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Past Events

Big Crow Conference

The Board would like to thank all the sponsors, speakers and attendees that made our biennial conference held on the 4th and 5th September 2013 such a huge success.

A record breaking 136 people from five different countries attended. The proceedings are available on the website:

(http://www.aardvarkaoc.co.za/index_files/Page5847.htm).

Upcoming Events

Aardvark Members Annual General Meeting

The Aardvark Roost's Annual General Meeting will be held on the 18th November 2013 at the CSIR. All the Aardvark's members are invited. The aim of the meeting is to give feedback on the past year's activities and achievements as well as to discuss member's expectations and new ideas to further the cause of EW in South Africa.

History of Electronic Warfare In South Africa

A reminder to anyone who has information on or are willing to contribute to our capturing of South Africa's EW history to contact Dave Howie on dhowie@telkomsa.net.



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Awards

Top Achiever Awards

The Aardvark Board would like to congratulate Maj Dirk Beukes and Lt Tessa Du Toit for receiving the Top Achiever awards for best student in the SA Army's R6 Signal Commanders and SAAF's EW Systems Course respectively.



Figure 1: Maj Dirk Beukes (right) receiving the trophy from Lt Col Jacques Theron. On the right is and Lt Tessa Du Toit, receiving the award from Brig Gen Burger.

Lifetime Awards

It was the Aardvark Board's privilege to present Mossie Basson and Ben Ash with lifetime awards to show South Africa's EW community's appreciation for their dedication and contribution to Electronic Warfare.

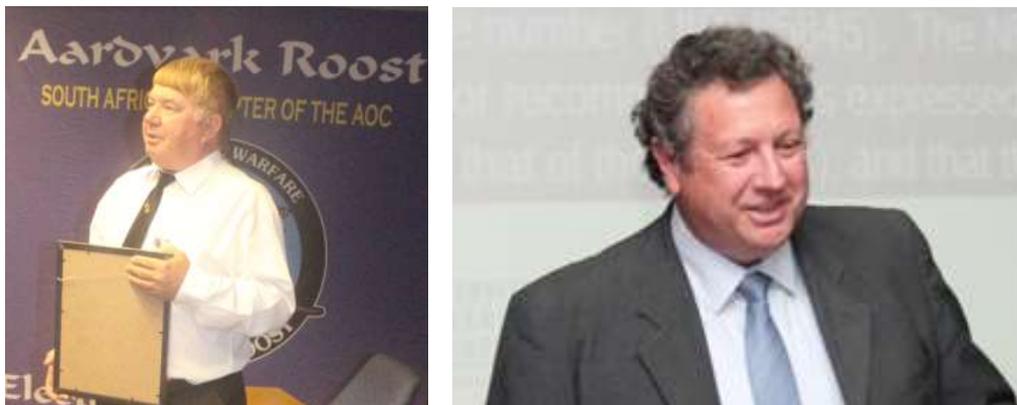


Figure 2: Mossie Basson (left) and Ben Ash (right).

The details of their achievements can be read on the website:

(http://www.aardvarkaoc.co.za/index_files/Page5636.htm).

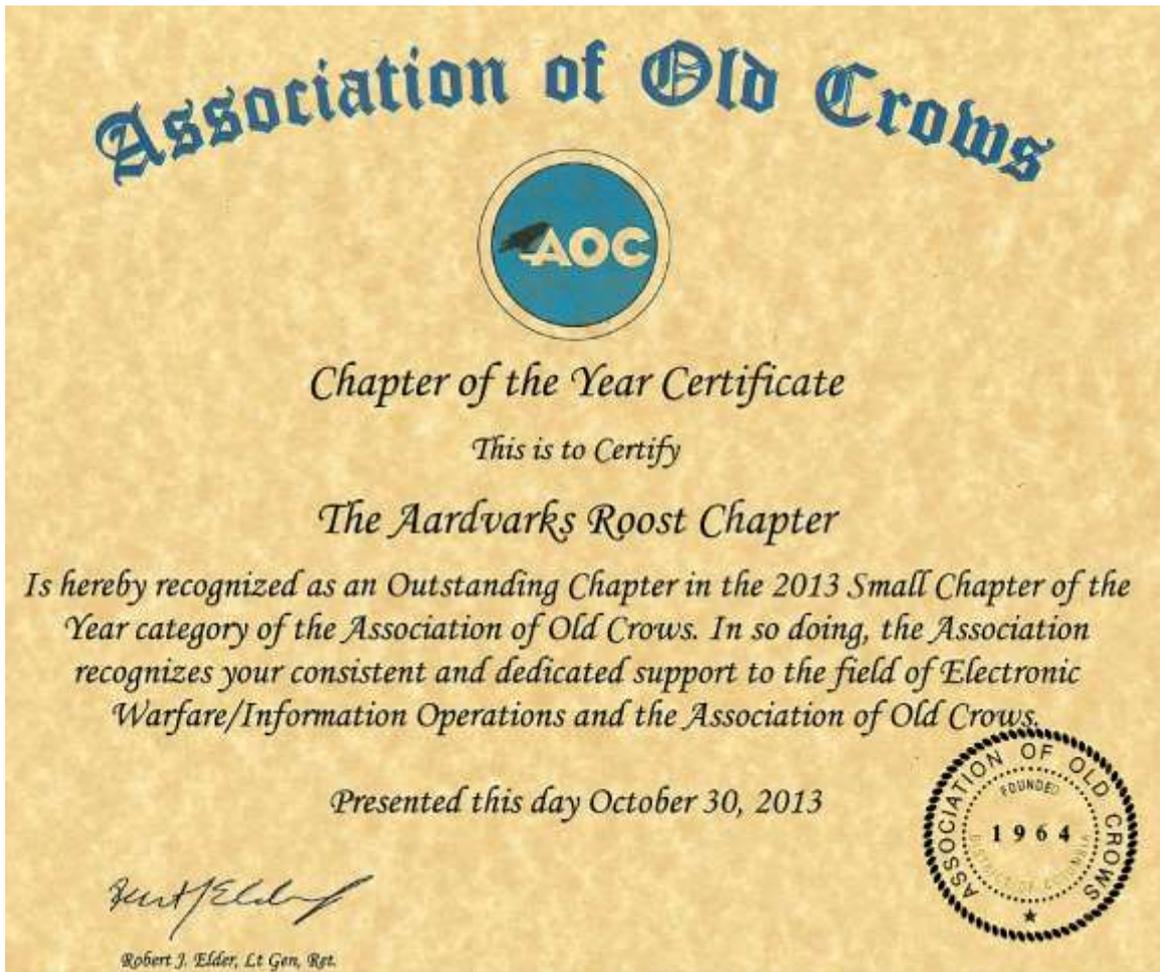


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Chapter of the Year

Thanks to the continued support from our sponsors and the local EW community, the Aardvark Roost, once again, received the Chapter of the Year award in the small chapter category during this year's international AOC Symposium.



50th Annual AOC International symposium & convention



The theme of the Symposium held in Washington DC, the 28th to the 30th Oct 2013 was: **Proud Legacy. Strong Future,** to tie up with the 50th anniversary of the AOC.





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The AOC also had History Hall, which showcased EW equipment from the Second World War onwards. The various chapters were also represented here.



There were more than 1594 attendees (nearly 300 more than the previous year) from 23 countries. Approximately 69% of all the attendees were from the USA, the previous year this figure was 81%. The countries represented were:

- 1 Australia
- 2 Brazil
- 3 Canada
- 4 China
- 5 Denmark
- 6 Estonia
- 7 Finland
- 8 France
- 9 Germany
- 10 Israel
- 11 Italy
- 12 Japan
- 13 Korea (South)
- 14 Netherlands
- 15 Norway
- 16 Saudi Arabia
- 17 Singapore
- 18 South Africa
- 19 Sweden
- 20 Turkey
- 21 UAE
- 22 UK
- 23 USA

95 Companies / Institutions exhibited this year.

Here are some of the highlights from the 50th Annual AOC International Symposium and Convention:



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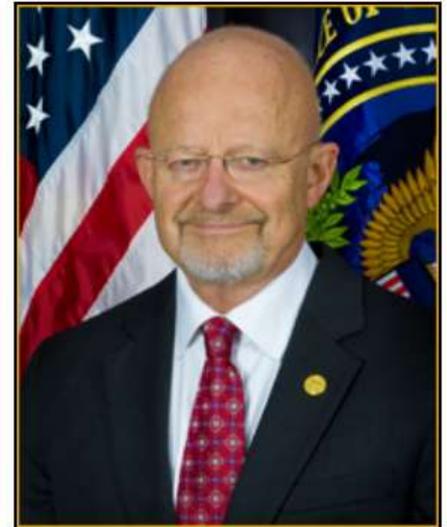
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Opening Keynote Address: Intelligence Integration - Past, Present and Future

Keynote Speaker: The Honourable James Clapper, Director of National Intelligence

The Honourable James Clapper, Director of National Intelligence, opened the Symposium with a discussion of critical issues facing today's intelligence community, touching on history, integration and the impact of the three S's: Sequestration, Snowden and Shutdown.

Clapper acknowledged hitting his own milestone anniversary in the intel community and paid tribute to the AOC's 50th Anniversary, noting that the intellectual span of today's crows had expanded exponentially. "It's not is not just your father's classic electronic warfare," he said. "Now it's information operations, cyber, and a whole range of applications and challenges we encounter in the electromagnetic spectrum."



Integration is changing the way that the electronic warfare and intelligence communities have to do business, Clapper said, recalling a time when there were debates about where lines between electronic warfare and SIGINT should be drawn – "The degree to which SIGINT should control the spectrum. Do we collect or do we attack?" Clapper said. "We have the same questions about where the lines are drawn, for example, between computer network exploitation and computer network defence today. And they're just as hotly debated," he said.

Clapper tipped his hat to crows, not just for the past, but for realizing the importance of the need to adapt to changing circumstances. "You've progressed, you've adopted, innovated and stayed up with technology," he said. "You've done what we often don't do in the Beltway."

On the intel side, integration is changing the operational picture internationally, Clapper said, detailing some of the successes and challenges the national intelligence community has face. At the National Security Agency, real-time SIGINT has been placed at the fingertips of combatant commanders. And, he said, we have developed the capabilities to locate our adversaries that we never could before. However, among challenges faced by the intelligence community in preventing future threats are the impacts of the three S's: Sequestration, Snowden and Shutdown.

In terms of the sequester, Clapper spoke of the challenge in explaining the impacts of sequestration to the public. "It's not like closing public parks, longer lines at the airport or air traffic control delays. In the case of intelligence, the capabilities that we do away with, cut, eliminate or reduce today – the impact of which may not be known for months or even years," Clapper said. "From my vantage, where I sit, we simply can't sustain the cuts in the long term."

In terms of the leaks from Edward Snowden, Clapper stressed that Snowden was "not a whistleblower" and that they are still assessing the impact of the damage from the information he has released. "It will probably be years before we know the full extent," Clapper said. "That all said, some of the conversation we're having about our so-called domestic surveillance program probably needed to happen."



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He noted that the NSA has attempted to work toward increased transparency, recently declassifying more than 1,800 pages of Foreign Intelligence Surveillance Act (FISA) court opinions, with additional declassified information on the horizon. “We have to do this if we’re going to regain the trust of the American people and their elected representatives,” Clapper said. Though, he noted that this transparency is a double-edged sword as it also works to the advantage of adversaries who can study the information.

As a result of the recent U.S. government shutdown, 70 percent of civilians in the intel community were initially furloughed, Clapper said. And while those under the DOD were brought back quickly under the Pay Our Military Act, intel at CIA and NSA were not protected. “The shutdown had a devastating and, I believe, long-lasting impact on the workforce. It was an attack on them and their service, which came on the heels of some people being furloughed because of sequestration,” Clapper said. “I’m really watching carefully now just to see what impact this has on our recruiting and retention.”

Session 1: Future Acquisition Strategies in a Constrained Environment

Session Chair: Mr. Jaymie Durnan, Senior Assistant to the Principle Deputy, OASD(R&E)

Despite the fiscal uncertainties associated with current and future defence spending, the globalization of sophisticated electromagnetic spectrum warfare capabilities, including the confluence of electronic attack, electronic protection and cyber demand a comprehensive investment strategy across the DOTMLPF spectrum. This strategy must embrace not only the technology enabling solutions, but new organizations and concepts of operations to maximize the power of the EMS in providing our warfighters with a significant competitive advantage. This session explored these complex issues by an engaging series of senior level perspectives and panel discussion.

Citing the President’s January 2012 strategy document as a central reference, Acting Assistant Secretary of Defence for Research and Engineering OASD (R&E), Al Shaffer, assured this morning’s audience at the opening joint session that the DOD does indeed have a strategy for guiding its future EW acquisition activities – a strategy that emphasizes continued and early investment in developing new EW technologies and capabilities together with an increased focus on the development of adaptable, rapidly-reconfigurable systems.

Shaffer was part of a panel of senior OSD and Service speakers in the session, chaired by Jaymie Durnan, Senior Assistant to the Principle Deputy, OASD(R&E), and addressing the impact of uncertainties and reductions in today’s defence spending, as well as other important EW trends such as the globalization of sophisticated EMS capabilities; and the confluence of electronic attack, electronic protection and cyber.

Shaffer observed that although the military of tomorrow will necessarily be leaner, it will also therefore need to be more technologically advanced and agile, and he reminded the audience that in past budget downturn cycles, the DOD has worked hard to protect its science and technology R&D funding. At the same time, however, he warned that “We have to stop thinking about large, monolithic systems that are hard to change, and instead focus on developing systems that are adaptable and capable of being reconfigured very quickly.”

Other common observations and recommendations of the panel included the need for new and innovative partnerships and collaboration between government and industry, international partners, as well as between industry players who might in the past have seen each other as strictly competitive. The need for greater use of both developmental and



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operational prototyping was also noted, and well as continued appreciation of the fact that decisions regarding technology investment and project prioritization must absolutely “be informed by the threat.”

Session 2: Industry Response: Future Strategies in a Constrained Environment

Session Chair: Mr. Steve Hogan, Northrop Grumman Corporation

With the “table set” in Session 1 as to future requirements, trends and priorities, how is Industry reacting to this complex set of issues? What efficiencies and opportunities exist to accelerate robust EW capabilities into the hands of the warfighter? What are the impediments — are they technical or procedural? This session responded with various corporate views on strategies being taken to deal with global EW markets and fiscal realities.

The afternoon session, chaired by Steve Hogan, Vice President & General Manager, Northrop Grumman Technical Services, provided the EW industry’s perspective on the Session 1 discussion of acquisition in the constrained environment. The discussion focused on how industry can potentially address the complex fiscal and business management challenges ahead – particularly as the true impact of sequestration cuts are realized and the use of unobligated funds is no longer an option.

The panel, chaired by Hogan, included representatives from Selex ES, Capitol Defence Consulting, Exelis, Raytheon, Rohde & Schwarz, BAE Systems, and Cobham Defence Systems. While generally agreeing with the assessment and recommendations of their DOD and Service customers relative to increased collaboration and driving toward more flexible, rapidly-adaptable capabilities, the industry participants also raised a number of their own additional points and suggestions. These included potentially increasing levels of Cooperative R&D and Independent R&D funding, the opening up of technology roadmaps, improved field testing, and, in particular, the continued need for flag-level EW “champions” within DOD to help drive whatever new collaborative EW acquisition plans and initiatives might be adopted to successful fruition.

Captain Thomas Williams, USN Ret, President of Capital Defence Consulting, also highlighted the need to better educate Capitol Hill on the unique benefits provided by EW technology as well as its very real high return on investment (ROI). “Congress needs to recognize, that although no immediate near-peer confrontation may be foreseen, EW also serves as America’s ‘own asymmetric weapon,’ providing for highly-flexible and cost-effective force preservation and force multiplication, and therefore warranting priority funding attention in a reduced funding environment.”

Session 3: International Perspective

Session Chair: Wing Commander John Clifford, OBE RAF (Ret).

Most military operations in the 21st Century will be conducted by international alliances such as NATO in Afghanistan and by coalitions of the willing elsewhere. EW and related EM operations, including ISR, SIGINT, communications and spectrum management are essential to effective military operations globally across the spectrum of conflict. Understanding mutual capabilities forms the foundation for international, cooperative, EW operational effectiveness and capability development but is difficult to achieve without a clear concept. Listening to and learning from others



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provides the vision needed for new concepts. This session will examine some of the issues and opportunities that effective international EW cooperation entails, with perhaps some surprising conclusions.

Session 3 featured a discussion of international EW capabilities, operations and plans from a wide range of participants who demonstrated that worldwide EW is undergoing shifts as the result of changing technology and operational requirements.

Chaired by Wing Commander John Clifford, OBE RAF (ret), the session included commentary from Lee Simonetta, Associate Laboratory Director, Electronics Systems Lab, at the Georgia Tech Research Institute, who discussed the growth in the foreign military sales (FMS) market. "I can't remember a time when EW, coming out of a series of conflicts, has been positioned as visibly as it is today," he said.

Simonetta stressed the need for focus on sustainment of existing systems and, given the number of systems, that foreign investment is critical to ensuring that those systems can be adapted and updated quickly to meet changing threats.

Commander Gunnar Marcusson of the Joint EW Branch of the Swedish Armed Forces HQ, detailed Sweden's journey to home-grown EW solutions and how those solutions are being maintained in the changing environment. Dr. Jim Wickes of the Defence Science and Technology Laboratory (Dstl) discussed NATO's ongoing EW Open Architecture development, which is working to provide operational, technical and commercial flexibility.

Major William Caldwell of the UK 14 Signals Regiment (EW), discussed some of the manpower, location and operational priority changes and challenges facing the regiment following its final pullback from Afghanistan.

Keynote Address: Imminent Domain 2014

Admiral Jonathan W. Greenert, USN, Chief of Naval Operations

Opening day two of the 50th Annual Symposium, keynote speaker Admiral Jonathan W. Greenert, USN Chief of Naval Operations, emphasized that he very much views EM spectrum and cyber operations as critical areas that will remain among his top priorities.

Among specific areas to be addressed, he pointed to the need for a better overall awareness of the EMS and cyber operational environments noting that, "while we are capable of knowing when there is a change in the status quo, we also need to know what the normal state of the EMS environment is."

Related to this, he observed that it's also important to better understand our own vulnerabilities to EM exploitation and to develop ways to minimize these through such things as cooperative international exercises. "We need to include cyber and EW operational factors in terms of our certifications for both deployment and joint operations."

In response to a question from incoming AOC President, Wayne Shaw, the Admiral confirmed that, given his often-referenced recognition of the impact and import of EW and cyber convergence, that Navy EW will remain a funding priority in any fiscal scenario. Said Greenert, "When I've developed my Program Objective Memoranda (POM), I've





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stated that we will continue to develop our asymmetric capabilities, and EW is a key element of that as well as cyber processes. This is where (EW) fits in, and we will continue to put money into that, so that by (2020) I will be able to operate at a certain level. That defines the capabilities I have programmed toward.”

Session 4: The Speed of EW

Session Chair: Marvin Potts, Division Technical Advisor, Spectrum Warfare Division, Air Force Research Lab.

Future EW challenges will be driven by time. Technology proliferation and flexibility continue to shorten the threat-to-countermeasure timeline into unprecedented territories. Development and upgrade cycles of years or even months will leave one on the losing end in the battle for EMS dominance. Future EW engagements will be won by those who can adapt in micro-timelines, even to the point of real-time EW design. This future will require significant paradigm changes in intelligence, EW reprogramming, and EW capability development and this session explored those concepts.

The speed advancing threats due to technology proliferation and flexibility is creating an unprecedented tightening of the timeline required to provide solutions to counter those threats, was the message of Session 4, looking at the historical advancement of EW and the factors that will drive future EW development.

Session 4, featured in-depth discussion of the challenges facing EW development in terms of coping with rapidly contracting timelines. “If we’ve learned anything from the IED scenario, it’s that we cannot have these extremely long development cycles in order to do the major countermeasure to capabilities anymore,” Potts said. “What we did was we just flooded the areas with these counter capabilities in there; they were largely uncoordinated in the beginning and we still were playing a catch-up game. As things move on and as time progresses here, closing that loop on the major countermeasure, we have to do that on a much quicker time scale than we have in the past.”

The session kicked off with Commander William Arnold, USN (Ret) and his son Colonel John Arnold, USAF, Deputy Director, Air Force Special Programs, father and son electronic warfare officers who offered a historical look at EW through the eyes of what they’ve seen during their respective careers, the message being that though EW has undergone significant change in the past 50 years, the scale of change has accelerated rapidly in the last 10 years.

In his presentation titled “MINI-UAS: a New Threat, and a New Challenge for Electronic Warfare?” Philippe Guillaume of Thales Communication & Security posed questions about the possible threats coming from small unmanned aerial systems, which can perform a number of functions. These systems’ ability to do everything from ISR and SIGINT to jamming and to essentially become a flying IED, make them an evolving threat that will need to be considered in terms of near-term countermeasures solutions.

Damian Hall, of Australia’s Defence Science & Technology Organization (DSTO) spoke on “Shared EW Battle Management” Challenges, and discussed some of the science and technology issues faced when looking at EW systems as a “System of Systems.” Among issues identified were the needs for not only EW battle management (EWBM), but a hierarchy of control for that system, as well as spectrum management and deconfliction to avoid fratricide. Though this is already being worked on Hall noted that “we’re really talking about the requirement for commanders to be able to respond dynamically to the environment.” Hall also described Australia’s Shared EW Testbed (SHEWT), which is being used to test some ideas for shared scenarios in EWBM.



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Dr. Yiftach Eisenberg, DARPA's program manager for the Information Innovation Office (I2O) discussed some of that agency's current work in Adaptive EW programs, specifically the Adaptive Radar Countermeasures (ARC) program, which deals with counter radar, and the Behavioral Leap for Adaptive EW (BLADE) program, which is counter communications. The idea is that once you're engaged, you want to look at what happens when you see threats you didn't expect, Eisenberg explained. "One of the challenges is not to solely rely on info programmed into the system prior to battle," he said. "You want to be able to scan the environment and sort out the clutter."

BLADE is heading toward phase 3 – open air testing – in 2014, while ARC is just starting into Phase 1, which covers algorithm development. – Elaine Richardson

Session 5: Developing Future EMSO Warriors

Session Chair: Dr. Casey Wardynski, Superintendent of Huntsville City Public Schools.

It is often said our greatest resource is people. With future EW/EMS paradigms on the horizon, what are we doing to produce that next generation of EMSO warrior? Purposeful efforts are required to develop a highly skilled EMSO and cyber workforce for the classified and technically demanding positions open today and those emerging for tomorrow — ranging from the K-12 STEM initiatives through the Service schools. Focused EW/EMS recruiting and career promotion is needed to keep from losing the best and brightest to other specialties. This interactive session will generate ideas for our government, industry and academic community to proactively work together to more clearly define our EW/EMS educational needs and career path development in engineering, physics! electromagnetics, mathematics, computer science, forensics, cyber technologies, and more.

Dr. Casey Wardynski brought together a terrific and quite diverse panel for this session tackling the pressing issue of developing future EMSO Warriors. Panelists ranged from a LT COL in Army Cyber Command, a high-school teacher specializing in Cyber Security, and two high-school students navigating their way through their exciting Science/ Technology/ Engineering/ Mathematics (STEM) education.

LT COL Jeffrey Metzger, US Army Cyber Command, presented the vast disconnect that the services face when it comes to recruiting talent – that many students in Advanced Placement (AP) STEM educational tracks have already decided on entering the commercial sector due to the overwhelming recruiting and visibility of those companies. He stressed the importance of preparation, knowledge, and instilling a culture of responsibility and Army values into students as early as junior-high and elementary school years.

CDR Pablo Breuer, USN, US Cyber Command, is a self-professed "Hacker that dresses up as a naval officer" as a contrast to the majority of his peers where the roles and uniforms are reversed." He highlighted the failings of the current educational processes and cultures that don't failing to engage training young women into STEM.

Ms. Sutton, Mr. Brahm, and Mr. Rogers represented an example of a system that is well on its way to 'getting it right.' They shared the excitement and emphasis placed on the Cyber Security courses offered at Grissom High School. They also emphasized the importance of ethical hacking competitions to the fun and camaraderie that adds passion to the educational process.



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The resonating theme of the session came through clearly – To develop future EMSO warriors, DoD and public education must do better at working together to instil passion for the STEM fields early in the educational process, and raise awareness of the opportunities to utilize these skills in defence applications.

Session 6: Navigation and Communications in Contested/Congested Environments

Session Chair: Dr. Jeffrey Boksiner, electronics engineer, Antennas and Spectrum Analysis, Space and Terrestrial Communications, US Army CERDEC.

Spectrum once reserved exclusively for military use is now being repurposed to satisfy the ever growing commercial demands for higher data rates to mobile devices. The decrease in bandwidth allocated to military communications and navigation, combined with the increasing reliance of our fighting forces on information and networking are posing significant challenges. Developers will need to leverage commercial communications components and systems to the greatest extent possible, despite them having significantly different architectures and operating environments compared to their military counterparts. This session explored new and innovated technologies and policies that will be necessary to enable military communications and navigation systems in order to meet functional and capacity demands in future congested! contested EMS environments.

Technologies to enable maneuver in the increasingly congested spectrum took center stage in session 6, which featured a variety of solutions currently being studied to assist with navigating and dominating the EMS domain.

Chaired by Dr. Jeffrey Boksiner, who sat in for original chair Dr. Paul Zablocky, the session featured in-depth discussion on major challenges facing military spectrum users who must fight for position in the crowded manoeuvre space.

Discussed topics included the shift toward Dynamic Spectrum Access (DSA), which allows both for spectrum integration and response to changing circumstances. Marc Russon, director of emerging technology for L-3 Communications Systems – West, noted that DSA is being pursued by the commercial market that that it will turn out to be “financially irresistible” to the point where anyone running spectrum dependent systems will have no choice but to plan for its use.

Though policy tends to lag technology in this area, speakers agreed that policy will need to catch up or the technology will drive things forward without military involvement.

New and emerging technologies, including software defined, cognitive technologies are critical to managing future spectrum and the ability to not just manage but to take advantage of the small areas of spectrum that aren't being used are critical to long-term success. Other presentations discussed new technologies such as “layerless” networking and improved algorithms to enable better control traffic cycles.

DARPA's Dr. Yiftach Eisenberg also shared details agency's current Spectrum Challenge, a national competition in which 18 university and individual teams are taking part in competitions to solve critical spectrum questions. “What we are seeking is new radio technology to enable reliable communications in congested and contested electromagnetic environments,” Eisenberg explained. “We are looking at strategies that can do this without direct coordination and spectrum pre-planning.”



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The competition includes two tournaments, one competitive and one cooperative, where teams have to pass data through software defined radios while trying to operate in the same 5 MHz of spectrum.

Session 7: Advanced EW Technologies

Session Chair: Dr. Peter Craig, EW Program Manager of the Office of Naval Research (ONR).

EW capabilities are fueled by their underlying component and systems technologies. But the broad-ranging EW mission can represent significant challenges to developers of these technologies. Electronic Support (ES) receivers must detect weak and transient signals buried in the midst of a congested EM spectrum covering many orders of magnitude in power and frequency. Electronic Attack (EA) transmitters must efficiently project kilowatts of emitted power while retaining sufficient linearity to faithfully reproduce highly complex waveforms and modulations. And to top it off, these ES and EA systems must often operate side-by-side without interference, as well as communicate with impunity to other systems within their EW network. This session highlighted the cutting edge research and exploratory development that enables future EW systems which can meet and surpass these challenges, leading to the next generation of advanced EW capabilities.

As noted in the program description of the afternoon session on “Advanced EW Technologies,” the requirements of the EW mission present very real technological challenges that demand cutting-edge research and advanced technology development to provide the next-generation capabilities needed to meet them.

The session included speakers from some of the nation’s top academic and research centres including MIT Lincoln Laboratory, UC Santa Barbara, Georgia Tech Research Institute, and the Universities of Nebraska at Lincoln and Colorado at Boulder.

The session did indeed include a number of “wow-that’s-impressive” moments, as speakers presented their work ranging from the latest advances in RF and EO devices to network-enabled, collaborative, EW applications of small tactical UAVs.

Presentations included new microscale-wavelength photonic RF circuits and devices operating at Terahertz carrier frequencies but achievable with commercial-grade VLSI fabrication technology; high ERP (10kW)/high-efficiency/high-linearity phased-array digital transmitter on a chip; a UV photodetector array with state-of-the-art responsivity performance at room temperature; multispectral III-V semiconductor laser sources with up to 5W power output at 4.5 um wavelength (currently), and ultimately aiming at 50W; and sophisticated “leader-based networks” controlling highly autonomous, homogeneous and heterogeneous tactical UAV squadrons capable of performing complex SEAD missions and generating phantom 3D tracks of ingressing manned aircraft to spoof dense air defence systems.

Session 8: Cognitive/Adaptive Systems: Can "Skynet" and "the Borg" Solve EW and Cyber Challenges?

Session Chair: Session Chair J.D. McCreary, chief, Strategic Technology Program Office at GTRI.

Future military operations are likely to encounter dense, diverse and dynamic target environments. As we think through the challenges of executing missions outlined in Air Sea Battle or the Joint Operational Access Concept, there is the balance of choosing effects and delivery mechanisms. Some choices will be driven by the level of apriori intelligence on the battlespace. Other factors include timely access, persistence, lethality, survivability and combat power



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regeneration. Command and control and situational awareness will become increasingly challenging for decision-makers at all levels of execution, to include the integration of machine-machine execution, whether that be unmanned vehicles or cyber and EW operations. This session explored how future warfighting capabilities might benefit from multi-disciplinary, multi-domain advances in cognitive/adaptive systems, machine hierarchies, and complex behaviour systems.

Referencing some of the key autonomous networked systems from recent science fiction, panelists for session 8 discussed the needs involved in realities of actually creating systems that can actually perform distributed autonomous mission execution across multiple domains for the modern warfighting environment.

Though sci-fi concepts like Star Trek's networked, hive mind Borg and the artificial network intelligence from the Terminator movies, "Skynet," aren't actually real, Session Chair J.D. McCreary, chief, Strategic Technology Program Office at GTRI, noted that they do offer a way to discuss key concepts. "How do we constantly, and as rapidly as we can, make an observation, try and understand what that information means to us and then make decisions?" asked J.D. McCreary. "And what happens when we don't fully understand it the first time?"

Key among challenges discussed is the issue of trust. In order for such systems to work, in as rapid a timeframe as threats require, there has to be trust on numerous levels – trust in information and devices, trust that the devices assembling the data have actionable information and then technical trust in the devices themselves. Panelists discussed concepts from the spatial opportunities in managing and utilizing spectrum to achieve shortening of OODA (observe, orient, decide, act) loops, to the thinking behind incentives that prevent defection in the type of networked systems that will be required moving forward and current work on adaptive and collaborative technologies in the area of acoustic ocean sensing.

Session 9: Game-changing Technologies: Revolution over Evolution

Session Chair: Dr. Gerry Borsuk, Associate Director of Research for Systems, Naval Research Laboratory.

Evolution is "a process of gradual or progressive change," whereas Revolution is "a radical or sudden, complete, marked change." As has been discussed throughout in this symposium, the future threat terrain is complex, ever-changing and has access to advanced electronics technologies. A few years ago, cloud computing was a "game changer," but today "the cloud" is part of our everyday experience. Are there new, revolutionary technologies that will fundamentally change the nature of the EW engagement — something that will provide a leap-ahead EW capability? This session presented several examples of such leap ahead advanced technologies.

In EW, we regularly speak of evolutionary and emerging threats and the application of advanced technology solutions to meet them, but to guarantee that we are always ready to bring these next-generation solutions to bear when needed, we need to continually pursue a different level of technology advancement – "revolutionary."

Wednesday's aptly named session on "Game-changing Technologies: Revolution over Evolution," addressed this area with presentations on a number of new technology developments aimed at providing "leap-ahead" EW capabilities. Included in the session, was ONR- and DARPA-sponsored work on microwave and mm-wave (1-200 GHz) GaN EW receiver components offering 3-5 times better figures of merit than today's best InP devices, together with increased survivability and high (>15 dB) dynamic range; InP on silicon, photonic True Time Delay (TTD) devices for phased-



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array beam forming such as a 4-bit delay, RF-in RF-out device with ns delay performance, high-precision tunability, and <0.01 dB/cm waveguide loss; DARPA's work in its HiFIVE and THz Electronics programs to drive boundaries in both vacuum electronics and solid-state amplifiers and power modules including new "super circuits" focusing on the integration and interconnection of THz-level transistors for precision MW systems; new mm-wave antenna technology delivering higher power, wider bandwidth and improved size, weight and power (SWaP) for EA and ESM applications; and reduced-SWaP, 1-110 GHz tuneable notched filters aimed at extending closed-loop control range.

Session 10: EM Spectrum/EW Battle Management Initiatives

Session Chair: chaired by Col Steve Ling, USAF, director of the STRATCOM Joint Electronic Warfare Centre.

The evolution of operations in the electromagnetic spectrum, driven by the proliferation of EMS enabled technologies, has far outpaced the development and adaptation of policy, doctrine, tactics, tools, and procedures. The hotly contested and congested EMS environment challenges the traditional approach of separating EMS operations into independent stove-piped subspecialties for operations, communications, and collections, and requires a more integrated approach. This session addressed on-going efforts within the joint community to merge electronic warfare and operational aspects of spectrum management operations into a unified concept of Joint Electromagnetic Spectrum Operations (JEMSO).

Bringing together many of the concepts discussed during this year's Symposium, Session 10, featured specific discussion from the front lines of the US government and Services on dealing with today's electromagnetic spectrum and EMS battle management challenges.

Col Ling discussed the current shift toward Joint Electromagnetic Spectrum Operations (JEMSO), which is being used in the joint environment to create a unified concept that merges EW and operational spectrum management operations. Col Jim Pryor, USAF, chief Electronic Warfare Division (A5RE) discussed the current USAF approach to applying the JEMSO concept, while Stu Timmerman, director of the Defence Spectrum Organization, detailed some of the overall policy issues underlying spectrum use and the challenges of ensuring assured spectrum access. Timmerman noted two DSO programs, the Joint Spectrum Data Registry and GEMSIS, the Global EMS Infrastructure System, which are being leveraged to help create flexible spectrum access, adaptability and operational agility.

Col Jim Ekvall, chief, HQDA G-3/5/7, Electronic Warfare Division, detailed the US Army's approach to JEMSO and introduced a slightly different organization, which the Service is calling Cyber EM Activities (CEMA), which blends EW, EW spectrum operations management and cyberspace operations under the same umbrella. CEMA, Ekvall said, would likely be added to official doctrine for the US Army by the end of November. LTC Jason Schuette, USMC, MAGTF EW Requirements, EW Branch Chief, briefed the group on the Marine Corps' Cyber EW Coordination Cell and how the Service is breaking down barriers among groups simply by putting the right people in rooms together to share information across intel, operations and communications. Schuette also noted that with the retirement of the Marine Corps' EA-6B Prowlers, that community is actually being merged in with the unmanned aerial system community to ensure that the EW knowledge is not lost.

Providing an industry perspective, Ron "Fog" Hahn, vice president, EMS Campaign, URS Federal Services, noted that the spectrum congestion is such that not only to adversaries "get a vote" in terms of spectrum usage, but society does



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as well, as the number devices that need spectrum in everyone's daily lives continues to grow. "Very expensive, very eloquent systems can often be denied through use of RF energy," he said.

Because the EMS is not a program of record, it's a major challenge in terms of funding because Title 10 authorities frequently ignore cross-domain consequences. Hahn stressed the importance of breaking down stovepipes to ensure that senior level DOD officials elected officials get a clear message that spectrum is a underlying need across everything we do. "We're starting to see the language," Hahn said, referring to Admiral Jonathan Greenert's comments during Wednesday's Keynote. "What has not yet evolved that I would like see still are the actions and the money flow to really make those things happen."

Closing Session and Keynote Address: Major General Robert E. Wheeler, USAF

Major General Robert Wheeler, USAF, DoD Deputy Chief Information Officer, C4 & Information Infrastructure Capabilities

Major General Robert Wheeler capped off the 50th Annual AOC International Symposium with a dynamic presentation addressing the impact of, and the role of, the EW community in the DOD's efforts to deal with DOD/Commercial spectrum management allocation and management challenges.

Pointing out that we are transitioning from primarily dealing with counterinsurgencies to a potential "kicking-down-the-door mode" of military operations, General Wheeler identified a number of areas for attention to assure spectrum access for our fighting forces including: adaptable, agile, efficient and rapidly-responsive communication systems; comprehensive and effective cyber security, and communication tool mobility driving the latest tools "from fixed bases to the tactical edge of the battlefield."



As part of its efforts in this area, DOD has embarked on the creation of an EMS Strategy Roadmap for spectrum reallocation, initially primarily focusing on dealing with spectrum congestion concerns as opposed to contested spectrum, though this is to become more balanced later, but including an EMS Operations Policy and EW directive to bring together spectrum management and EW. The roadmap is expected to publish in April of 2014.

DOD is also working to create a National Advanced Spectrum and Communications Test Network (NASCTN) to support an environment for testing DOD systems together with commercial systems. General Wheeler emphasized that the EW community must continue to be knowledgeable educators and advocates for the concerns and requirements of the EW, spectrum management and cyber communities within the EMS environment.

Industry News

Saab South Africa to develop self-protection system for international customer

Pretoria, 23 September - Swedish/South African defence and security company Saab Grintek Defence (SGD) has received two orders from Hindustan Aeronautic Limited (HAL), India for serial production of an integrated electronic warfare self-protection system.



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The system, which will be installed on the Indian Army's and Air Force's Advanced Light Helicopter Dhruv, will be developed and produced at Saab South Africa's headquarters in Centurion (Saab Grintek Defence) and has a total value of approximately R335 million (\$ 33 million).

Saab's Integrated Defensive Aids Suite (IDAS), protects crew and aircraft and enhances the survivability in sophisticated, diverse and dense threat environments. The system provides a timely warning against different types of threats including radar, laser and missile approach warning; and automatically deploys the appropriate countermeasures.

"Saab has an unbeaten capability in the field of electronic warfare and self-protection. The IDAS system is one of our flagship products sold to customers around the world", says Micael Johansson, Senior Vice President and Head of Saab's business area Electronic Defence Systems.

Commenting on the development of the integrated system at Saab's South African base, CEO Magnus Lewis-Olsson said: "Saab in South Africa fulfils an important mandate on the African continent and beyond by delivering an impressive range of South African electronic warfare technology. Up to 90% of these systems are being designed and produced in SAAB Grintek Defence facilities in South Africa – and we are proud to deliver on this important contract."

These orders follow initial serial production orders received in 2008 and further established Saab as a local partner to the Indian Industry and provider of high tech products and systems to the Indian Armed Forces.

"With these orders we continue to build on our very successful partnership with HAL. The fact that HAL and the armed forces have continued to show faith in the IDAS system is a testimony of the effectiveness and reliability of the solution", says Lars-Olof Lindgren, Head of Market Area Saab India.

Deliveries are scheduled to commence in 2014. Development and production of the IDAS system will take place at Saab in Centurion, South Africa (Saab Grintek Defence).

The system has a long and successful history with proven capability on many airborne platforms such as the Saab 2000, Agusta-Westland A109, Super Lynx 300, Boeing CH-47 Chinook, Denel Rooivalk and Oryx, Eurocopter Cougar, Puma & Super Puma, NH Industries NH90, C-130 and L100 Hercules, Sukhoi Su-30MKM.

Deliveries are ongoing for the Hindustan Aeronautics Limited Advanced Light Helicopter Dhruv.

Saab serves the global market with world-leading products, services and solutions ranging from military defence to civil security. Saab has operations and employees on all continents and constantly develops, adopts and improves new technology to meet customers' changing needs.

For further information, please contact:

Anne Lewis-Olsson, +27 (0)71 6810429,

www.saabgroup.com/southafrica

www.saabgroup.com/Twitter

www.saabgroup.com/YouTube

For any inputs/comments on this newsletter, please contact Christo Cloete at ccloete@csir.co.za or 012-841 4485.