, maintenance, training and logistics support of air traffic control systems), counter-proliferation and counter-terrorism, homeland security solutions, base and range operations and customized engineering and manufacturing.

*Space and Airborne Systems [SAS] (El Segundo, CA):*

A leading provider of sensor systems giving military forces the most accurate and timely actionable intelligence available for the network-centric battlefield. With 2006 revenues of \$4.3 billion and 12,000 employees, SAS is headquartered in El Segundo, CA. Additional facilities are in Goleta, CA; Forest, MS; Dallas, McKinney and Plano, TX; and several international locations.

### **ROCKWELL COLLINS**

400 Collins Road NE  
Cedar Rapids, IA 52498  
www.rockwellcollins.com/gs  
Phone: +1-319-295-5100  
Toll-free: +1-800-321-2223  
Fax: +1-319-295-4777  
learnmore@rockwellcollins.com

Rockwell Collins is a pioneer in the design, production and support of innovative solutions for its customers in aerospace and defense. Its expertise in flight deck avionics, cabin electronics, mission communications, information management and simulation and training is strengthened by its global service and support network spanning 27 countries. Working together, its global team of 20,000 employees shares a vision to create the most trusted source of communication and aviation electronics solutions, applying insight and foresight to help its customers succeed.

Its aviation electronics systems and products are installed in the flight decks of nearly every air transport aircraft in the world. Its airborne and ground-based communication systems transmit nearly 70 percent of all US and allied military

communication. Whether developing new technology to enable network-centric operations for the military, delivering integrated electronic solutions for new commercial aircraft or providing a level of service and support that increases reliability and lowers costs for aircraft operators throughout the world, Rockwell Collins delivers on its commitments.

Its EW/SIGINT solutions form the key elements of intelligence systems used by the US military and allied governments to provide the warfighter with a fused Electronic Order of Battle (EOB). These COTS solutions, designed for airborne, shipboard, man-packable or mobile applications, encompass electronic attack, ELINT, ESM and COMINT applications.

Rockwell Collins believes that the closer it gets to its customers, based on promises kept, the greater the benefit for all involved. This is how it creates value for its customers and how it builds trust every day.

## S

### **SAAB AVITRONICS**

Nettovägen 6  
SE-175 88 Järfälla, Sweden  
www.saabgroup.com  
Phone +46-8-580-840-00  
avitronics@saabgroup.com  
President: Micael Johansson  
**AOC contact:** Ben Ash

P.O. Box 8492  
Centurion 0046, South Africa  
www.saabgroup.com  
Phone +27-12-672-6000  
avitronics@saabgroup.com  
**AOC contact:** Philip Willcock

Saab Avitronics is a leading supplier of avionics and EW systems on the international market.

It offers a full range of EW assets, with focus on systems, equipment and in-service support for self-protection, ESM and electronic attack. Key elements are radar, UV and laser sensors, as well as jammers, decoys and countermeasures dispenser systems. Complete EW systems are available for airborne, naval and ground vehicle applications.

It also has avionics subsystems in its product portfolio – safety-critical utility and control systems; mission systems, such as reconnaissance systems and display systems; and a wide range of modular avionics for fighters, helicopters and transport aircraft, as well as commercial aircraft. Key competence areas are safety critical systems and software, modular avionics, video and graphics processing, digital map systems and sensor integration.

Its systems have been delivered to all Swedish Air Force combat aircraft since the 1960s and are in use with several European air forces and in the United States, Middle East, South and South East Asia and Africa.

Saab Avitronics has some 1,300 employees in Sweden (Järfälla and Kista in the Stockholm region and in Jönköping)

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**INSTITUTE/UNIVERSITY MEMBERS**


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and in South Africa (Centurion and Cape Town).

Saab Avionics is a business unit within Saab, a company that serves the global market with world-leading products, services and solutions, ranging from military defense to civil security. Saab has operations and employees on all continents and constantly develops, adopts and improves new technology to meet customers' changing needs. Saab has 13,700 employees. Its annual sales are SEK 23 billion (€2.5 billion), with research and development corresponding to about 20 percent of its annual sales.

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**T**


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**THALES COMMUNICATION**

22605 Gateway Center Drive  
Clarksburg, MD 20871  
www.thalescommin.com  
Phone: +1-240-864-7000  
Toll-free: +1-800-258-4420  
Fax: +1-240-864-7920

**THALES AEROSPACE DIVISION**

Thales is a leading international electronics and systems group, addressing defense, aerospace and security markets worldwide. Thales' leading-edge technology is supported by 22,000 R&D engineers who offer a capability unmatched in Europe to develop and deploy field-proven mission-critical information systems. Thales employs 68,000 people in 50 countries with 2007 revenues of €12.3 billion.

Land & Joint Systems, a division of Thales with 13,000 employees in 20 countries around the world, generates annual revenues of 2.8 billion euros. It is involved in major land programs worldwide (cooperative fighting systems, vehicle and soldier systems, land-based weapon systems and battlespace digitization) and delivers military forces with integrated and modular C4ISR solutions for joint operations that contribute to information superiority on the digitized battlespace (C4I, ISR, combat net and software-defined radios, satellite communications and infrastructure networks).

Thales' Land and Joint Systems Division provides joint, army, navy, air force and government security agencies with the most advanced integrated C4ISR solutions to guarantee information dominance for both homeland defense and out-of-area operations through multi-source intelligence gathering, analysis and presentation.

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).

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**INSTITUTE/  
UNIVERSITY  
MEMBERS:**


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**G**


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**GEORGIA TECH RESEARCH  
INSTITUTE (GTRI)**

400 W. 10th St. NW  
Atlanta, GA 30332-0801  
www.gtri.gatech.edu  
Phone: +1-404-407-7401  
Fax: +1-404-407-9280  
Director: Dr. Stephen E. Cross, VP, Georgia Institute of Technology  
**AOC contact:** Thomas McDermott, GTRI Deputy Director and Director of Research  
Phone: +1-404-407-8240

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

Today, its excellence continues not only in the ECM technique development, modeling and analysis area, but in the modernization of radar warning receivers, jamming systems and test systems. GTRI has participated in the development of future integrated EW 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 with unbiased, independent technique effectiveness and technology insertion solutions.

Other key EW areas in which GTRI offers excellence include EO/IR countermeasures, lasers, C4ISR, integrated EW training, ECM technique development and effectiveness analysis, EW systems integration, flight test support, sensor performance analysis, a network-centric test/training system (NeTTS), threat data analysis and modeling, multispectral (RF and IR/EO) techniques, algorithm development, sensors, network-centric operations and data fusion, human systems engineering, defensive system integration, embedded training, mission planning, integrated support stations, threat simulation and test and evaluation. The combination of these areas provides strong expertise

for GTRI to address future multispectral threats, systems of systems concepts and other EW and information operations challenges that lie ahead.

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

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**M**


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**MERCER ENGINEERING  
RESEARCH CENTER**

135 Osigian Blvd.  
Warner Robins, GA 31088  
Phone: +1-478-953-6800  
CEO: Dr. David Barwick, MERC Executive Director  
**AOC contact:** Ray Mitchell, Director, Advanced Programs

Mercer Engineering Research Center (MERC) is a nonprofit operating unit of Mercer University, a private, comprehensive university located in Macon, GA. 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 150 engineers, scientists, managers, logisticians and business consultants. MERC occupies a modern 110,000 square-foot 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 at Robins AFB; the Air Force Research Laboratory (AFRL) at Wright-Patterson AFB, OH; the 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's commercial clients have included businesses ranging from small businesses such as KOR Electronics Inc., Research Associates of Syracuse and MacAulay Brown Inc. to Fortune 500 companies such as Raytheon, Northrop Grumman, Teledyne, BAE, EDO Corporation, Lockheed Martin and Boeing.

MERC has more than 250 man-years of EW 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; simulation and modeling; real-time operational flight program (OFP) development; information systems technology; large Web-based applications; structures technology; integrated logistics systems; industrial systems technology; and rehabilitation and ergonomic science technology.

MERC combines the in-house expertise of its scientists, engineers and logisticians with direct reach to the Mercer University staff. This gives MERC the ability to provide quality, quick-reaction resources to meet urgent requirements while using world-class researchers and engineers.

## GROUP MEMBERS:

## A

**AAI CORPORATION**

124 Industry Lane  
Hunt Valley, MD 21030  
www.aaicorp.com  
Phone: +1-410-666-1400  
Chief Executive: Ellen M. Lord, Senior VP  
and General Manager  
**AOC contact:** Sharon Corona  
Phone: +1-410-628-3184

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; the Advanced Moving Target Simulator (AMTS) short-range air defense trainer; the E-8 Joint Surveillance Target Attack Radar System, or J-STARS, trainer; the E-3 Sentry Airborne Warning and Control System, or AWACS, trainer; the C-17, F-22 and F-35 maintenance trainers; the T25 SECT, or Simulator for Electronic Combat Training; the Shadow® Crew Trainer, which is part of the larger Training Aids, Devices, Simulators and Simulations suite; and the C-130H Compass Call Mission Crew Simulator aircrew training system. AAI simulators and stimulators have been used to train virtually all US Navy and Air Force EW systems, including those on the B-52, EA-6B, EF-111, A-10 and F-16 aircraft. AAI's expertise includes real-time software modeling, simulation and control; embedded and multiprocessor applications; real-time signal processing; and visual and sensor database development.

**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. Lab JSECST, a derivative of the JSECST system, has been developed for use in systems integration and government EW laboratories. At the depot level, AAI's AN/ALM-234 Advanced Standard Threat Generator, or ASTG, provides a high-fidelity, dense radio frequency threat environment to

evaluate and validate electronic combat system changes and upgrades. The new Advanced Architecture Phase Amplitude and Time Simulator (A2PATS) incorporates phase-coherent properties that allow the creation of signals necessary for future electronic combat scenarios. AAI is a leading producer of modular, automatic test equipment systems supporting DOD initiatives to standardize automatic test equipment for greater efficiency. On the flight line, the Handheld Radar Test Set (HRS) follows AAI's highly successful Model 527 and provides state-of-the-art radar signal generation and system response testing for the US Navy and other service platforms. AAI's Universal Test Set (UTS) provides a similar function for ground-based CREW improvised explosive device (IED) jammer systems. The company's electro-optic/infrared simulators provide testing for airborne countermeasures systems on the flight line and range, as well as in the laboratory. AAI also has introduced an aircrew training system for missile warning systems called MAST, or the Man-portable Aircraft Survivability Equipment (ASE) System Trainer, offering full-range stimulation and detailed after-action review.

In April 2005, AAI Corporation acquired ESL Defence Limited, an EW systems company based in the UK. (See profile under ESL Defence.)

In November 2006, AAI acquired Symtx Inc. of Austin, TX. Symtx is a leader in the design and manufacture of high-performance functional test solutions for mission-critical electronic systems on the factory floor, in the laboratory and in the depot.

**Unmanned Aircraft Systems (UAS):** The company's family of UAS includes the Shadow 200, which is in full-rate production and deployed as the RQ-7B with U.S. Army and Marine Corps forces in Operations Iraqi Freedom and Enduring Freedom. The Shadow tactical UAS has surpassed 360,000 total hours of flight operations. AAI's family of UAS also includes the Shadow 400, Shadow 600 and Aerosonde®, which is manufactured by the company's Australian subsidiary, Aerosonde Pty Ltd. This small UAS supports scientific, civil and intelligence and surveillance missions.

**Services:** AAI Services Corporation, a strategic business of AAI, provides total life-cycle support to military and commercial organizations worldwide for its products and those of other companies. The company specializes in responsive, efficient and effective contractor logistics support, depot support, supply chain management and training and simulation systems and service, providing and supporting cutting-edge technologies and equipment for government and commercial customers across the globe.

**ADVANCED CONCEPTS INC.**

9861 Broken Land Parkway, Ste. 150  
Columbia, MD 21046  
Phone: +1-301-596-2712 or +1-410-381-3780  
Fax: +1-410-381-9275  
CEO: Frank White  
Phone: +1-301-596-2712  
COO: John Register  
Phone: 301-596-2712  
**AOC contact:** Bill Bonacki (Columbia, MD),  
R. Michael Kane (Warner Robins, GA)  
Phone: +1-301-596-2712 or +1-478-929-8911

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.

Washington Technology has recognized ACI as achieving the area's fast-fifty growth list for seven consecutive years. ACI also was recognized by *Inc.* magazine as one of the top 500 fastest-growing companies in the US, ranking 201st; by the Deloitte & Touche Maryland Fast 50 (ranking 20th in 2005, the company's ninth year consecutively); and by the Deloitte & Touche Fast 500 in the US (ranking 148th).

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.

In the 21st century, information is power and customers need a team dedicated to accomplishing their goals on time and on budget. ACI is this team.

ACI is recognized as a minority business enterprise (MBE) in the state of Maryland.

**ADVANCED TESTING TECHNOLOGIES INC.**

110 Ricefield Lane  
Hauppauge, NY 11788  
www.attinet.com  
Phone: +1-631-231-8777  
Fax: +1-631-231-8517  
Executive VP and COO: Eli Levi

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

## GROUP MEMBERS

software. Utilizing ATTI's 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.

**AETHERCOMM INC.**

2910 Norman Strasse Road  
San Marcos, CA 92069

www.aethercomm.com  
Phone: +1-760-598-4340  
Fax: +1-760-598-4342

**AOC contact:** Freddie Chavez  
sales@aethercomm.com

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.**

3505 Murrell Road  
Rockledge, FL 32955  
www.airscan.com  
Phone: +1-321-631-0005  
Fax: +1-321-631-5811

**AKON INC.**

2135 Ringwood Drive  
San Jose, CA 95131  
www.akoninc.com  
Phone: +1-408-432-8039  
Fax: +1-408-321-1089

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**

1750 Tysons Blvd., Ste. 1300  
McLean, VA 22102

www.alionscience.com  
Phone: +1-703-918-4480  
Fax: +1-703-714-6511

Chairman and CEO: Dr. Bahman Atefi  
**AOC contact:** David Erteschik

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**

P.O. Box 4648  
Clearwater, FL 33758-4648  
www.atk.com  
Phone: +1-727-572-1900  
Fax: +1-727-572-2169

**AOC contact:** Terry Thames

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. Once a threat is detected, the system may direct electronic countermeasures to deny the effective use of these radar systems. The radar track information may be integrated with other air defense networks.

ATK's Advance 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.

ATK also provides integration services for special mission aircraft. Its capabilities include engineering, fabrication, assembly, installation and testing of EO/IR sensors, radar systems, aircraft survivability equipment, avionics and other special mission equipment.

**AMPEX DATA SYSTEMS**

1228 Douglas Ave.  
Redwood City, CA 94063

www.ampexdata.com  
Phone: +1-650-367-3365

CEO: Gordon Strickland  
President: Larry Chiarella

**AOC contact:** Don Downing  
don\_downing@ampexdata.com  
Phone: +1-303-697-9499

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. – SPACE & DEFENSE GROUP**

6635 Kirkville Road  
East Syracuse, NY 13057  
www.anaren.com

Phone: +1-315-432-8909  
Toll-free: +1-800-411-6591  
Fax: +1-315-432-9121

**AOC contact:** Mark Kosalek or Tim Glavin  
space&defensemktg@anaren.com

Founded in 1967 as a supplier of microwave components and subassemblies to the defense electronics markets, today's Anaren is a worldwide innovator of standard and custom high-frequency technology for the defense, space, commercial wireless infrastructure and wireless consumer electronics sectors. Specializing in solving tough RF and microwave problems with integrated solutions that now combine Anaren's multilayer softboard and LTCC solutions – with the additional capabilities of newly acquired subsidiaries M.S. Kennedy (www.mskennedy.com) and Unicircuit Inc. (www.unicircuit.com) – Anaren's Space & Defense Group is a trusted and fast-growing subcontractor to the world's Tier 1 defense primes.

Anaren's high-frequency, high-density mil-spec solutions include

- broadband receivers for missile applications;
- RF and LO distribution for complex receivers;
- beamformers for satellite communications antennas;
- 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; and
- standard, mil-spec components and assemblies (passive, active and hybrid), including SM couplers, amplifiers, motor controllers, power PEMs, linear and switching regulators, DC/DC converters and RAD hard components.

Anaren's design-to-spec solutions are supported by

- a 90+-person engineering staff dedicated to space and defense programs;
- an extensive library of design, modeling, simulation and testing software;
- a range of manufacturing and materials capabilities, including high-precision, multilayer PWB, multilayer softboard, LTCC, BGA, flip-chip, fuzz-button and more; and
- a range of certifications where applicable, including ISO 9001-2000, AS9100 Rev B, Mil-PRF-31032, Mil-PRF-38534, Mil-P-55110 and Mil-STD-1772 Class H & K.

#### **ANNAPOLIS MICRO SYSTEMS INC.**

190 Admiral Cochrane Drive, Ste. 130  
Annapolis, MD 21401  
www.annapmicro.com  
Phone: +1-410-841-2514  
Fax: +1-410-841-2518

Annapolis Micro Systems is the world leader in 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**

www.anritsu.com

#### **APPLIED SIGNAL TECHNOLOGY**

460 West California Ave.  
Sunnyvale, CA 94086  
www.appsig.com  
Phone: +1-408-749-1888  
Fax: +1-408-738-1928

#### **ARINC ENGINEERING SERVICES, LLC**

2551 Riva Road  
Annapolis, MD 21401  
www.arinc.com  
Phone: +1-301-863-2300  
Fax: +1-301-863-2331  
CEO: John M. Belcher  
**AOC contact:** Jay Amadio  
jamadio@arinc.com

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 & sensors (C4IEW&S) systems. ARINC also provides engineering and technical support services to the Navy's SPAWAR Space and Naval Warfare Systems Center.

ARINC's team of operationally experienced EW professionals is currently utilizing its fleet and T&E backgrounds to assist the Naval Air Warfare Center, Patuxent River, in the evaluation of EW systems on the EA-6B Prowler, the F/A-18E/F Super Hornet and the EA-18G Growler (electronic attack series of the F/A-18F Super Hornet). This T&E includes box-level reliability predictions and failure modes, effects and criticality analysis, instrumentation, operational effectiveness and suitability analysis, Electromagnetic Environmental Effects (EEE) design engineering, electronic attack effectiveness and EW T&E engineering support on the EA-6B ICAP II & III programs and the EA-18G Growler programs.

#### **ASELSAN A.S.**

Mehmet Akif Ersoy Mah  
16. Cadde No. 16 Macunköy, Ankara, Turkey  
Phone: +90-312 592-1000  
Fax: +90-312 354-5205  
CEO and President: Cengiz Ergeneman  
**AOC contact:** Türker Murat, Project Engineer

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.

ASELSAN is the reliable source and a powerful partner in defense requirements.

#### **ATDI**

8, rue de l'Arcade  
75008 Paris, France  
www.atdi.com  
Phone: +33-(0)-1-53-30-89-40  
Fax: +33-(0)-1-53-30-89-49

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

## GROUP MEMBERS

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.

HTZ warfare *nG* can be configured by the user to be the specialist toolbox for EW mission planning, technical spectrum management, network planning or as a coverage and link planning tool for field operations (indoor and outdoor). HTZ warfare *nG* is designed to allow integration into other systems as mission planning suites, spectrum management/monitoring systems or as individual system frequency management packages.

The HTZ warfare *nG* tool utilizes digital terrain models to simulate communication effects with a dynamic two- and three-dimensional display from a frequency range of 10 kHz to 450 GHz.

HTZ warfare *nG* utilizes a proprietary three-dimensional cartographic workspace (digital elevation model) for all operations and analyses. In consequence, analysis results can be displayed on dynamic two- or three-dimensional display.

**ATK MISSILE SYSTEMS COMPANY LLC**

P.O. Box 4648  
Clearwater, FL 33758-4648  
Phone: +1-727-572-1900 (2516)  
Fax: +1-727-572-2180

**AOC contact:** Mr. Terry Thames, III

**AVALON ELECTRONICS INC.**

100 Bartow Municipal Airport  
Bartow, FL 33830  
www.avalon-electronics.com  
Phone: +1-800-797-1337 or +1-863-519-0905  
Fax: +1-863-519-0763

**AOC contact:** Fred A. Thames, Jr., CEO  
fredthames@hughes.net

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'ed 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.

## B

**BLACKHAWK MANAGEMENT CORPORATION**

1335 Regents Park Drive, Ste. 130  
Houston, TX 77058  
www.blackhawkmgmt.com  
Phone: +1-281-286-5751  
Fax: +1-281-286-5752  
President and CEO: Linda Moorehead  
**AOC contact:** Stan Moorehead, VP, Business Development

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**

8283 Greensboro Drive  
McLean, VA 22102  
www.boozallen.com  
Phone: +1-703-902-5000  
Fax: +1-703-902-3333  
CEO: Dr. Ralph W. Shrader  
**AOC contact:** Gregory D. Best  
Phone: +1-937-781-2447  
best\_gregory@bah.com

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.

As an employer, it seeks the most talented and experienced EW professionals. It is among *G.I. Jobs'* "Top 50 Military-Friendly Employers" (for the third consecutive year), *BusinessWeek* magazine's "Best Places to Launch a Career" (for the third consecutive year), *FORTUNE* magazine's "100 Best Companies to Work For" (for the fourth consecutive year) and *Working Mother's* "100 Best Companies for Working Mothers" (for the 10th consecutive year). Booz Allen Hamilton's many regional offices are routinely voted among the best places to work by publications such as the *San Antonio Business Journal* and *Dayton Business Journal*.

## C

**CACI INTERNATIONAL INC.**

749 Hope Road  
Eatontown, NJ 07724  
www.caci.com  
President and CEO: Paul M. Cofoni  
**AOC contact:** Joe Zirilli, VP

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.

CACI's involvement in EW systems technology is a powerful contributor to US dominance of the EW electronic spectrum. The profound worldwide changes taking place in EW demand an unprecedented level of sophistication, both in treating the evolving threat and pacing the changes taking place in EW-related technology. CACI designs, builds, operates and supports

multi-mission and multispectral EW systems. Its open-architecture approach focuses on EW systems interoperability and the rapid, cost-effective integration of advanced systems and processes. Its EW systems meet both the challenges of the threat environment and the real-time needs of the warfighter.

CACI is a member of the Fortune 1000 Largest Companies of 2007 and provides dynamic careers for approximately 12,400 employees working in more than 120 offices in the United States and Europe.

#### **CALHOUN INTERNATIONAL**

100 N. Tampa St., Ste. 2330  
Tampa, FL 33602-5809  
www.calhouninternational.com  
**AOC contact:** Robert Rieke  
rriek@calhouninternational.com

#### **CDES – M/A-COM SIGINT PRODUCTS**

10713 Gilroy Road  
Hunt Valley, MD 21030  
www.macom.com/sigint  
Phone: +1-410-329-7914  
Fax: +1-410-329-7990  
President/GM: Rudy Hallenbeck  
**AOC contact:** Ken Eagen  
sigintsales@tycoelectronics.com

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.

#### **COLSA CORPORATION**

www.colsa.com  
**AOC contact:** Linda Palmer  
lpalmer@colsa.com

COLSA Corporation in Huntsville, Alabama, is a technology services company that applies systems engineering and analysis to testbed development and operation, modeling and simulation, and technical support. Building on successful development and delivery of space, sensor, and electronic warfare models for One Semi-Automated Forces (OneSAF), the Army's constructive simulation for research, development, and training, COLSA is developing models for specific jammers, signals intelligence systems, and high-altitude platforms.

#### **COMTECH PST CORP.**

105 Baylis Road  
Melville, NY 11747  
Phone: +1-631-777-8900  
President: Larry Konopelko  
**AOC contact:** Robert J. Califra, VP,  
Marketing and Sales

Comtech PST Corp. (CPST) designs, develops and manufactures solid-state high-power amplifiers. A wholly-owned subsidiary of Comtech Telecommunications Corporation, it serves a variety of domestic and international markets, including defense, wireless and satellite communications, cellular instrumentation, electromagnetic compatibility testing and medical testing systems. Its design and manufacturing strength rests with supporting high-quality, high-mix and high-complexity amplifier requirements with experienced engineering talent solely dedicated to designing and developing RF amplifiers. Located in Melville, NY, Comtech PST's facility is a modern, 46,000-square-foot structure that provides office space, as well as engineering, test and customer service.

Founded in 1987, CPST's focus has been on making superior solid-state amplifiers. Its engineering staff has participated in the major growth of this technology, and has led to the development of a versatile and highly reliable product line. This background in solid-state amplifier design and development has provided CPST with experience in such diverse fields as EW/ECM systems, radar systems, TACAN, TWT replacement, high-power testing, satellite tracking systems, communication, RFI/EMC testing, radio transmitters, boosters and general laboratory testing. Whether its customers' needs include amplifier module building blocks, rack-mounted amplifier units or complete amplifier systems, its standard and customized solid-state power amplifier products provide a flexible effective solution. CPST offers solid-state power amplifiers in frequency ranges from 1 MHz through 6 GHz, with output power levels ranging from 2 W to more than 30 kW.

Furthermore, its Hill Engineering Division product line has enabled CPST to better serve its customers, expanding the range of its products and expertise to include high-power PIN-diode control devices in additional military and satellite requirements.

#### **CPI**

811 Hansen Way  
Palo Alto, CA 94304  
www.cpii.com  
Phone: +1-650-846-2900  
CEO: Joe Caldarelli  
**AOC contact:** Linda Di Lorenzo

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.

#### **CUBIC DEFENSE APPLICATIONS INC.**

9333 Balboa Ave.  
San Diego, CA 92123  
www.cubic.com  
Phone: +1-858-277-6780  
Fax: +1-858-505-1523  
President and CEO: Walter J. Zable  
**AOC contact:** Robert Kraft  
robert.kraft@cubic.com  
Phone: +1-858-505-2219

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.

Additionally, the company develops wireless products for public safety, commercial telecommunications and maritime and civil aviation industries. CDA's software-defined technologies ensure modern, spectrally-efficient communications.

The CDA group is one of Cubic Corporation's two major segments. The corporation's other segment, Cubic Transportation Systems, designs and manufactures automatic fare collection systems for public mass transit authorities worldwide. Cubic Transportation Systems, in conjunction with CDA, has developed an explosives detection system that is capable of being deployed in large-scale public transportation systems. CDA is working with both small and large companies to take the best of radiation and explosives detection subsystems and integrate the two areas to provide detection and prevention of terrorist incidents in a public transportation system.

**CURTISS-WRIGHT CONTROLS  
EMBEDDED COMPUTING**

741-G Miller Drive SE  
Leesburg, VA 20175  
Phone: +1-703-779-7800  
Fax: +1-703-779-7805  
President: Tom Quinly

Curtiss-Wright Controls Embedded Computing is the defense and aerospace industry's most comprehensive and experienced single source for rugged embedded computing solutions. Its complete portfolio of products includes processing, data communications, digital signal processing, video and graphics, recording and storage, analog acquisition and reconstruction, radar and integrated subsystems. All of its quality products are architected with the most advanced technology for a rugged environment and are enhanced by services such as life-cycle management and custom engineering. As part of the Motion Control division of Curtiss-Wright, its focus on engineering excellence is based on more than a century of innovation that includes some of the most important advancements in aviation pioneered by its founders, Glenn Curtiss and Orville and Wilbur Wright.

To provide customers access to the highest performing technology available, its designs begin with leading-edge, COTS technology based on industry standards and open system architectures. The use of COTS components as key subsystem building blocks maximizes the reuse of both common hardware and software building blocks tightly coupled with the program support services it delivers. This approach decreases its customers' time to market and lower their overall program development costs.

When a program requires a solution that goes beyond COTS, it can reengineer COTS hardware and software products into a unique customer design. By maintaining flexibility in systems designs, it is able to solve the most difficult legacy subsystem upgrades and mitigate risk by reducing development time and program costs. It is the industry leader in defining and delivering programs that meet the most stringent life-cycle requirements.

**CYBERVILLAGE NETWORKERS INC.**

7773 Blueberry Hill  
Ellicott City, MD 21043  
www.cybernetworkers.com  
Phone: +1-410-579-1993  
Toll-free: +1-866-541-6140  
Fax: +1-410-579-1773

**AOC contact:** Connie S. Mazur, CEO

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.

**D****DAVID H. POLLOCK  
CONSULTANTS INC.**

99 Kinderkamack Road, Ste. 301  
Westwood, NJ 07675  
www.dhpconsultants.com  
Phone: +1-201-722-0615  
Fax: +1-201-722-0618

Executive VP: Joseph Aletta

**AOC contact:** David H. Pollock, President  
dpollock@dhpconsultants.com

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.

**DB CONTROL INC.**

1120 Auburn St.  
Fremont, CA 94538  
www.dbcontrol.com  
Phone: +1-510-656-2325  
CEO: Joseph Hajduk, CEO

**AOC contact:** Steve Olson, Marketing Manager  
solson@dbcontrol.com

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.

dB Control's repair depot complements its contract manufacturing services with the ability to repair, refurbish or replace microwave amplifier components. The company's reputation for successfully repairing tightly packaged high-voltage power supplies, and expertise with high-voltage and high-power microwaves, enables it to offer testing services as well.

Established in 1990, dB Control provides convenient "one-stop shopping" for the build, test and burn-in of high-voltage and microwave equipment at its 40,000-square-foot facility. The company supplies mission-critical (often sole source) products worldwide to military organizations, as well as to major defense contractors and commercial manufacturers.

**DEFENCE RESEARCH AND  
DEVELOPMENT CANADA**

305 Rideau St.  
Ottawa, Ontario  
K1A 0K2, Canada  
www.drdc-rddc.gc.ca  
Phone: +1-613-998-2137  
Fax: +1-613-998-2675  
**AOC contact:** Mr. Dan Martella  
Phone: +1-613-998-2203  
collabo-ottawa@drdc-rddc.gc.ca

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. It is designed to provide integrated capabilities and services from R&D, testing, evaluation and engineering to technology exploitation of forward-thinking, operational solutions by private sector partners.

For DRDC, the rapid transition of S&T into defense and security capabilities involves engaging industry early in technology development, moving away from the traditional linear process for procurement to an evolutionary approach. Through timely commercialization, a synergy is achieved between Canada's defense and security objectives and Canada's economic goals.

With an innovative workforce of more than 1,600 people, DRDC is working to shape the CF of tomorrow and strengthen Canada's security.

#### **DEFENSE RESEARCH ASSOCIATES INC.**

3915 Germany Lane, Ste. 102  
Beavercreek, OH 45431  
www.dra-inc.net  
Phone: +1-937-431-1644  
Fax: +1-937-427-4526

**AOC contact:** Andrew L. White,  
Director, Business Development  
info@dramail.com

Defense Research Associates (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 33 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 (M<sup>2</sup>CAS), 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 from which it inductively draws its power and uses 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.

Other ongoing programs include the Power Line Urban Sentry (PLUS), a new class of self-refueling SUAS providing virtually unlimited persistence through inductive power line energy harvesting and fulfilling a variety of layered sensing mission requirements, and the Man-in-the-Loop (MITL) virtual cockpit, which develops, integrates and operates high-fidelity manned and unmanned visualization systems for the US Army and Air Force. DRA conducts analysis of alternative studies and provides customers with information to make strategic decisions.

Recently, DRA has been contracted for the second phase of the Vigilant Eagle program. Vigilant Eagle II is a layered sensing initiative and an adaptation of the Angel Fire electro-optical (EO) surveillance system, expanded to include infrared (IR) and any other type of sensor(s) deemed of interest to the surveillance community. Its purpose is to provide an advanced, highly flexible and expandable multi-spectrum sensor platform to support the development of multi-target detection algorithms, or any other sensor-based algorithms used within the surveillance community. It can support multiple sensing modalities. The system will provide a testbed for ground-based and aerial-based evaluations of current/new sensor technologies, as well as support multi-layered data collections requiring both ground- and aerial-based imagery.

DRA boasts a 90 percent commercialization rate for technology developed under small business innovative research (SBIR) programs, and was awarded the Small Business Administration's Award for Excellence for innovative utilization of affordable COTS technology.

#### **DRS CODEM SYSTEMS INC.**

21 Continental Blvd.  
Merrimack, NH 03054  
Phone: +1-603-429-0111  
www.drs-cs.com

General Manager: Conrad Struckman  
**AOC contact:** Lynda Derby, Marketing  
Communications  
lynda.derby@drs-cs.com

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, 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. Its markets include the DOD and Department of Homeland Security, as well as regulatory and intelligence agencies in the United States and throughout the world.

DRS Codem's SIGINT business specializes in electronic surveillance systems,

products and related services. It integrates the best equipment available to create turnkey systems that meet its unique customers' requirements. It designs and develops COMINT/DF systems for HF and VHF/UHF communication signals reconnaissance, plus systems for tactical and strategic collection missions. SIGINT provides advanced systems that intercept, monitor and locate radio and wireless signals. Also provided are related services, including requirements definition, system specification, design, development, installation of turnkey systems and post-delivery training and support. These solutions are employed in a variety of mission critical applications, including communications intelligence, EW, spectrum management and signal geolocation.

DRS Codem's Antenna and Wireless business provides a wide range of antenna controllers, stabilized gimbals, miniature positioners, antenna refurbishment services and monitor and control software for broadband satellite communications, telemetry tracking and control (TT&C), mobile (On-The-Move) communications and datalinks.

The company's Network Systems business provides internetworking solutions for military and commercial communications networks. These solutions enable migration to modern network technologies while leveraging existing network infrastructure investments. The primary focus is on designing, developing and delivering specialized network solutions within the architecture of the industry's most flexible, robust and scalable COTS integrated access devices.

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 RECORDING TECHNOLOGIES**

9790 H Patuxent Woods Drive  
Columbia, MD 21046  
www.drs-srt.com  
VP: Larry Butera

**AOC contact:** Carey Hayden

DRS Signal Recording Technologies develops, manufactures and markets high-performance wideband data recorders, interface systems and custom storage system solutions for the government and commercial markets. Targeted application areas include SIGINT, ELINT, SATCOM, TELECOM, radar, sensor test and characterization, imaging and digital radio. DRS Signal Recording Technologies' products provide state-of-the-art signal collection and processing and recording capabilities with seamless communications to networked C4I systems. The Eagle recorder line and recorded data access (RDA) systems provide the complete solution in support of survey, training and validation missions for counter-

## GROUP MEMBERS

IED, homeland security and intelligence applications

**DRS SIGNAL SOLUTIONS INC.**

700 Quince Blvd.  
Gaithersburg, MD 20878  
www.drs-ss.com  
Phone: +1-800-954-3577

**AOC contact:** Ondrea Hall, Manager,  
Marketing Communications  
ondrea.hall@drs-ss.com

DRS Signal Solutions Inc. (DRS-SS) is the legacy of the Watkins-Johnson Company. With more than 45 years of experience leading technology development for the SIGINT community, the company has established a standard of state-of-the-art surveillance equipment that has become the benchmark of the industry. CEI became a Watkins-Johnson Company in 1971, extending its RF performance leadership in the market while introducing digital signal processing (DSP) technology into the mix. Though in today's marketplace, many companies tout their prowess in the DSP arena, few have developed the ability to integrate high-performance DSP with RF technology of similar caliber. Watkins-Johnson Company refined the techniques for tightly integrating these two capabilities into small packages. A series of acquisitions beginning in 2000 and ending with DRS Technologies acquiring the company in 2004 saw the division renamed DRS Signal Solutions Inc. and its commitment to providing high-performance SIGINT equipment endures.

DRS-SS has a broad product profile covering all aspects of SIGINT. Major product areas include tuners, receivers, signal processing, subsystems and microwave components. DRS-SS reinvests a significant portion of its revenue back into the company in the form of internal research and development. This, in combination with extensive customer-funded research and development, maintains the company at the leading edge of technology.

DRS-SS is in a unique position to supply proof-of-concept technology, as well as define, design and develop the small, lightweight, low-power software-definable radio assets required to address various mission requirements. Its background in SIGINT system development provides significant insight into the problems and necessary development to achieve high-performance equipment under real world conditions. Its understanding of system tier problems, combined with its extensive experience in the development of high-performance software-definable receivers, makes it an ideal partner.

**DRS TECHNOLOGIES SUSTAINMENT SYSTEMS**

5 Sylvan Way  
Parsippany, NJ 07054  
www.drs.com  
Phone: +1-973-898-1500  
Fax: +1-973-898-4730  
snesbit@drs-s3.com

**DRS TRAINING & CONTROL SYSTEMS INC.**

645 Anchors St.  
Ft. Walton Beach, FL 32548  
www.drs.com  
Phone: +1-850-302-3000  
Fax: +1-850-302-3371  
CEO: Edwin "Robbie" Epstein, President,  
DRS Training & Control Systems Inc.  
**AOC contact:** Todd Kortbein, VP, Business  
Development, Range Systems  
tkortbein@drs-tcs.com

DRS Training & Control Systems (DRS-TCS) is a designer, developer, manufacturer and system integrator of range instrumentation and control systems. Its products are used by land, sea and air military forces to train air combat pilots, and can be integrated with live-virtual-constructive (L-V-C) simulation. Military forces also depend on its control systems' technology-based operational products and integrated sensor solutions for weapon systems and platforms.

DRS-TCS has fielded and supported a wide range of both test and training systems worldwide for over 45 years. It designs and manufactures GPS-based airborne instrumentation pods and internal systems for fighter, bomber, transport and helicopter platforms for domestic and international customers. Its USAFE Rangeless Instrumentation System (URITS) is in daily operation by US Air Force crews to train and one day fly real-world combat missions. Its next-generation airborne P5 Combat Training System (P5CTS) supports state-of-the-art readiness training capabilities such as EW, no-drop bomb scoring and enhanced weapon simulations, with real-time kill notification. The DRS Advanced Range Data System (ARDS) is the time-space-position-information (TSPI) standard at all major US test ranges.

DRS-TCS also provides the hardware and software necessary to complete ground infrastructure for these ranges, including post-mission and real-time display and debriefing ground stations, microwave systems, training, documentation and aftermarket performance-based logistics support. DRS-TCS provides life-cycle support for domestic and international customer test and training systems with a full range of test equipment, spares, training, documentation, depot repair and contractor logistics support.

**DYNETICS INC.**

P.O. Box 5500  
Huntsville, AL 35814-5500  
www.dynetics.com  
Phone: +1-256-964-4000  
Fax: +1-256-964-4031  
CEO: Marcus J. Bendickson, Ph.D.  
**AOC contact:** James M. Stanfield, Senior VP

For more than 33 years, Dynetics has been a leader in research, development, tests and engineering for government agencies and commercial firms in the areas of Intelligence, Systems Research & Development; Hardware & Software Product Development, System Analysis, Engineering & Integration; Information Assurance; Acquisition, Logistics &

Program Support; Test, Evaluation & Experimentation; Modeling & Simulation; and Vehicle Diagnostics & Prognostics. Corporate expertise includes Modeling and Simulation; Radar, Ladar, EO/IR and RF/MMW Sensor Systems; Exploitation of Radars, Missiles, C4I, EO/IR/Acoustic devices and Launchers; Data Mining; Network Architectures & Security; Data Fusion; and Web-enabled Data Management.

Dynetics' comprehensive threat descriptions, high-fidelity models and simulations support conceptual development of EW equipment. Its predictions of IR, UV and RF signatures support development of algorithms to identify and track threat missiles. Through detailed signals analyses, Dynetics develops innovative threat radar signal representations for use in improving the performance of EW systems. Dynetics supports development of the Next Generation EWIR System (NGES) with development of display tools and conversion utilities that allow interactive display and direct ingestion of the threat signal representations into RF simulators to develop detection algorithms. Dynetics develops special test equipment to characterize threat vulnerabilities and develop potential countermeasures and tactics. Dynetics' test equipment, instrumentation and models and simulations are used at open-air ranges in the United States and overseas to support developmental and operational testing.

Dynetics develops, implements and evaluates ECCM techniques that cover the full spectrum of system components, as well as operational strategies for mitigating susceptibility to ECM. Dynetics has developed and evaluated antenna specifications to achieve low-angle sidelobes to mitigate sidelobe ECM and clutter. Dynetics has developed ECM-resistant waveform designs and advanced signal and data processing techniques for ECCM support to address both noise ECM and deceptive ECM. Dynetics develops concepts and conducts analyses of candidate EW techniques for electronic attack, electronic protection and ES systems. Dynetics also provides EW operational and engineering expertise and direct support across the entire spectrum of EW missions. Dynetics' expertise addresses sustainment obsolescence issues of EW equipment, such as the A5 Filter/Detector Assembly of the AN/ALR-69 RWR.

Dynetics has a professional staff of more than 1,000 employees and annual revenues exceeding \$260 million. Dynetics is headquartered in Huntsville, AL, with offices in Arlington, VA; Dayton, OH; Shalimar, FL; San Antonio, TX; Colorado Springs, CO; Detroit, MI; and Tullahoma, TN. Dynetics is ISO 9001:2000- and SEI CMM Level 3- and CMMI Level 2-certified. Dynetics is a four-time recipient of the Cogswell Award for Industrial Security and a recipient of the Small Business Administration's National Small Business Prime Contractor of the Year Award.

## E

**ELBIT SYSTEMS OF AMERICA**

4700 Marine Creek Parkway  
Fort Worth, TX 76179-3505  
Phone: +1-817-234-6600  
**AOC contact:** Gary Quarve  
gary.quarve@elbitsystems-us.com

**ELCOM TECHNOLOGIES INC.**

11 Volvo Drive  
Rockleigh, NJ 07647  
www.elcom-tech.com  
Phone: +1-201-767-8030, ext. 286  
CEO: Jim Davis

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. When exceptional phase noise performance is needed at the module, subsystem or instrument level, Elcom has for more than 10 years been the vendor of choice by major aerospace, defense and commercial companies around the world.

**ELECTRO-METRICS CORP.**

231 Enterprise Road  
Johnstown, NY 12095  
Phone: +1-518-762-2600  
Fax: +1-518-762-2812

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.**

48 Mivtza Kadesh St.  
Bene Beraq, 51203, Israel  
www.elisra.com  
Phone: +972-3-6175522  
Fax: +972-3-6175850  
CEO: Itzchak Gat

**AOC contact:** Jacob Limor, Planning & Development Director, Airborne EW Systems Division  
marketing@elisra.com

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.

Elisra's complete EW self-protection suite for helicopters includes passive subsystems, such as RWR, LWS and the passive approach warning system (PAWS), a passive, IR-based missile warning system that detects IR radiation emitted by an incoming missile. The suite also includes active ECM and is fully integrated with a chaff and flare dispenser.

Different configurations are in service with the Israel Air Force, as well as with air forces of other nations. The suite is installed on a variety of helicopters types,

including the Apache, Cobra, CH53 and Black Hawk helicopters. Elisra's strategic alliances and cooperation agreements with global defense leaders include several important contracts awarded recently.

**ELTA SYSTEMS LTD.**

www.elta-iai.com

ELTA Systems Ltd, a group and subsidiary of Israel Aerospace Industries, is one of Israel's leading defense electronics companies and a global leader in a variety of areas.

It operates as a defense systems house based on electromagnetic sensors (radar, EW and communication) and on advanced technologies.

ELTA Systems' products are designed for Intelligence, Surveillance, Target, Acquisition and Reconnaissance (ISTAR), Early Warning and Control, Homeland Security (HLS), Self-Protection and Self-Defense, and Fire Control applications, and include systems, subsystems and critical technological subassemblies and components designed and produced in-house. This enables the Group to offer comprehensive solutions and sell products and systems tailored and adapted to the special requirements of customers and users, thereby creating a competitive advantage vis-à-vis the leading defense firms worldwide. The Group has a variety of unique technological excellence centers, as well as exclusive facilities and national infrastructures. ELTA operates a worldwide marketing network, which also includes customer service and after-sales support activities.

The ELTA Systems Group has five divisions: **ELTA IMINT & Radar Division; ELTA SIGINT, EW & Communication Division; ELTA AEW & Communication Division; and ELTA Technologies Division.**

Sales in 2007 reached US\$924 million, of which 85 percent was exported to the armed forces of more than 50 countries worldwide and 15 percent was sold to the domestic market where ELTA is a major supplier to the IDF. Profit before tax reached US\$72.4 million. A backlog of US\$2.198 billion covers on average more than 24 months of work.

The Group has holdings in subsidiaries/affiliated companies located in Israel, Europe and South America. ELTA Systems is a partner in teaming agreements with numerous other defense companies around the world. Based on its existing advanced technologies, ELTA also is active in paramilitary and commercial markets.

**EMCORE**

2015 W. Chestnut St.  
Alhambra, CA 91803  
www.emcore.com  
Phone: +1-626-293-3400  
**AOC contact:** Todd Olson  
toddo@emcore.com

For more than 25 years, EMCORE Corporation's Microwave and Specialty Group has provided the widest range of products for sending RF and microwave signals on fiber for satellite communication; cable television; video,

## GROUP MEMBERS

audio and data fiber transport; fiber-optic gyros; wireless antenna remoting; sensing; delay lines; radar calibration; towed decoys; and RF countermeasures.

EMCORE's specific products include DFB lasers and transmitters, phase and amplitude lithium niobate modulators and transmitters, PIN and APD photodiodes and receivers, vertical cavity surface emitting lasers (VCSEL) and 2-THz continuously tunable sources and detectors for chemical detection.

EMCORE has amassed this full portfolio through its acquisition of such industry-leading companies as Ortel, Phasebridge, Force, Opticomm and JDSU's Microwave Fiber Systems Group.

**EMS TECHNOLOGIES INC.**

Defense & Space Systems  
660 Engineering Drive  
Norcross, GA 30092  
www.ems-t.com

Phone: +1-770-263-9200  
Toll-free: +1-877-532-1828  
Fax: +1-770-729-6524

VP and GM: David Smith

**AOC contact:** Mike Fatig, VP, Business Development

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.**

130 Baytech Drive  
San Jose, CA 95134  
Phone: +1-408-522-3180

CEO: Edward Keible

**AOC contact:** David Hall, SVP and GM, Endwave Defense & Security Division

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, including

- unmanned aerial vehicles (UAVs);
- missile front-ends, exciters and fuses;
- airborne warning and surveillance;
- secure satellite communications;
- attack helicopters/airborne programs;
- automatic landing guidance;
- intelligent battlefield communications;
- phased-array, monopulse, fire control radar;
- microwave perimeter "fences"; and
- whole body imaging.

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.**

Deftechpark 26  
2628 XH Delft, The Netherlands  
www.eonic.com

Phone: +31-15-2600-432

Fax: +31-15-2600-431

CEO: Hans Vanderhoek

**AOC contact:** Dan Simard  
dan.simard@eonic.com

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 LTD.**

(A subsidiary of AAI Corporation – an operating unit of Textron Systems, a Textron Inc. company)

16 Compass Point, Ensign Way  
Hamble, Southampton  
Hampshire  
SO31 4RA, UK

www.esldefence.co.uk

Phone: +44-(0)-23-8045-5110

Fax: +44-(0)-23-8074-4200

Managing Director: Mr. Robert Fox

**AOC contact:** Emma Cogdell, Sales Office Manager

ESL is a leading provider of test and training products for defensive aid suites and self-protection systems. The company has specialist expertise in 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 flightline 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, it manufactures a wide range of products for testing ultraviolet (UV) and IR missile, laser and radar threat warners; IR jammers; and directed IR countermeasures (DIRCM).

The company's stimulators assess the operational readiness of sophisticated threat warning and countermeasures self-protection sensors on any military aircraft, including fighters, transport aircraft and rotorcraft. Advanced EO/IR stimulators also are used at military test and evaluation and training ranges to evaluate the effectiveness of new self-protection systems and to train pilots for combat readiness. ESL can provide integrated logistics support, trials support, open-range integration and training for military personnel in training range environments.

ESL has developed strong relationships with both government agencies and defence industry participants worldwide. Currently, the company is developing test equipment capable of stimulating the next generation of self-protection systems, including single- and two-color IR missile warners and hostile fire indicators. The company's current products include the UV/IR Baringa missile warning system (MWS) FLTS; Hydra laser warning receiver FLTS; Model 527 radar warning receiver FLTS; Solent IR jammer FLTS; MEON DIRCM FLTS; Mallina/Phoenix family for UV/IR MWS and DIRCM test, evaluation and training; Portable Range Threat Simulator for total spectrum training; Advanced Boresight Equipment (ABE™); and Advanced Architecture Phase Amplitude and Time

Simulator (A<sup>2</sup>PATS) for next-generation EW simulation.

### ESTERLINE DEFENSE GROUP

85901 Ave. 53  
Coachella, CA 92236  
www.armtecdefense.com  
Phone: +1-760-398-0143  
Fax: +1-760-398-3896  
President: Robert R. Harris  
**AOC contact:** Lisa Montgomery  
sales@armtecdefense.com

Esterline Defense Group is a division of Esterline Technologies, a specialized manufacturing company serving principally aerospace and defense markets.

The company has more than 30 years of experience in the development and manufacture of Armtec®-branded expendable countermeasures and combustible ordnance product lines. Its US and UK locations house research and development, test and IR flare production facilities.

Esterline Defense Group is dedicated to serving the expendable countermeasures and combustible ordnance needs of its customers worldwide, and is proud of its role in contributing to the preparedness of the US and allied armed forces.

### E2V

106 Waterhouse Lane, Chelmsford, Essex, CM1 2QU, UK  
CEO: Keith Attwood  
**AOC contact:** Jessica Broom  
Phone: +44-0-1245-493493

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.

### EW SIMULATION TECHNOLOGY LTD.

B9 Armstrong Hall  
Southwood Business Park  
Farnborough Hants, GU14 0NR, UK  
www.ewst.co.uk  
Phone: +44-1252512951  
Fax: +44-1252512428  
**AOC contact:** Dr. Robert S. Andrews, CEO  
info@ewst.co.uk

EW Simulation Technology (EWsT), owned by Herley Industries Inc., is a UK-based company that specializes in the design and manufacture of radar threat, radar target and electronic countermeasures simulation equipment for EW and radar training, test and evaluation applications. The company's products include the RSS8000 threat simulator, the CHAMELEON-II ECM simulator, the RTG/RES radar environment simulator and the MERTS mobile EW and radar test system. All products cover the 0.5-40 GHz range.

EWsT has been in the simulator business since 1984 and has a well-proven and distinguished track record worldwide. It has been successful in the supply of high-quality products and has kept a total commitment to post-sales service and logistic support.

EWsT manages a continuous product improvement design philosophy and is able to upgrade older products with the latest designs. The company operates a fully-documented quality control system certified to ISO 9001:2000.

Since 1984, EWsT has supplied more than 100 simulation equipments to naval, air force, army and civilian customers in more than 17 countries around the globe. Supported by a network of local sales and representative offices, and with a related facility in Nowra, Australia, EWsT offers total capabilities for the marketing, sale, design, manufacture and support of radar threat, radar target and countermeasures simulator products.

### EWA-AUSTRALIA PTY LTD.

Level 1, 214 Northbourne Ave.  
Braddon ACT 2612, Australia  
www.ewa-australia.com  
Phone: +61-2-6230-6833  
Fax: +61-2-6230-5833  
**AOC contact:** Paul McMahan, Managing Director  
paul.mcmahan@ewa-australia.com  
info@ewa-australia.com

Electronic Warfare Associates-Australia (EWA-Australia) is headquartered in Canberra, with offices in Adelaide and Brisbane. It is an ISO 9001:2000-certified, vendor-independent company focused on the engineering support of EW and related systems to Australia and regional defense, government and industry. EWA-Australia's defense experience includes project management, systems engineering, systems integration, test and evaluation, ILS management, business analysis and information security solutions. It also offers a growing range of commercial and government information security solutions, including Security Systems Engineering Capability Maturity Model (SSE-CMM) appraisals, security reviews and network vulnerability assessments.

EWA-Australia's EW technical specialists and consultants typically have more than 15 years of EW experience in Australian defense as engineers, operators, intelligence analysts and research scientists. The company also has defense systems engineering experience in the areas of communications, weapons systems, command support systems,

avionics and related fields, as well as a wide range of information security solutions.

EWA-Australia offers its services to its government customers through a number of standing offer contracts, including the Defence Materiel Organisation Support Services Panel (through SME Gateway) and Capability Definition Documentation Panel, the Defence Science and Technology Organisation's EW Capability Panel, the Rapid Prototyping Development and Evaluation (RPDE) program and the information security panels for the Australian Customs Service and Australian Taxation Office. EWA-Australia also offers a range of customer-tailored training courses and seminars on a wide variety of EW and information security topics.

### EWATER SOLUTIONS

3609 Conch Drive  
Edgewater, MD 21037  
www.ewaterolutions.com  
info@ewaterolutions.com

## H

### HONEYWELL INTERNATIONAL

101 Columbia Road  
Morristown, NJ 07962  
www.honeywell.com  
Phone: +1-973-455-2000  
Fax: +1-973-455-4807

### HUBER+SUHNER INC.

19 Thompson Drive  
Essex Jct., VT 05452  
www.hubersuhner.com  
Phone: +1-802-878-0555  
Fax: +1-802-878-9880  
President and General Manager: Drew Nixon  
drew.nixon@hubersuhner.com  
**AOC contact:** John Studebaker, VP, Sales and Marketing  
john.studebaker@hubersuhner.com  
info@hubersuhner.com

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.

## IFI

www.ifi.com

IFI is a leader in amplifier technology, originally founded in 1953, and now the only manufacturer building product in house from DC to 45GHz. IFI manufactures low-, medium- and high-power amplifiers; CW amplifiers with power levels to 5,000 W; and pulse amplifiers to 50,000 W. IFI manufactures a full range of TWT, solid-state and tetrode tube amplifiers, as well as antennas, E-field Sensors, TEM cells and RF and microwave accessories. Customers can purchase a complete solution for all their testing requirements from a single source. IFI offers "Single Amplifier Solutions" from 10 KHz to 1 GHz, 0.8 GHz to 18 GHz and 18 GHz to 40 GHz. These single amplifier solutions are ideal for all types of testing, simplifying the customers' test setups by providing time savings for other necessary lab tasks.

IFI is actively involved in the design and manufacture of solid-state, TWT and tetrode tube amplifiers (pulsed and CW). IFI continues with the development of low-, medium- and high-power state-of-the-art products enhancing its product lines. Its designs are the simplest for customers to use, while providing the maximum amount of user information for the test application. The equipment is designed for any remote control a customer could require, which is why IFI equipment is used successfully in applications all around the world.

IFI products are used for EMC/RF testing applications for commercial and military programs, as well as military EW/ECM applications. These products are used by the automotive, aircraft, military, medical, electronics, wireless, communications and educational markets.

IFI is an ISO9001-2000-registered company. It builds in accordance to MIL-I-45208A and can implement special quality control procedures as required by the end user.

## INNOVATIONSZENTRUM FÜR TELEKOMMUNIKATIONSTECHNIK GMBH IZT

Am Weichselgarten 5  
91058 Erlangen, Germany  
www.izt-labs.de  
Phone: +49 (0)9131-4800-100  
Fax: +49 (0)9131-4800-190  
General Manager: Rainer Perthold  
**AOC contact:** Katrin Kornblum  
katrin.kornblum@izt-labs.de

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.

Furthermore, IZT offers the IZT S5000 COMINT Stimulator for development and validation of communication intelligence systems and operator training. The IZT S5000 is designed to simulate realistic RF spectrum. It generates up to several hundred realistic signals of different bandwidth with real content. If more signals over a larger bandwidth are required, the control software can integrate multiple IZT S5000s for continuous coverage of the spectrum with thousands of emissions. The signal processing is performed in real-time to enable time-variant test scenarios for mobile receivers or transmitters. Multiple accurately synchronized RF outputs allow the stimulation of interferometric direction finders.

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.

## ITCN INC.

591 Congress Park Drive  
Dayton, OH 45459  
www.itcninc.com  
Phone: +1-937-439-9223  
Toll-free: +1-800-439-4039  
President: Roy Penwell  
**AOC contact:** Kimberley White, Marketing Specialist

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 CMTS 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.

The BCIT is a network analyzer and all-in-one tool for MIL-STD-1553 systems. It tracks bus and communication errors, and its TDR function will find cabling faults to within 6 inches. It is available now in a lab and semi-ruggedized version, and will be available soon in a fully ruggedized version.

## IVEIA, LLC

51 Franklin St., Ste. 301  
Annapolis, MD 21401  
Phone: +1-410-858-4560  
CEO: Karl Sattler  
**AOC contact:** Mary Hoskins  
Phone: +1-410-858-4560, ext. 8302

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."

The Titan system is modular and scalable with a variety of different processor, I/O, backplane and enclosure options to suit specific commercial and ruggedized processing needs. iVeia also offers design hardware and software services to complement its portfolio of products.

## J

**JABIL DEFENSE AND AEROSPACE SERVICES**

2007 Gandy Blvd. N  
St. Petersburg, FL 33702  
www.jabil.com  
Phone: +1-727-803-5810  
General Manager: Patrick Redmond  
**AOC contact:** Larry Stenger  
larry\_stenger@jabil.com

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.

JDAS is an experienced electronics manufacturer of high-mix, low-volume products. It is AS 9100-, EN 9100-, ISO 14001-, S20:20-, ISO 9001:2000-, 18001-, UL-, CSA- and TUV-certified, and has FAA-certified repair stations.

Jabil is an electronics solutions company providing comprehensive electronics design, production and product management services to global electronics and technology companies. It helps bring electronics products to the market by providing complete electronic product supply chain management solutions around the world. With more than 85,000 employees and 55 facilities in 21 countries, Jabil provides comprehensive, individualized, focused solutions to its customers.

**JB MANAGEMENT INC.**

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 & Configuration Management; Logistics Support Services; and Systems Engineering & 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.

JBM is a growth company proud of its record and committed to customer satisfaction. Its ability to attract, hire and retain proven, experienced people is its strength and, coupled with its flat management structure, results in superior performance executed in a competitive, cost-effective manner.

**JT3, LLC**

www.jt3.com

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.

## K

**KERAGIS CORPORATION**

12131 Community Road  
Poway, CA 92064  
www.keragis.com

Phone: +1-858-486-1716  
Mobile: +1-858-204-8945  
Fax: +1-858-486-0445  
CEO: Dan Piergentili

**AOC contact:** Ron Earl, VP, Marketing

Keragis Corporation, a subsidiary of Mitec Corp., 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 RF and microwave products such as ultra low-noise, low-VSWR, high-dynamic-range, high-intercept-point amplifiers; extremely broadband medium- and high-power amplifiers; very high-power microwave amplifiers (in the ranges of 2-20 GHz and up to thousands of Watts) using its unique (patent pending) octahedrons and dodecahedrons. These amplifiers can be used as TWT replacements.

**KOR ELECTRONICS**

10855 Business Center Drive, Building A  
Cypress, CA 90630  
www.korelectronics.com  
Phone: +1-714-898-8200  
President and CEO: Kevin Carnino  
**AOC contact:** Rich Beeber, VP, Advanced Development

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 and services include

- mission processing analysis;
- digital RF memory (DRFM)-based solutions;
- radar and ECM/target simulators;
- waveform modulation generators;
- high-speed, wideband data collection systems;
- program specific test equipment (STE); and
- RF- millimeter-wave sensors and payloads.

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

**L-3 COMMUNICATIONS**

600 Third Ave., 34th Floor  
New York, NY 10016

Phone: +1-212-697-1111

President and CEO: Michael T. Strianese

**AOC contact:** MGEN Larry Henry, USAF (Ret)

1215 S. Clark St., Ste. 1205  
Arlington, VA 22202

Phone: +1-703-412-6072

Fax: +1-703-412-7198

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.

**L-3 COMMUNICATIONS, APPLIED SIGNAL & IMAGE TECHNOLOGY**

613 Global Way  
Linthicum Heights, MD 21090

Phone: +1-443-457-1111

Fax: +1-443-457-1112

businessdevelopment.asit@l-3com.com

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 proven experience in tactical missions, 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) and hyperspectral processing markets.

The primary systems provided by the company include manned and unmanned airborne COMINT/DF payloads. Payloads for both pressurized and unpressurized applications have been successfully delivered to a variety of users with special tactical missions. The company strives to produce payloads that require minimum special modifications or specific accommodations so that these payloads require less expense to integrate onto the aircraft.

The main products provided by the company include signal DF sensors, equipment and software for ground-based tactical platforms. These products enable rapid DF and RF geolocation for a variety of communications signal types. Innovative proprietary DF algorithms are utilized that produce high-accuracy results from cost-effective hardware solutions that are

easy to use and implement. This approach decreases risk overall and achieves high-value results at reduced costs.

The goal of L-3 ASIT is to provide its customers with high-performance products and system solutions along with comprehensive training and support to ensure end user success. The discriminating feature of L-3 ASIT is its ability as a small organization to provide these solutions quickly and economically. Quick Reaction Capability (QRC) is part of its company culture, with many of its systems designed and completed in months, not years. The L-3 ASIT staff of dedicated professionals is totally committed to its customers' mission success. It also has behind it the global resources of L-3 Communications Corporation (NYSE: LLL), the nation's No. 1 source of sophisticated defense electronics.

**L-3 COMMUNICATIONS-CINCINNATI ELECTRONICS**

7500 Innovation Way  
Mason, OH 45040

www.l-3com.com/ce

Phone: +1-513-573-6100

Fax: +1-513-573-6566

President and CEO: Dr. Jim Wimmers

**AOC contact:** Mike Spicer, GM, IR Systems

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 COMMUNICATIONS/RANDTRON ANTENNA SYSTEMS**

130 Constitution Drive  
Menlo Park, CA 94010  
www.l-3com.com/randtron

Phone: +1-650-326-9500

Fax: +1-650-326-1033

**AOC contact:** Greg Bischak, Director, Advanced Antennas and Systems  
greg.bischak@l-3com.com

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 TRAC-A AEW antenna and numerous broadband EW antenna elements 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 VHF 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.

Randtron's design methods employ both analytical and experimental tools, using powerful and innovative software programs to create computer models to verify design concepts. Broadband antennas and scale models are utilized to conform and refine the analytical approach. Automated data acquisition allows measured data to be input to advanced simulation software. Computer optimization then allows for prediction of the performance without undergoing the expense of hardware fabrication. Final hardware designs are tested and qualified with its extensive anechoic chambers, compact range, all-weather far-field range and comprehensive environmental test facilities.

Randtron possesses extensive fabrication, assembly and production test facilities that provide in-house capability to manufacture both quick prototype designs and to sustain production. With a rigorous supplier qualification and selection process, Randtron has the flexibility to choose between "make" or "buy" for almost all fabricated component parts. It provides its customers with the best value combination and with advanced technologies to achieve mission success.



**LOCKHEED MARTIN ACULIGHT**

22121 20th Ave. SE  
Bothell, WA 98021  
www.aculight.com  
Phone: +1-425-482-1100  
Fax: +1-425-482-1101  
VP: Don Rich

**AOC contact:** Robert Afzal  
info@aculight.com

Lockheed Martin Aculight is a complete laser solutions resource. Founded in 1993 and privately held as Aculight Corporation, it develops and manufactures innovative lasers for the industrial, research, government and medical markets. 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 particular performance, packaging or service requirements. Lockheed Martin Aculight provides its clients with value at every level, from expert advice and pioneering research to solid prototyping and flexible manufacturing.

Lockheed Martin Aculight's constant growth has fueled recognition from several organizations. In 2006 alone, it was named one of the "50 Fastest-Growing Technology Companies in Washington, Oregon and Idaho" by Deloitte & Touche USA LLP; one of the "Top 50 High-Tech Firms in Washington" by *Washington CEO* magazine; and one of the "100 Fastest-Growing Private Companies" by the *Puget Sound Business Journal*.

Thanks to its phenomenal growth, the company moved to a new corporate headquarters in December 2006. Located just two miles from the original Aculight facility, the headquarters is almost twice as large, with approximately 50,000 square feet of combined office, laboratory and manufacturing space. The facility will allow a significant expansion of Lockheed Martin Aculight's research, product development and manufacturing capabilities.

Lockheed Martin Corporation announced the completion of its acquisition of Aculight Corporation in September 2008. Based in Bothell, WA, Lockheed Martin Aculight is focused on providing laser-based solutions for national defense and aerospace customers. The company has expertise in countermeasures, laser radar, high-power directed energy and medical products. These capabilities are expected to benefit Lockheed Martin's customers in areas such as guided munitions, airborne self-protection, advanced sensors and warfighter security. The acquisition was originally announced July 28, 2008.

Headquartered in Bethesda, MD, Lockheed Martin is a global security company that employs about 140,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services. The corporation reported 2007 sales of \$41.9 billion.

**LOCKHEED MARTIN MS2**

P.O. Box 4840  
Syracuse, NY 13221  
www.lockheedmartin.com/ms2  
Phone: +1-315-456-1990  
Fax: +1-315-456-1793  
VP and GM: Carl Bannar  
**AOC contact:** Mark Wesel  
Phone: +1-315-456-1701

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

MS2's capabilities-based approach to systems integration combines the best technology with talented industry teams from across the corporation to provide exacting solutions that can be tailored to the mission needs of the customer.

MS2's EW sensor systems provide air, battlefield and maritime surveillance; undersea mine and submarine detection; missile detection and tracking; and advanced early warning.

The company's focus areas include advanced platforms, including the US Navy's first Littoral Combat Ship, the USS Freedom, and advanced manned and unmanned vehicles with platforms for diverse missions; homeland security, including integrated systems such as Deepwater and tethered aerostats, which provide situational awareness across a wide variety of crucial domains such as waterway, border and transportation security; and integrated warfare systems such as Aegis weapon systems, the SQ-89 Undersea Warfare System and other open architecture solutions that respond to changing missions and threats.

MS2's focus areas also include lifetime support, logistics and training, encompassing a full suite of services designed to enhance customer performance, increase system lifespan and reduce risks, operational costs and response times; network-centric warfare, including Aegis Ballistic Missile Defense, HAA and the Medium Extended Air Defense System (MEADS), which provide connectivity and interoperability for better situational awareness; sensors and surveillance; and systems integration spanning land, sea, air and space mission areas.

MS2's facilities are located in Akron, OH; Baltimore, MD; Eagan, MN; Manassas, VA; Marion, MA; Mitchel Field, NY; Moorestown, NJ; Riviera Beach, FL; Syracuse, NY; and Kanata, Ontario, Canada.

Of further note, Lockheed Martin Aeronautics Company (<http://www.lmaeronautics.com>), headquartered in Fort Worth, TX, has operations that complement EW defense laboratories and support every aspect of aircraft design and development, from airframe to avionics systems. These include the US Air Force EW Evaluation Simulator, design and development/integration labs, system integration labs, the flight simulation laboratory and the Integrated Warfare Development Center.

**LORCH MICROWAVE**

1725 N. Salisbury Blvd.  
Salisbury, MD 21801  
www.lorch.com  
Phone: +1-410-860-5100  
Fax: +1-410-860-1949  
President: Kevin Bernstein

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.

**LNX CORPORATION**

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.

**M****M/A-COM****MACAULAY-BROWN INC.**

4021 Executive Drive  
Dayton, OH 45430  
www.macb.com  
Phone: +1-937-426-3421  
Fax: +1-937-426-5364

## GROUP MEMBERS

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 LTD.**

Grove House, Rampley Lane, Little Paxton  
Cambridgeshire, PE19 6EL, UK  
www.mass.co.uk

Phone: +44-1480-222600

Fax: +44-1480-407366

Managing Director: Andy Thomis

**AOC contact:** Malcolm Lowes  
mlowes@mass.co.uk

MASS is an independent systems house with a strong defense focus, particularly in the field of Electronic Warfare Operational Support (EWOS). EWOS can be considered to be the intellectual and data support required by EW systems and their operators for successful operational employment. It is the amalgamation of software and hardware tools combined with specialist training and technical expertise that together provide the capability for an end-user to manage intelligence information, develop platform protection countermeasures and create mission data for front-line platforms and EW systems.

As a leading supplier of EWOS products and services, the company's capability spans EW Data Management Systems, advanced training, platform protection countermeasures development, mission data production, test and evaluation and the supply of expert personnel. Its customers include the UK's Defence EW Centre and major platform and EW system providers. With a growing international demand for self-sufficiency in EWOS, MASS can assist end-users, either directly or in cooperation with an equipment provider, to achieve this goal.

With MASS, customers benefit from

- independent advice in support of their procurement activities;
- an advanced EW data management system that provides a national EW database capability and that will readily integrate with mission

data production tools from any EW equipment provider;

- specialist training courses that provide the knowledge of how to set up and operate EW support centers, including how to develop indigenous platform protection countermeasures; and
- seasoned experts working in-country providing on-the-job training in all aspects of running an operational support center, including the development of platform protection countermeasures and the production of mission data.

MASS is part of the Cohort Group plc.

**MC COUNTERMEASURES INC.**

260 Hearst Way, Ste. 207  
Kanata, ON K2L 3H1, Canada  
www.mc-cm.com

Phone: +613-592-0818

Fax: +613-592-2818

President: Ken McRitchie

**AOC contact:** Scott McDonald  
info@mc-cm.com

MC Countermeasures Inc. (MCCM) takes great pride in providing specialized, high-quality EW products and service to both industry and government departments. MCCM has been supporting the global EW community for more than 13 years with products and services designed specifically for ECM applications. Its hardware products include radar jammers, radar target generators (RTGs), radar environment simulators (RESs), situation awareness receivers (ESM), data collection/instrumentation and performance-enhancing subsystems such as the PRED series of radar PRI and RF agility predictors that enhance the ECM effectiveness of jammers (VCO or DRFM-based) against (PRI and RF) agile-agile radars.

MCCM also offers consulting services such as ECM technique development and technology/threat analysis. A unique aspect of the MCCM Prediction 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. This process also enhances situational awareness and can be combined with GPS data and used for instrumentation and data recording purposes. Predictors are easily upgradeable since they are based on FPGA technology. Systems are available in ATR or 19-inch 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 straightforward and an evaluation station is available to help integrators and evaluators alike. IS09000:2000 procedures are in place to ensure high-quality products. "At MCCM we know that technology moves fast – but we move faster."

**MEGAPHASE, LLC**

2098 W. Main St.  
Stroudsburg, PA 18360  
www.megaphase.com  
Phone: +1-570-424-8400  
Fax: +1-570-424-6031  
fastquote@megaphase.com  
President and CEO: William Pote  
wpote@megaphase.com

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.

**MICRO-COAX INC.**

206 Jones Blvd.  
Pottstown, PA 19460  
www.micro-coax.com  
Phone: +1-610-495-0110  
Fax: +1-610-495-6656  
President: Chris Kneizys  
**AOC contact:** Dan Birch

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. In addition, its manufacturing facility in the UK provides 12,000 square feet of manufacturing and distribution capability, serving customers in Europe and abroad. Micro-Coax is ISO 9001:2000- and AS 9100-certified and qualifies as a small business.

The company's cable assemblies are built to customer specifications, and prototype samples can be supplied promptly. Micro-Coax's solder operators are trained and certified to ANSI-J-STD-001. It operates Class 1,000 and Class 10,000 clean-room environments for the construction of spaceflight assemblies, and has a full DPA lab and live X-ray capability, in addition to a full range of RF test capabilities. Whatever the transmission-line problem, Micro-Coax has the solution.

#### MICRO SYSTEMS INC.

RF Simulation Systems Group  
17252 Armstrong Ave., Ste. B  
Irvine, CA 92614

www.gomicrosystems.com

Phone: +1-949-251-0690

Fax: +1-949-251-0813

**AOC contact:** Richard Damon, GM  
richard.damon@herley.com

Micro Systems provides the broadest range of RF simulation systems in the industry. Its multispectral stimulation capabilities encompass radar threat/EW, ECM, UV/IR and complex radar target/clutter/ECM generation for radar and EW system testing and operator training. It's 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. It provides its 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. Its latest developments in digital signal processing (DSP) provide signals with advanced modulations and characteristics required by modern radars and 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.

Its family of DRFMs exhibit higher fidelity (10-16 bits of digitization) and wider bandwidths (more than 1 GHz, growth to 5 GHz) that lead the industry. They can operate from baseband to 100 GHz and have either a fixed or variable operating frequency.

Its product portfolio includes radar threat simulators and radar ECM simulators that are available in a wide range of configurations suited for all types of applications. Key products include

- digital RF memories,
- radar target/ECM simulators,
- radar environment simulators,
- threat radar signal simulators,
- UV/IR/EO simulators and
- integrated multispectral systems.

Its products are fully modular in design, allowing system flexibility and upgradeability. It utilizes the latest suite of Graphical User Interface (GUI) software applications to provide ease of use and operation.

Micro Systems Inc., a wholly owned subsidiary of Herley Industries, is an ISO 9001:2000-certified company and a member of the AOC. For more than 40 years, Herley has been supplying solid, innovative and sophisticated RF, microwave and millimeter-wave components and subsystems to the defense and aerospace industries.

#### MIKES MICROWAVE ELECTRONIC SYSTEMS INC.

Cankiri Yolu 5. km

Akyurt 06750

Ankara, Turkey

www.mikes.com.tr

Phone: +90-312-847-5100 (14 lines)

Fax: +90-312-847-5114 (three lines)

General Manager: Tarik Koray

**AOC contact:** Kubilay Cinar

info@mikes.com.tr

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.

Programs currently being conducted by MiKES include the TUAF F-16 Block 50 Aircraft Self-Protection EW System (SPEWS II), of which ASELSAN is the prime contractor; the TUAF AEW&C aircraft ESM system; the TUAF Reconnaissance F-4 Aircraft RWR; the TAF Helicopter Fleet CMDS; the TAF Helicopter Fleet RWR/

RF jammer, of which ASELSAN is the prime contractor; subsystems design and production for Joint Strike Fighter (JSF); and special purpose RF jammers for land forces protection.

MiKES has been providing EW systems for all TUAF fighters and TAF helicopters. These systems have been proven by TUAF and TAF to address stringent operational requirements. In addition, MiKES provides the Electronic Warfare Support Center laboratories with necessary training for all programs.

MiKES' 6,500-square meter facility includes a TEMPEST-protected software lab. The facility and its procedures comply with the requirements of the Turkish defense industry's security policy and are approved for secret level processing.

The resident capabilities and technological background of MiKES' staff, along with its experience in EW systems, enables MiKES to provide reliable, effective and high-performance system solutions to the ever-changing operational requirements of the armed forces.

#### MITEQ INC.

100 Davids Drive

Hauppauge, NY 11788

www.miteq.com

Phone: +1-631-436-7400

Fax: +1-631-436-7430

President: Howard Hausman

**AOC contact:** David Krautheimer, Executive VP, Business Development

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 39 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.

MITEQ is a recognized leader in the field of low-noise amplifier technology, offering the lowest noise figures in the industry. It also offers ultra-wideband, medium-power

and bipolar designs into millimeter-wave frequencies.

MITEQ's products include single-, double- and triple-balanced MESFET and Schottky mixers; broadband active and passive multipliers; low-noise receiver front-ends; low phase-noise synthesizers; free-running and phase-locked VCOs and DROs; solid-state switches; pin diode attenuators; limiters; phase shifters; high-speed logarithmic and constant phase-limiting amplifiers; frequency discriminators; DLVAs; and VGC and AGC amplifiers.

In addition, MITEQ produces passive components, including power coaxial terminations, power dividers/combiners, attenuators, directional couplers and hybrids; integrated multifunction assemblies, including monopulse and front-end receivers; and phase interferometer receiver systems and fiber-optic system components, including fiber-optic transmitters and receivers, wideband links, modulator drivers and amplifiers.

### THE MITRE CORPORATION

202 Burlington Road  
Bedford, MA 01730

www.mitre.org

Phone: +781-271-7372

President and CEO: Alfred Grasso

Senior VP and Director, DOD C3I FFRDC:

Raymond Haller

**AOC contact:** Lucinda T. Spaney, Executive Director, Strategy & Plans

Phone: +781-271-7372

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 three Federally Funded Research and Development Centers (FFRDCs) – one for the 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) and one for the Internal Revenue Service and US Department of Veterans Affairs (the Center for Enterprise Modernization).

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 through the acquisition and fielding of advanced capabilities. Information systems technology, coupled with domain knowledge and integration expertise, underpins the work of the C3I FFRDC. The depth and breadth of the C3I FFRDC's work program generate both the obligation and the opportunity to help accelerate the DOD's achievement of its vision for transformation to net-centric

operations that support joint and coalition warfare.

MITRE's research and development program explores new technologies and new uses of technologies to solve its FFRDC sponsors' problems in the near-term and in the future.

The corporation has approximately 6,800 scientists, engineers and support specialists – 65 percent of whom have master's or Ph.D. degrees. Staff members work on hundreds of different projects across the company, demanding a high level of skill and experience, as well as a culture of innovation and collaboration.

MITRE is headquartered in Bedford, MA, and McLean, VA, and has more than 60 sites around the world.

### MRSL

2015 Cattleman Road  
Sarasota, FL 34232

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. Its involvement in all development stages and its familiarity with the end-users and field maintainers gives it a distinctive understanding of the desired attributes for mission-oriented applications and services. MRSL is located in Sarasota, FL. The MRSL mission is to market and develop advanced, real-time, signal processing systems and services, providing superior quality, value and customer satisfaction through the integration of people and technology.

### MULTICONSULT SRL

Via Porta Pinciana 34

00187, Roma, Italy

Phone: +39-06-483505

Fax: +39-06-4819815

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

Vintergatan 2

SE-17269 Sundbyberg, Sweden

www.mykonsult.com

Phone: +0046-703-440350

Fax: +0046-28-83-61

**AOC contact:** Tommy Kahlin

tommy.kahlin@mykonsult.com

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.

## N

### NEW WORLD SOLUTIONS INC.

14325 Willard Road, Ste. 202A

Chantilly, VA 20151

Phone: +1-703-396-7314

CEO: John J. Todd

**AOC contact:** Harry G. Looney, Jr.

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.

NWS employees provide life-cycle systems engineering and technical assistance to their customers for military and intelligence collection, processing and dissemination systems, including system requirements definition and analyses, concept development, studies and analyses, operational assessments and tests and evaluations. NWS also has extensive experience supporting the design, integration, testing and deployment of Director of Central Intelligence (DCID) 6/3-compliant Protection Level (PL)-4 and PL-5 controlled interfaces that effectively connect SCI systems to SECRET-collateral or unclassified systems. NWS provides this support throughout the IS security system life-cycle, from concept development through operations and maintenance.

#### **NURAD TECHNOLOGIES**

3310 Carlins Park Drive  
Baltimore, MD 21215  
www.nurad.com  
Phone: +1-410-542-1700  
Fax: +1-410-542-9184  
CEO: John McNulla

**AOC contact:** Randy Engle, Director, Engineering  
Phone: +1-410-542-1700, ext. 208  
sales@nurad.com

Nurad Technologies, a division of Cobham Defense Electronic Systems, is the single source for antennas, radomes and advanced composite structures. Founded in 1965, Nurad Technologies has distinguished itself as a world leader in the design, development and production of antennas and radomes for EW communication, navigation and identification (CNI) applications. Nurad's high-power horns, broadband spirals and blade antennas are currently deployed on nearly every military aircraft, both in the US and worldwide. Nurad 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, including unique radar cross section (RCS) and high-RF-power test services. Nurad has the facilities, personnel and experience to produce antennas and radomes that satisfy even the most demanding environmental conditions, including military aircraft, launch vehicles, and shipboard and ground mobile applications.



#### **OERLIKON CONTRAVES AG**

Birchstrasse 155  
CH-8050 Zurich, Switzerland  
www.oerlikoncontraves.com  
Phone: +41-44-316-22-11  
Fax: +41-44-311-31-54

**AOC contact:** Fabian Ochsner  
czof@ocag.ch

Oerlikon Contraves, a Rheinmetall Defence company, is an internationally renowned center of expertise in air defense. It is headquartered in Zurich and has other companies in Germany, Italy, Canada, Malaysia and Singapore. Oerlikon Contraves is responsible for all air defense activities encompassing the development, production, sales, training and support of complete anti-aircraft weapon systems.

Oerlikon Contraves' services include system integration and active battle management, protection of stationary high-value assets and mobile units and battlefield and naval air defense. All of these services incorporate anti-aircraft and anti-missile (Ahead) guns and high-performance guided missiles controlled by modern tactical radar and fire control systems, which allow for complete system solutions.

Oerlikon Contraves is not only a market leader in the area of gun-based air defense, but also is the only total systems supplier of sensors, weapons and ammunition.

The company's long history and continuous development have ensured that Oerlikon Contraves' systems, deployed in over 45 countries throughout the world, always provide the performance required to meet any modern terrorist or military threat. The company's additional fields of activity worldwide include upgrading and modernization, vehicle armament, air defense simulators, training systems, power electronics and communication systems for the rail industry.

#### **OPHIR RF INC.**

5300 Beethoven St.  
Los Angeles, CA 90066  
Phone: +1-310-306-5556  
Fax: +1-310-821-7413  
www.ophirrf.com

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.**

Headquarters:  
2211 Buena Vista Drive SE, Ste. 309  
Albuquerque, NM 87106  
www.orionint.com  
Phone: +1-505-998-4000  
Fax: +1-505-998-5060  
CEO: Miguel Rios Jr., Ph.D.  
**AOC contact:** Joe Barfoot, Chief Engineer

East Coast Office:  
5510 Cherokee Ave., Ste. 120  
Alexandria, VA 22312-2320  
Phone: +1-703-642-3535  
Fax: +1-703-642-1088  
Director: Marc F. Tripp

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., CEO. Dr. Rios has had a distinguished career, with more than 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;

Dr. Rios received a Ph.D. in physics from the University of Maryland in 1971 and worked for two years as a postdoctoral fellow in nuclear astrophysics at the California Institute of Technology. After briefly serving as an assistant professor at the California Polytechnic Institute (CALPOLY) in 1975, he and his family relocated to Albuquerque, NM. For a decade, he worked as a physicist on staff at Sandia National Laboratories before leaving to become an entrepreneur.

At Sandia Laboratories, Dr. Rios performed research in such diverse fields as

- defense – security and survivability of nuclear weapons,
- nuclear energy – safety and security of light-water and liquid-metal cooled reactors and
- solar energy – research and development of photovoltaic concentrator modules and arrays.

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; San Diego, CA; and Stanford University SLAC, CA. 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, EW countermeasures systems, information technologies, test and evaluation, modeling and simulation, nuclear weapons and counter proliferation and staff augmentation.

### OVERWATCH SYSTEMS TACTICAL OPERATIONS

5301 Southwest Parkway  
Austin, TX 78735  
www.overwatch.com  
Phone: +1-512-358-2600  
CEO: Randall L. Averitte, GM/Senior VP  
**AOC contact:** Christine Martin,  
Communications Editor  
info@overwatch.com

Overwatch Systems develops and markets intelligence analysis products and custom intelligence systems. Overwatch is investing to integrate all of its products into the Overwatch Intelligence Center (OIC) to enhance collaboration, usability, performance and user training.

Overwatch's business model supports a shared cost environment through software component reuse. OIC solutions and products allow intelligence analysts to take raw sensor data and combat reports, and develop products to support combat and intelligence operations. Analysts develop and maintain relational databases and visualize information on maps, images and charts. These tools facilitate fusion at all levels of the intelligence chain. The company continues to expand its product line and services to meet emerging customer needs.

Overwatch Satellite Communication's business unit's patented feed technology combines dual polarization with multiple frequency band coverage into a single feed that can be fitted onto new or existing antenna systems, reducing footprint and overall life cycle costs.

The company has CMMI® Level 5, AS9100 and ISO9001-2000 certifications.

Overwatch Systems' Tactical Operations four strategic objectives are to

- provide products that produce actionable intelligence quickly for warfighters, first responders and policy makers;
- leverage fusion research work and the existing product base to provide the intelligence community with low-cost, simple-to-use, rapidly deployable approaches to multi-source intelligence;
- enable meaningful interoperability and information-sharing between agencies and organizations within the intelligence community; and
- provide innovative solutions for satellite terminals to meet emerging multiband requirements.

Overwatch Systems Tactical Operations efforts focus in five key areas:

- tools for all intelligence analysts;
- tools to support automated multi-source analysis;
- tools that merge national and tactical sources to support the tactical warfighter, first responder and policy maker;

- systems to support communications required to support network-centric capabilities; and
  - satellite communications capabilities.
- For communication systems products, call (469) 330-5020 or e-mail [multiband@overwatch.com](mailto:multiband@overwatch.com).

## P

### PHOENIX INTERNATIONAL SYSTEMS INC.

812 W. Southern Ave.  
Orange, CA 92865  
www.phenixint.com  
Phone: +1-714-283-4800  
Toll-free: +1-800-203-4800  
Fax: +1-714-283-1169  
**AOC contact:** Amos Deacon, III

Phoenix International Systems has been designing and building rugged 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.

Phoenix's data storage solutions exploit proven leading-edge technology to meet new requirements and enhance or upgrade existing data storage and networking applications. For example, Phoenix recently introduced solid-state VME disk modules to replace or be integrated to work with other types of legacy technology in real-time operating applications. Phoenix also offers new storage area network configurations, incorporating the latest in switched fabric and Fibre Channel technology.

Phoenix builds data storage systems configured for any application, integrating any storage device and capability, from multi-terabyte Fibre Channel RAID, NAS and storage area network (SAN) configurations to plug-in hard disk drive

and conduction-cooled solid-state (flash) disk VME storage modules.

### PLATH GMBH

Gotenstrasse 18  
20097 Hamburg, Germany  
www.plath.de  
Phone: +49-40-23-73-40  
Fax: +49-40-23-73-41-73  
Managing Director: Nico Scharfe  
**AOC contact:** Christina Meier-Ewert  
info@plath.de

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.

For more than 50 years, PLATH has designed COMINT and EW systems for international customers with a focus on NATO members, and has developed a profound understanding of the respective reconnaissance processes. Each new system and product represents practices based on leading-edge technology.

PLATH is an independent provider of innovative system solutions and offers competent consulting for individual system design, including optimal modeling of system structure and allocation of work processes; innovative modular hardware and software for a flexible functionality-driven system design; efficient storage of mass data for minimal access time; optimal integration, installation and commissioning of all systems; thorough training of customers' operators and technical staff; and complete after-sales service, including maintenance, remote service systems and upgrades.



### **QINETIQ NORTH AMERICA – TECHNOLOGY SOLUTIONS GROUP (FORMERLY FOSTER-MILLER)**

350 Second Ave.  
Waltham, MA 02451  
Phone: +1-781-684-4000  
Fax: +1-781-890-3489

Group President: Dr. William Ribich  
**AOC contact:** Rick Neidlinger

The Technology Solutions Group (TSG) of QinetiQ North America 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® add-on Armor has been used to up-armor thousands of combat air and land vehicles since its debut in Operation Desert Storm in 1991. Its Precision Air Drop System (PADS™) has been used on hundreds of missions and has dropped more than 10 million pounds of cargo since its debut in August 2006.

TSG, a group of more than 700 engineers, scientists and support staff with offices across the United States, includes members who are certified to Aerospace Quality Management Standard AS9100, ISO13485 and SW-CMM Level 3 software.

It currently offers services in the following areas:

- Robotic Systems and Engineering Design – advanced robotic systems that safely extend the reach of humans to restricted and hazardous environments.
- Advanced Materials Technology Development – today's new products require cutting-edge materials technology.
- Biomedical Technology Development – products that save, prolong and improve life begin with inspiration, take form through innovation and emerge ready to meet patient needs.
- Smart Sensor and Electronics Design – embedded microprocessors that detect, gather and analyze multiple data variables.
- Thermal Systems Development – in outer space or deep underground, its engineers have designed systems that run the gamut of environments.
- Ocean Science Technology – customized hardware and software addressing ocean-related research and operations for military and civilian agencies.
- Transportation Systems and Structural Modeling – employs the latest advances in computer simulation and finite element analysis.
- Custom Equipment, Product and Process Design – solving manufacturing problems that stand between concept and marketplace.

### **QUALCOMM**

5775 Morehouse Drive  
San Diego, CA 92121  
www.qualcomm.com  
Phone: +1-858-658-2100  
Fax: +1-858-658-2100

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.



### **RAFAEL ADVANCED DEFENSE SYSTEMS LTD.**

P.O. Box 2250  
Haifa, 31021, Israel  
Phone: +972-4-879-4202  
Fax: +972-4-8794794  
President and CEO: Y. Yaari (VADM)  
Head of Naval & EW Directorate: T. Brilon  
**AOC contact:** Jacob Ilan  
Phone: +972-52-8890337  
jacobil@rafael.co.il

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.

Rafael's EW systems consists of air, naval and ground EW products based on state-of-the-art digital technology, ranging from digital receivers through the most advanced technique generators and solid-state amplifiers (SSA) used for high-power phased array multi-beam array transmitters (MBATs).

Rafael's applications for EW systems are mostly used for ESM, DF, ECM, on-board and off-board jammers and decoys, as well as various RF systems and transmitters that provide the building blocks for advanced EW systems.

Rafael's Sky Shield airborne escort jamming pod and its naval SEWS-DV frigate full-protection suite are the leading EW systems in every aspect around the world.

In addition, Rafael's Jam-Air Directional IR Countermeasure (DIRCM) system, protecting light and medium-sized helicopters from Man Portable Air Defense Systems (MANPADS) and anti-tank Command Line-of Sight (CLOS) missiles, is the most mature and proven system of its kind.

### **RESEARCH ASSOCIATES OF SYRACUSE INC.**

6780 Northern Blvd., Ste. 100  
East Syracuse, NY 13507  
www.ras.com  
Phone: +1-315-463-2266, ext. 201 (Main), or  
+1-315-339-4800, ext. 408 (Rome Office)  
Fax: +1-315-463-8261  
**AOC contact:** Brian D. Moore, VP, Defense  
bmoore@ras.com

RAS is a small business of highly qualified engineers and analysts working in EW, ELINT, ESM and related fields. The company studies, models algorithms via simulation, develops hardware and software prototypes and provides technical training for signal detection, characterization, identification, geo-location and tracking. RAS collects and exploits modern signals of interest (including conventional radar, low probability of intercept (LPI) and recently RF MASINT emitters) and has developed an extensive digital library of collected signals (actively used by several other organizations). RAS developed robust real-time equalization techniques to mitigate receiver distortion and processes for real-time specific emitter tracking (SET), multi-technique specific emitter identification (SEI) and intercepting and characterizing LPI and wideband signals.

The company provided integration and test support for a key 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 Field Programmable Gate Array (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. In addition, RAS is developing portals to support time-sensitive targeting (TST) and working on advanced concepts for Network Electronic Warfare Training Systems (NEWTS). RAS provides subject matter experts in support of national EW database development efforts. The company has offices in Syracuse, NY, and Rome, NY, with computing resources and laboratory for classified work.

**RIISING EDGE TECHNOLOGIES**

500-D Huntmar Park Drive  
Herndon, VA 20170  
www.risingedge.com  
Phone: +1-703-471-8108  
Fax: +1-703-471-8195

**AOC contact:** Don Maffei, President

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.

Rising Edge's facilities include prototyping, testing and manufacturing areas, as well as classified work spaces. It maintains a staff of cleared personnel capable of supporting both prime contract and sub-contract development activities. Contact the company directly to discuss specific needs.

**ROHDE & SCHWARZ GMBH & CO. KG**

P. O. Box 80 14 69  
81614 Muenchen  
Muehldorfstrasse 15  
81671 Muenchen, Germany  
www.rohde-schwarz.com  
Phone: +49-89-41-29-12943  
Fax: +49-89-41-29-11376

**AOC contact:** Olaf Lukas, Dr. Christof H. Rohner  
olaf.lukas@rsd.rohde-schwarz.com,  
comint@rsd.rohde-schwarz.com

Rohde & Schwarz is the leading European company for Test & 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 HOLDING**

Stauffacherstrasse 65  
3000 Bern 22, Switzerland  
Phone: +41-33-827-25-65  
CEO: Toni J. Wicki

**AOC contact:** Benjamin Wepfer, RUAG Aerospace Interlaken

RUAG is an international aerospace and defense company with strong technological skills. RUAG has production sites in Switzerland, Germany and Sweden. As an internationally operating technology group, the company focuses on three markets: aviation/space, defense/security and ammunition/products.

RUAG is a leading supplier and integrator of systems and components for civilian and military aerospace applications. The company is active in aircraft construction, as well as in the maintenance and outfitting of aircraft and helicopters. As an experienced integrator of self-protection systems, RUAG has developed test equipment for such integrations, allowing precise and effective testing of EW systems to ensure the security of the crew.

The company is the industry partner for the technical systems upgrade program of the Swiss Armed Forces. It supplies and integrates weapon, command and control and simulation systems for other nations' armed forces and the international government agencies market.

RUAG also is an international leader in small-caliber ammunition manufacturing. RUAG is an expert in high-precision manufacturing technologies for the aerospace and defense sectors, as well as for the automotive, semiconductor and mechanical engineering industries.

RUAG's engineering skills provide the foundation of its dynamic role in development and production.

**S****SAGE LABORATORIES INC.**

8 Executive Drive  
Hudson, NH 03051  
Phone: +1-603-459-1600  
Fax: +1-603-459-1605  
President: Anthony Cappello  
**AOC contact:** Michael Wisner

With a collective heritage of more than 50 years, Sage Laboratories Inc. provides a unique combination of technologies and talents to support the radar, ESM, EW, anti-IED and tactical communications markets.

It offers innovative solutions for custom-designed components and integrated subsystems. Its suspended stripline technology results in broader frequencies of operation and lower loss characteristics. Its state-of-the-art production facility is designed to support its changing customer needs.

From catalog standard designs to custom solutions, Sage Laboratories is the source for frequency converters, featuring broadband and small integrated packages; IFMs/DFDs, which are fast with few false error flags; switched filters, providing integrated low-loss solution and packaged and discreet switches; multifunction assemblies, which are fully integrated to improve noise figures; couplers and hybrids, featuring low loss, directivity, coupling flatness and low reflection; filters and multiplexers, featuring low loss, high selectivity, small footprint and a combination of technologies (lumped element, combline, SSS and waveguide technologies available); and power dividers/combiners, with amplitude balance, low VSWR, high isolation and low phase balance.

Sage Laboratories is an ISO 9000:2000-certified supplier.

**SAGE MANAGEMENT**

1344 Ashton Road  
Hanover, MD 21076-3123  
www.sage-mgt.net  
Phone: +1-410-878-2080  
Fax: +1-443-283-8107

**AOC contact:** Peter Ward  
pete.ward@sage-mgt.net

**SCIENCE APPLICATIONS INTERNATIONAL CORP.**

10260 Campus Point Drive  
San Diego, CA 92121  
www.saic.com  
Phone: +1-858-826-6000  
CEO: Ken Dahlberg  
**AOC contact:** JJ Romano  
Phone: +1-210-674-5667, ext. 13  
james.j.romano@saic.com

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.**

2300 Windy Ridge Parkway, Ste. 400 S  
Atlanta, GA 30339  
www.scires.com  
Phone: +1-770-859-9161  
Fax: +1-770-859-9315  
President and CEO: Michael Watt

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. SRC's core competencies include systems engineering; software design, development and integration; real-time software development and implementation; communications and networking systems research, design and development; information technology; system automation; digital signal processing; production engineering; modeling and simulation; test and evaluation; radar instrumentation and training systems; technology insertion for aging and end-of-life military logistics and test systems; and logistical support services.

#### SELEX GALILEO

300 Capability Green  
Luton, Bedfordshire, LU1 3PG, UK  
www.selexgalileo.com  
Phone: +44-1582-886000  
Fax: +44-1582-795900  
Senior VP: Alvin Wilby

**AOC contact:** John Hymns, VP, Business Development

SELEX Galileo is the brand name adopted by SELEX Sensors and Airborne Systems Ltd. and Galileo Avionica Spa. of Finmeccanica, employing more than 7,000 personnel through its operations in the UK, Italy and the United States. SELEX Galileo is a world leader in the development and manufacture of integrated sensor solutions and is the UK's largest supplier of electronic systems for military platforms on land, in the air and at sea.

With nearly 60 years of experience in EW solutions, SELEX Galileo has a unique strength in the integration of advanced electronic support, protection and attack. It also provides infrastructure solutions to insure EW capability is delivered to the warfighter.

As the lead consortium partner for the Eurofighter Typhoon Defensive Aids Sub System (now known as Praetorian), it is responsible for the largest ever European contract for EW system integration and supply. For battlefield helicopters, it developed and fielded HIDAS, the Helicopter Integrated Defensive Aids System, as well as the Aircraft Gateway Processor (AGP) for EW

systems management and integration. SELEX Galileo also produces the Sky Guardian family of sophisticated RWR and ESM systems, and has developed next-generation digital receivers, one example being the unique and lightweight SEER. It produces advanced laser warning systems, as well as on-board and off-board electronic countermeasures systems for the airborne and naval environment using variants of its DRFM-based techniques generators.

SELEX Galileo is a strategic partner to Northrop Grumman on DIRCM systems. To date, it has delivered more than 1,000 transmitters for the AN/AAQ-24(V) LAIRCM and has launched its own novel IRCM pointer-tracker Eclipse.

SELEX Galileo's other key technologies and capabilities include airborne electronically scanned radar, electro-optical systems, military lasers, land systems, unmanned aerial vehicles and payloads, mission systems and equipment, homeland security systems and support services.

#### SELEX SENSORS & AIRBORNE SYSTEMS US INC.

201 12th Street S, Ste. 704  
Arlington, VA 22202  
Phone: +1-703-418-8918  
Fax: +1-703-418-7281

CEO: R. Scott Rettig

**AOC contact:** Clio Timmerman

SELEX Sensors & Airborne Systems Inc. (S&AS), 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 S&AS Inc. is incorporated in the state of Delaware. Its corporate headquarters is based in Arlington, VA, with regional offices in Long Island, NY; Melbourne, FL; Dayton, OH; and operations in Huntsville, AL; Atlanta, GA; Stennis, MS; and the US AFB in Hurlburt Field, FL.

Its key technologies include avionics, electro-optical and EW systems, airborne radar, military lasers, simulators and unmanned aerial systems.

#### SIEMENS SCHWEIZ AG

Freilagerstrasse 40  
CH-8047, Zurich, Switzerland  
www.siemens.ch/ics  
Phone: +41-(0)-58-558-4849

Fax: +41-(0)-58-558-3816

VP: Hans Jürg Wieser, VP, Civil and National Security

**AOC contact:** Bernhard Heimlicher

Phone: +41-58-558-3039

Fax: +41-58-558-3816

security.ch@siemens.com

Siemens delivers a full spectrum of civil and defense solutions, from submarine propulsion systems to closed-circuit security surveillance, which sets the company apart from other strategic suppliers. This approach can be applied to its customers' specific challenges at

any part of their process landscape in any part of the world. With ongoing innovation driving the evolution of power generation, public transportation, network communication, digital health, e-government and so much more, Siemens' customers are assured an all-around partner that is always one step ahead. Whatever its customers' immediate challenges – in network-centric operations, defense logistics or 21st-century interoperability, Siemens delivers the technology scope, the global presence and the accumulated experience to realize their visions.

Global yet local, Siemens can deliver the edge in thinking and execution needed to master special security challenges. Siemens is a process architect, system integrator and technology provider – with Siemens, its customers get a strategic consultant and a practiced field engineer all in one.

#### SIERRA NEVADA CORPORATION

444 Salomon Circle

Sparks, NV 89434

www.sncorp.com

Phone: +1-775-331-0222

Chairman of the Board: Ms. Eren Ozmen

CEO: Fatih Ozmen

**AOC contact:** Ed Brown

Phone: +1-775-560-3004

Sierra Nevada Corporation (SNC), headquartered in Sparks, NV, is a fast-growing, innovative and agile technology solutions corporation, focusing on system integration electronics engineering, manufacturing and aircraft modification. SNC specializes in the integration, design, development, installation and servicing of complex airborne, ground- and ship-based systems for the US government, its prime contractors and international customers.

SNC is a privately-held, woman-owned business with a strong, stable, debt-free financial foundation that provides flexible low-risk financial performance for its customers. It has invested heavily over the years in experienced employees, modern facilities and state-of-the-art equipment needed to enhance its internal capabilities and development efforts for its customers' technical advantage. SNC has more than 1,000 employees, with 24 locations in 13 states across the US.

SNC's business areas include ISR, in which it performs end-to-end product development and develops a vast array of products and services focused on airborne ISR collection and processing systems. These products and services include airborne test lab, aircraft and UAV systems integration and aircraft modification and maintenance, contractor logistic support, field service, information operations, knowledge engineering and ISR processing systems.

The company also specializes in communication, navigation, surveillance and air traffic management (CNS/ATM) systems, providing precision approach and automatic landing systems, and is the world leader of automatic take-off and landing systems for UAVs.

SNC's business areas also include command, control, communications, computers and networks (C4N), specializing in high-performance, ruggedized handheld computing and communication devices for militaries; instrumentation, test and training/EW (ITT/EW), specializing in tactical and synthetic communications jammers and battlefield instrumentation systems used in testing the operational performance of tactical communication equipment; system sensors and technology (SST), providing real-time sensor management and control software, automatic digital signal processing, database design, specialized chip design and programming, digital receiver systems, antenna calibration and object-oriented software development; and integrated mission systems (IMS), providing total system solutions for aircraft modification and maintenance, primary mission equipment integration, operations, contractor logistic support, lead systems integration and full turnkey field operations.

#### **SIMULATION TECHNOLOGIES INC.**

P.O. Box 7009  
Huntsville, AL 35807  
Phone: +1-256-876-4204  
Fax: +1-256-955-7376  
CEO: Dr. Dwight McPherson  
**AOC contact:** Dr. Annie Saylor

Simulation Technologies (SimTech) is responsible for RF HWIL design, scene generation and systems engineering at the US Army's Systems Simulation and Development Directorate. Missile systems under test in digital and hardware-in-the-loop (HITL) simulations using SimTech scene generators include the NLOS-LS, the Joint Common Missile, the Patriot PAC-3, the Apache Longbow and foreign RF seekers. A key SimTech area is real-time radar scene generation using special purpose software and hardware. SimTech has unique capabilities for high-resolution radar target modeling, from turntable measurement to RCS prediction (XPATCH) data.

SimTech also is involved in the design and development of hardware prototypes to generate radar signatures in both HWIL and field test environments. SimTech products include PC-based real-time data collection and display software, which has been used successfully in several Army labs. SimTech's radar scene generator is now integrated into the Army's Common Scene Generator. Through an SBIR development, SimTech provides realistic multispectral, field-expedient range targets ([www.rangetargets.com](http://www.rangetargets.com)). SimTech also has supported several synthetic line-of-sight implementations for HWIL. SimTech has provided excellence in simulation and testing since 1983.

#### **SIVERS IMA AB**

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 IMA's customers primarily use its microwave products for military, industrial and test and measurement 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.

To enhance Sivers IMA's competitive edge in the future, the company will continue its long-lasting cooperation with the GigaHertz Centre at Chalmers University. In the scope of this competence center, it has access to more than 50 world-leading scientists in the microwave and millimeter-wave field, paired with one of the most advanced laboratories available.

#### **SONETICOM INC.**

1045 S. Johns Rodes Blvd.  
West Melbourne, FL 32904  
Phone: +1-321-733-0400  
Fax: +1-321-733-1841  
[www.soneticom.com](http://www.soneticom.com)  
**AOC contact:** Brian Jaskiewicz  
[bjaskiewicz@soneticom.com](mailto:bjaskiewicz@soneticom.com)

#### **SPRAYCOOL**

2218 North Molter Road  
Liberty Lake, WA 99019  
[www.spraycool.com](http://www.spraycool.com)  
Phone: +1-866-993-2665  
Fax: +1-509-444-1082  
**AOC contact:** Marie Hartis, Director,  
Marketing  
[mhartis@spraycool.com](mailto:mhartis@spraycool.com)

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.

The company's customers use SprayCool system solutions to enable both embedded and next-generation electronics. Benefits of using SprayCool go beyond thermal management and include environmental isolation, increased performance density (up to 400 W per card slot) and flexibility of electronics deployment, as well as lifecycle savings and overall faster deployment. The company has been awarded several contracts by Northrop Grumman, General Dynamics and Lockheed Martin, which include enclosure solutions for deployment on high-altitude aircraft such as the U-2 and UAVs such as Global Hawk, Predator, Sky Warrior and the soon-to-be Reaper, as well as ground-based programs such as MEADS.

#### **SRCTEC INC.**

5801 E. Taft Road  
North Syracuse, NY 13212  
[www.srctecinc.com](http://www.srctecinc.com)  
Phone: +1-315-452-8700  
President and CEO: Mary Ann Tyszko  
**AOC contact:** David Bessey  
Phone: +1-315-452-8224  
[dbessey@srctecinc.com](mailto:dbessey@srctecinc.com)

SRCTec, Inc. is a high-tech, ISO 9001-registered manufacturer of complex defense electronics systems. SRCTec provides integrated solutions, program management and full life-cycle support, including sparing, field support, training and depot repairs, to a broad range of customers. Established in 2006, SRCTec is a subsidiary of SRC, a not-for-profit research and development company with more than 50 years experience in the areas of defense, environment and intelligence. Together, the companies develop next-generation solutions to challenges of national significance through the innovative application of science, technology and information.

SRC and SRCTec employ more than 900 people and have offices in Arlington, VA; Chantilly, VA; Charlottesville, VA; Dayton, OH; Denver, CO; Hanover, MD; Rome, NY; San Antonio, TX; and Syracuse, NY. SRCTec also has a testing site in Yuma, AZ, and representation in Aberdeen, MD, and Huntsville, AL.

**SRI INTERNATIONAL**

333 Ravenswood Ave.  
Menlo Park, CA 94025  
www.sri.com

Phone: +1-650-859-2000

President and CEO: Dr. Curtis Carlson  
**AOC contact:** Jonathan Cory, Director,  
Intelligence & Information Systems  
Program

jonathan.cory@sri.com

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.

SRI's I2S program provides core support to the Army Reprogramming Analysis Team (ARAT). After designing and building the initial Army rapid reprogramming infrastructure for target- and threat-sensing systems, the I2S program has helped improve capabilities, so much so that the ARAT has become recognized as the premier organization providing support to fielded Army ASE.

Initial EW support has grown to include multiple precision GPS applications and C4I capabilities. Projects have included GPS programs in support of the Small Diameter Bomb (SDB) program and EW programs supporting multi-service ASE and C4I projects such as the Internet Protocol Version 6 (IPv6) transitional support.

**SUNSHINE AERO INDUSTRIES**

5545 John Givens Road, Hangar B  
Crestview, FL 32539

www.sunshineaero.com

Phone: +1-850-682-6811

Fax: +1-850-729-1507

Sunshine Aero Industries (SAI) is a privately-owned small business located at the Bob Sikes Airport in Crestview, FL. Additional facilities are located at Floral, 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 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.

All of these considerations make SAI and Crestview a logical and cost-effective choice for performing aircraft and systems modifications, as well as basing flight test operations.

**SURVICE ENGINEERING**

4695 Millennium Drive  
Belcamp, MD 21017

www.survice.com

Phone: +1-410-273-7722

Fax: +1-410-272-7417

President: Jeffrey Foulk  
jeff.foulk@survice.com  
**AOC contact:** Michael Ray  
mike.ray@survice.com

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 Hunttsville, AL; Niceville, FL; Washington, DC; Patuxent River, MD; Dayton, OH; and Ridgcrest, CA.

**SYMETRICS INDUSTRIES**

Symetrics Industries, an AS9100- and ISO9001-2000-registered small business, specializes in electronics design, manufacture and test for the DOD, US State Department and several major prime contractors. The company has three main business sectors: EW, digital communications and electronic manufacturing services.

Symetrics' EW products include the AN/ALE-47 Countermeasures Dispenser System (CMDS), an EW self-protection system that provides combat aircrews with enhanced survivability against surface-to-air and air-to-air missile threats in all environments. Symetrics also manufactures the AN/ALM-295 Countermeasures Dispenser Test Set and the AN/USQ-131 Memory Loader Verifier Set (MLVS), utilized for loading EW suite software.

Its family of Improved Data Modems (IDMs) includes the IDM-304, the Army version of the IDM-302. The IDM-501, a Symetrics-developed product, is a flight-proven design that is smaller and lighter than the IDM-302 and IDM-304, but provides virtually the same functionality. Additionally, Symetrics developed a Mini-IDM, the smallest yet in the family, which is ideally suited as a Weapons Data Link. Imagery transmission can be added to the IDMs utilizing trademarked PRISM technology.

Accounting for the third sector of business is the production of circuit card assemblies for use in numerous prime contractors' subassemblies, including the Bradley Fighting Vehicle and US Air Force programmable fuses. Symetrics offers a wide range of electronics manufacturing services and solutions, from initial design to mass production.

Symetrics has been designing, manufacturing, testing and delivering high reliability electronic assemblies and sophisticated EW and communication systems of the highest quality to the DOD for more than 46 years. It is the US government's prime supplier of the AN/ALE-47 CMDS and a full family of improved data modems, including the IDM-304. Digital imagery and solid-state digital video recording solutions also are available from its highly diversified portfolio.

**SYPRIS DATA SYSTEMS**

160 E. Via Verde  
San Dimas, CA 91773

www.syprisdatasystems.com

Phone: +1-909-962-9400 or +1-877-797-7478

Fax: +1-909-962-9401

President: Darrell Robertson

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 CORPORATION**

www.srcinc.com

Syracuse Research Corporation (SRC) is a not-for-profit research and development company with more than 50 years of experience in the areas of defense, environment and intelligence. SRCtec, an ISO-registered subsidiary of SRC, provides high-tech manufacturing, program management and integrated logistics. Together, through the innovative application of science, technology and information, the companies develop next-generation solutions to challenges of national significance.

SRC and SRCtec employ more than 950 people and have offices in Arlington, VA; Chantilly, VA; Charlottesville, VA; Dayton, OH; Denver, CO; Hanover, MD; Rome, NY; San Antonio, TX; and Syracuse, NY. Currently, there are more than 100 positions available nationwide.

#### **SYSTEMATIC SOFTWARE ENGINEERING**

Kesteven Business Centre  
2 Kesteven Street, Sleaford  
Lincolnshire NG34 7DT, UK  
www.systematic.co.uk  
Phone: +44(0)1529-303322  
Mobile: +44(0)7786-156763  
Fax: +44(0)1529-410280

**AOCCONTACT:** Chris Howe MBE, EW Manager (VP, UK Chapter)  
chris.howe@systematic.co.uk

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.

EWare can provide a number of outputs, but is primarily used to support a variety of "end users," including ESM equipment, pre-flight messages and mission data sets. The PC-based system uses Oracle-based client-server architecture, allowing multiple clients access to the database simultaneously. The core functionality of EWare is the storage and manipulation of EW data and intercepts.

#### **SYSTEMS & PROCESSES ENGINEERING CORPORATION (SPEC)**

6800 Burleson Road, Building 320  
Austin, TX 78744-2306  
www.spec.com  
Phone: +1-512-479-7732  
Fax: +1-512-494-0756  
CEO and President: Randolph E. Noster  
**AOCCONTACT:** Jim Wilson, VP, Business Development  
Phone: +1-512-691-8106 or  
+1-512-632-6061 (cell)  
wilson@spec.com

With 22+ years of aerospace/defense systems development experience, SPEC has fielded a variety of products, including air, land, sea, missile and space systems. Some SPEC personnel have more than 40 years of experience in the research, design, development, fabrication, test and delivery of advanced technology systems that include

- Agile Digital Effects Processor (ADEP™), with advanced coherent Digital RF Memory (DRFM) & other applications;
- RF/EO/IR countermeasures and dispensing systems;
- miniature LADAR-based systems; and
- solid-state recorders – C4ISR-focused, TeraB+ class, GigaB/sec I/O, read-while-write, encryption.

Its customers include the Army, Navy, USAF, USMC, DARPA, OSD, MDA, NASA, 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 currently focused in three areas – ADEP™-based systems, high-intensity visible light strobes and kinetic kill expendable CM. SPEC's COTS/OA-based ADEP™ architecture offers next-generation, state-of-the-art performance today, including

- continuous instantaneous bandwidth (IBW): 1.3GHz (single channel);
- multiple, simultaneous, overlapping, coherent waveforms;
- bit depth of 10 input, 12 output;
- each waveform is fully programmable: delay, Doppler, phase, amplitude modulation;

- multiple independent channels;
  - programmable signal delay for each channel over wide time range;
  - low spurious levels;
  - flat frequency response; and
  - Integrated Digital Frequency Discriminator (DFD).
- ADEP™ system applications include
- DRFM/counter-DRFM,
  - radar environment simulators (RES),
  - air/land/sea electronic attack (EA),
  - jammers: stand-off/escort/stand-in/self-protection/CREW/communications,
  - coherent target generator (CTG),
  - technique generators,
  - high-fidelity signal modulators,
  - electronic support (ES),
  - specific emitter identification (SEI),
  - radar digital receiver exciter (DREX),
  - radar electronic protection (EP) and ECCM development and
  - arbitrary waveform generator (AWG).

#### **SYSTEMWARE INC.**

325 E. Hillcrest Drive, #100  
Thousand Oaks, CA 91360  
www.sysware.com  
Phone: +1-805-497-9603  
Fax: +1-805-494-9719  
CEO: Stan Kranzler, Ph.D., Chief Scientist

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. As an example of the flexibility of this underlying technology, it is used as the basis for electronic security, as well as signal acquisition and analysis tools. Customer satisfaction before, during and after delivery is SystemWare's primary goal and paramount focus, and SystemWare is committed to delivering the absolute best.

T

**T. BEAR LARSON & ASSOCIATES INC.**

4723B Eisenhower Ave.  
Alexandria, VA 22304  
Phone: +1-703-823-4270  
Fax: +1-703-823-4275  
Co-Presidents: T. Bear Larson and John Sciacca

**AOC contact:** John Sciacca

T. Bear Larson & Associates is a company that provides engineering services in the areas of technology insertion, requirements definition, cost, operational effectiveness analysis, program initiation, management and flight test support. The company serves clients in tasks such as red teaming proposals, technology investment plan analysis and system-level operational analysis of C2W, IW, EW and Combat ID applications. Additionally, test issues for all of the above areas can be identified, planned and executed. The co-presidents, T. Bear Larson and John Sciacca, have extensive operational, flight test and acquisition experience at all levels in the DOD.

**TACTICAL TECHNOLOGIES INC.**

356 Woodroffe Ave.  
Ottawa, Ontario, K2A 3V6, Canada  
www.tti.on.ca  
Phone: +1-613-828-0775  
Fax: +1-613-828-8310

President and CEO: Dr. Trevor W. Tucker  
**AOC contact:** John Bednarz, Director, Business Development  
info@tti.on.ca

Tactical Technologies Inc. (TTI) supports countermeasure training, research and development and testing requirements in close to 30 countries. Tactical Engagement Simulation Software™ (TESS™) products enable users to analyze, evaluate and develop effective countermeasures by providing “integrated engagement simulations” between radar, infrared and SACLOS-guided and unguided weapons and targets in surface-to-air, air-to-air, anti-ship and anti-tank engagements.

TTI focuses on the physics associated with guided and unguided weapons in the terminal phase of tactical engagements, and the effect countermeasures have on the outcome. TTI's contributions include training in countermeasure effectiveness evaluation methodology, and the delivery of analytical tools and technology that use high-fidelity weapon system models in engagement simulations.

Simulated engagements between radar, infrared and SACLOS-guided weapons or unguided rocket-propelled grenades (RPGs) and a target allow the user to experiment, analyze and evaluate the effect various countermeasure tactics and techniques have on the end-game results.

The TESS COTS product line simulates guided weapons engaging with a target with various self-protection capabilities, including active and passive, on-board and off-board countermeasures and evasive maneuvers. By manipulating how and when these capabilities are used, the user

gains insight in how to optimize their effectiveness or counter them.

All TESS products generate miss distance and probability of survival metrics to evaluate effect. The TESS Master Interface provides the user with a test set-up configuration panel, a database for the system parameters and a simulation execution manager supporting Monte Carlo and/or deterministic batch runs. Standard TESS features include system scopes and three dimensional synthetic and virtual reality displays of the engagement.

The TESS product family is completely open, modular and extensible, allowing easy adaptation to special or unique requirements. Source code and software description documentation and customization also are available. TESS runs on personal computers with MATLAB™ and Simulink™ from The MathWorks Inc.

**TADIRAN ELECTRONIC SYSTEMS LTD.**

29 Hamerkava Street, P.O. Box 150  
Holon 58101, Israel  
www.tadsys.com  
President and CEO: Itzhak Beni  
Phone: +1-972-3-557-7211  
Fax: +972-3-557-7536

**AOC contact:** Rahamim Sarano, Director, Sales, EW and Intelligence Systems  
rahamims@tadsys.com

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 COTS 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.

**TECH RESOURCES INC.**

1 Meadowbrook Drive  
Milford, NH 03055  
Phone: +1-603-673-9000  
Fax: +1-603-673-0582

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.**

375 Conejo Ridge Ave.  
Thousand Oaks, CA 91361  
www.tecom-ind.com  
Phone: +1-805-267-0100  
Fax: +1-866-840-8550  
President: Arsen Melconian

**AOC contact:** Raju Chandra, VP, Marketing and Sales

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.

TECOM Industries is located in Thousand Oaks, CA, a suburb of Los Angeles. TECOM's 70,000-square-foot facility maintains complete design, manufacturing and test capabilities for all types of precision antennas and antenna systems. TECOM's facilities also include an outdoor antenna range that allows for far field pattern testing.

TECOM Industries Inc. is part of the Smiths Interconnect family of companies. Smiths Interconnect, a division Smiths Group, is a global provider of electronic application specific components and subsystems for the electronics interconnect, telecommunications, medical, industrial and aerospace markets, as well as military and satellite markets worldwide.

**TEKTRONIX INC.**

P.O. Box 500  
Beaverton, OR 97077-0001  
Phone: +1-503-627-5037  
www.tek.com

**AOC contact:** Darren McCarthy  
darren.michael.mccarthy@tektronix.com

**TELEPLAN AS**

Fornebuveien 31 No-1324  
Lysaker, Norway  
www.teleplanglobe.no  
Phone: +47-67-12-70-00  
Fax: +47-67-12-72-70  
CEO: Eirik T. Jensen  
info@teleplan.no

Teleplan Globe is a software engineering company with a strong international reputation. The company offers a broad spectrum of solutions relating to defence, telecom and business system solutions. Teleplan Globe and its sister companies have 50 years of experience within the defence and telecom industry since its establishment in 1959.

Teleplan Globe supplies a wide range of defence solutions already in daily use internationally. The company provides command and control systems, battle management systems, dismantled soldier systems, weapon control systems, geographic information systems, frequency and communication management systems, simulators, mission planning and EW and intelligence collection and analysis tools.

The company's main focus areas for the next two years within the C4ISR and ISR domains are battlefield management/dismounted soldier systems and CCIRM (Collection Coordination and Intelligence Requirements Management).

MARIA™ BMS (Battle Management System) is a system supporting tactical navigation in the field, automatic information exchange and FAC/JTAC operations.

MARIA™ DSS (Dismounted Soldier System) provides an updated situation picture and has the capability to send and receive secure e-mail to operational units utilizing PDAs.

NORCCIRM is a collection management tool designed to provide support to the military Collection Coordination and Intelligence Requirement Management (CCIRM) process according to NATO doctrines and procedures. The tool is applicable to the CCIRM process at all command levels and services.

Most importantly, Teleplan Globe listens to military personnel in the field and joins their exercises and training when appropriate. As a result, Teleplan Globe creates products and solutions that support their needs and meet their requirements in the warfare theatre.

**TERMA A/S**

Hovmarken 4  
DK-8520 Lystrup, Denmark  
www.terma.com  
Phone: +45-8743-6000  
Fax: +45-8743-6001  
President and CEO: Jens Maaløe  
terma.dk@terma.com

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 air traffic management systems, 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; Besozzo, Italy; Darmstadt (near Frankfurt), Germany; Washington, DC; and Warner Robins, GA.

**THALES COMPONENTS CORPORATION**

40G Commerce Way, P.O. Box 540  
Totowa, NJ 07511  
www.thalescomponents-us.com  
Phone: +1-973-812-9000  
Fax: +1-973-812-9050  
CEO: Stephen W. Shpock  
**AOC contact:** Joseph Emanuele  
emanuele@tccus.com

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.

**THALES HOMELAND SECURITY****TIMES MICROWAVE SYSTEMS**

358 Hall Ave., P.O. Box 5039  
Wallingford, CT 06492  
www.timesmicrowave.com  
Phone: +1-800-867-2629  
Fax: +1-203-949-8423  
**AOC contact:** Joe Lanoue  
jlanoue@timesmicrowave.com

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 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.

Times Microwave Systems designs and manufactures high-performance coaxial cables, connectors and cable assemblies, incorporating a wide range of materials and technologies. Its products include the MT family of sealed coaxial transmission lines for airborne systems, the SiO2 coaxial transmission lines for high temperature and/or high radiation environments, the Phasetrack and Phasetrack II coaxial cables for systems requiring minimal phase change with temperature, the LLSB and TCOM-LS low-smoke zero-halogen coaxial cables with shipboard and vehicle applications and the QEAM coaxial cable assemblies for field-deployable communication systems.

**TINEX AS**

Postboks 55  
N - 1306 BÆRUM POSTTERMINAL  
www.tinex.no  
Phone: +47-67-80-84-90  
Fax: +47-67-80-84-99  
CEO: Werner Fuchs  
**AOC contact:** Christian Fuchs  
mail@tinex.no

TINEX, founded in 1991, is active within defence, security and communications and railway technology. Its activity includes customer advisory, development, delivery, set in operation, maintenance and training. In Norway, TINEX represents international important suppliers that have achieved broad acknowledgement from customers all over the world. The strategy of TINEX is to make its customers even more competitive by offering optimal solutions. TINEX works in clusters to achieve strength and flexibility from project to project.

TINEX is a system house representing international companies and is a partner within public and defence projects in the following technologies: EW systems, radars, other sensors (active and passive), communications, security systems and maintenance.

TINEX carries out the design, installation and integration of C4I in various armoured and unarmoured vehicles.

Its local representation and services in Norway comprise marketing and sales for defence, public, homeland security and rail products; adoption of equipment to the Norwegian requirements/standards; installation and maintenance; and documentation and training in Norwegian. Its offset tasks are acting as a contact point for Norway abroad, supporting contacts between foreign and Norway industry and coordinating Norwegian production abroad. The company's efforts to coordinate offset obligations

include consultancy and banking and multinational activities.

#### TMD TECHNOLOGIES LTD.

Swallowfield Way  
Hayes  
Middlesex UB3 1DQ, UK  
www.tmd.co.uk  
Phone: +44-(0)20-8573-5555  
Fax: +44-(0)20-8569-1839  
Chairman & Managing Director: Peter J Butcher  
Sales Director: Graham H Brown  
**AOC contact:** Paul Davies, Sales & Marketing Executive  
wecare@tmd.co.uk

TMD Technologies Ltd. has more than 60 years experience in all aspects of the design and manufacture of equipment for 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) that are 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).

#### TRAK MICROWAVE

4726 Eisenhower Blvd.  
Tampa, FL 33634  
www.trak.com  
Phone: +1-813-901-7200  
Fax: +1-813-901-7491  
sales@trak.com

TRAK Microwave is a world-class supplier of high-reliability microwave and RF components and subsystems for the world's most demanding applications and environments. The company's 40 years of experience in defense, space and wireless markets led it to become a major global supplier to manufacturers of military electronics, satellite, navigation and communication systems around the world. Its 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, EW equipment and radar and missile applications. Space applications include components for communication, television broadcast, meteorological, earth resource and intelligence-gathering satellites. Its commercial products are used in point-to-point radio, wireless communications, base stations, collision avoidance systems, distance-measuring equipment and airborne weather radar.

TRAK Microwave operates from a world-class facility in Tampa, FL. TRAK is specifically structured to provide customers with close technical support and rapid product development and prototyping. Its philosophy provides a consistent, controlled evolution of applied RF technology and product development, which guarantees excellent performance and price benefits to its customers. Its engineering experts combine the most advanced design tools and manufacturing techniques to ensure high-quality products with on-time deliveries.

OEMs choose TRAK as their supply partner because it meets demanding delivery schedules and provides tomorrow's technical solutions today. Many military and commercial systems providers continue to name TRAK as their certified supplier year after year. In addition, TRAK Microwave is an ISO 9001:2000- and AS9100A-registered company. Its versatile design software allows custom units to be produced efficiently and rapidly with a high confidence factor. Its internal design processes and manufacturing capabilities insure that the most robust, flexible, cost-efficient and high-performance products are manufactured for optimum solutions.

#### TRIASYS TECHNOLOGIES CORPORATION

227 Chelmsford St.  
Chelmsford, MA 01824  
www.triasys.us  
Phone: +1-978-244-1060  
Fax: +1-978-244-1062  
President: John Apostle  
japostle@triasys.us

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.

#### TRU CORPORATION

245 Lynnfield St.  
Peabody, MA 01960  
Phone: +1-800-262-9878  
Fax: +1-978-717-2531  
CEO: Eugene O'Neill  
President: Scott O'Neill

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

#### ULTRA ELECTRONICS FLIGHT LINE SYSTEMS

7625 Omnitech Place  
Victor, NY 14564-9795  
www.ultra-fei.com  
Phone: +1-585-742-5310  
Fax: +1-585-742-5397  
**AOC contact:** Moira Young  
moira.young@ultra-fei.com

#### ULTRA ELECTRONICS TELEMUS

88 Hines Road  
Ottawa, ON K2K 2T8, Canada  
www.ultra-telemus.com  
Phone: +1-613-592-2288  
Fax: +1-613-592-8855  
**AOC contact:** P. Michael Gale, Marketing Director  
pmgale@telemus.com

Ultra Electronics Telemus is a recognized industry leader of C4ISR 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 EW 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 ISR 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 ES receiver systems available in the world today for ISR 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 ES roles, including ESM and SIGINT.

As a leading international supplier, Ultra Electronics Telemus brings an analytical approach to every one of its projects by assessing the operational imperatives, constraints and needs of its customers and their unique environment. Through careful analysis, Ultra Electronics Telemus determines which architectures and products from its comprehensive EW technology base best address the customer's operational goals in terms of effectiveness, reliability and economy.

## W

### WAVEPOINT RESEARCH INC.

7444 Timber View Drive  
Newburgh, IN 47630-8119  
www.wavepointresearch.com  
Phone: +1-812-490-7947  
**AOC contact:** Eric R. Wandel  
eric@wavepointresearch.com

Wavepoint Research Inc. is engaged in research and engineering development in RF and photonics applications. The company is located in Southern Indiana near Naval Surface Weapons Center (NSWC) Crane. Areas of expertise include electromagnetic analysis, antenna design and analysis, component development for high fidelity digital receiver architectures, signal processing for military and commercial radar 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 both differential-based finite element simulations such as HFSS, as well as method of moments tools such as the Numerical Electromagnetics Code (NEC). In addition to military applications, analyses for commercial applications have included pattern distortion analyses for multiple-emitter, multiple-tower transmission sites for high-power commercial broadcast locations.

Wavepoint Research Inc. recently completed a Phase I Small Business Innovation Research (SBIR) project with the US Air Force to develop an RF/Microwave Hazard (RHAZ) assessment tool for use in determining the efficacy and hazard potential of emitter installations. The RHAZ tool allows users to determine whether human exposure hazards exist for a defined assessment scenario. In addition to personnel hazard assessment, the RHAZ tool provides utility for fuel and ordnance hazard assessment, or HERP, HERF and HERO.

Wavepoint Research performs systems analyses for EW applications involving high-speed digital receivers and post-processing. 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 multispectral, multi-domain and multi-mission perspective.

### WERLATONE INC.

2095 Route 22  
Brewster, NY 10509-5914  
www.werlatone.com  
Phone: +1-845-279-6187  
Fax: +1-845-279-7404  
**AOC contact:** Peter A Kuring  
pkuring@werlatone.com

## X

### XWAVE (BELL ALIANT REGIONAL COMMUNICATIONS, LIMITED PARTNERSHIP)

65 Iber Road  
Stittsville, Ontario  
K2S 1E7, Canada  
www.xwave.com  
Phone: +1-613-831-1836  
Fax: +1-613-831-1836  
President and CEO: Karen Sheriff  
**AOC contact:** Luc Dumouchel, P. Eng.

xwave is a large and well-established information technology (IT) services organization with its roots in mission-critical defence and aerospace technologies and also in cutting-edge public safety applications. xwave comprises more than 1,500 professionals working at locations across Canada and in the United States. xwave is a division of Bell Aliant, a limited partnership with strengths in telecommunications, information technology, mobile satellite communications and emerging business.

xwave is a dynamic IT company focused on providing clients with end-to-end solutions, from software engineering and systems integration to product fulfillment and infrastructure services. In addition to this broad Canadian presence, xwave has international offices in the New England region of the United States. xwave's Defence, Security and Aerospace business is an integral part of its success as a world-class systems engineering and IT company. For more than two decades, xwave has been a key Defence, Security and Aerospace contractor.

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