
## Annual Banquet

Mr. Bryan Clark, Senior Fellow at the Center for Strategic and Budgetary Assessments spoke on the topic of "A Next Phase in Electronic Warfare." Mr. Clark pointed out that the recent EM spectrum focus has been on the RF spectrum, but EMS contains more than RF. We have the chance to gain spectrum superiority by going where the enemy does not expect us to be. Since 1990, the focus has shifted to stealth vs. passive sensors and LDI/LPD sensors. The future may be with non-RF sensors and networks, such as SIGINT, ELINT and multi-static sensing. EO and IR processing is improving and soon we will be able to search with EO and IR sensors. There is a new generation of EO/IR commercial satellites, and within 10 years, Mr. Clark expects these satellites to pass over the Earth taking images three times per hour. Counter-ISR concepts have been focused on RF but we could be seeing what we can not see with RF under the EO/IR spectrum. Mr. Clark recommended investment in EO/IR RTD&E because we need to expand our capabilities to monitor and control the whole spectrum.

- Stephanie Benefield

## Session 8
## EMSO from a European Regional Perspective

Dr. Robert Andrews of EW Simulation Technology Ltd. chaired the session which was comprised of four separate presentations.

The first speaker was Mr. Christopher Chang, the USEUCOM Command EWO, with a presentation entitled "The USEUCOM EMSO Perspective." Mr. Chang described the EMSO situation inside the 51 member NATO nations, saying EMSO is a command in transition. Since 2010, there has been a re-emergence of Cold War adversaries who are more competent in EW than prior to 2010 since they have had the chance to watch and learn from the US since the 1990s. He pointed out that there is misperception among the NATO staff on the meaning of the spectrum, and that command "buy-in" and integration are needed. He expects the future of EMSO will improve with a proactive attitude, and with strategic and tactical integration.

The second speaker was Colonel Petro Kulbida, Commander, CEW units of the Armed Forces of the Ukraine, with a presentation entitled "The Uses of EW by the Russian Federation in the Ato Region in East Ukraine." Colonel Kulbida began by explaining

that the Russian Federation has EW capabilities which are excellent in comparison with other countries, and in fact, is using more than state-of-the-art equipment on Ukrainian territory. He showed many photographs of mobile jamming stations with various types of functionality, such as P-3771A, P-3306MB, P-330X, etc. which were taken in 2015 and 2016 on the Ukrainian border. Various news reports have circulated saying that the people operating these stations are not professionals. Colonel Kulbida said that the equipment is very complicated, necessitating a lengthy training process, and therefore, only professionals would be capable of operating them. Some of the necessary capabilities for EW units in modern conflicts are UAV signals, banded radio signals, cellular wireless signals, wireless internet and Zello type internet radio, radio and TV broadcasting. In addition, there are illegal HF and UHF radio transmissions operated by amateur radio operators. Colonel Kulbida said that Ukraine can not stand alone against this powerful enemy, and without collaboration from others, within 1 to 2 years the Ukraine will be so far behind that it will never be able to catch up. The Ukraine has chosen the path toward the West. Russia was long considered a brother to the Ukraine, but it has stabbed the Ukraine in the back. The Ukraine is ready and open for cooperation and would welcome any experts to come and visit.

The third speaker was Major General Luca Goretti, the Defense Attache at the Italian Embassy, with a presentation entitled, "The Italian EMSO Perspective." General Goretti explained the current status of the Italian Defense operational environments, and gave an overview of their capabilities and challenges. He said that there has been a paradigm shift in Italian Defense Policy with all systems having become EMS enabled or dependent. Currently the education and training in EW, Intelligence and FM/SM for commanders is a necessity. Many Italian forces are deployed abroad in joint environments where they are providing training and advice to other countries. In the future, the Italians are looking forward to stronger cooperation with other armed forces including in the EMSO/EW area. The Italian defense community is seeking EMS supremacy through a focus on the following fundamentals: EM battle management, EMSO common effect, a strong link between the Armed Forces and industry, and training for operators and commanders.

The fourth and fifth speakers gave the Norwegian EMSO perspective. Major Erik Bamford of the Royal Norwegian Air Force gave a presentation entitled, "The Norwegian EMSO Concept." He emphasized Norway's strategic location next door to Russia, Denmark and Sweden. Major Bamford emphasized the need to share information and cooperate with the NATO countries. Norwegian EMO objectives are to be interoperable with NATO, to share EW, SIGINT and spectrum navigation operational exercises, participate in multinational operations and learn to operate in the legal framework for peace vs. crisis. He mentioned several cultural issues, such as a need to change the current culture to operate properly in the EMO world, and explained that EW is spearheading a transformation where the civilian and military worlds are developing EMO extensively. Major Per William Bertelsen of the Royal Norwegian Air Force gave a presentation on the 717 Squadron, which operates the Norwegian airborne EW platform. The squadron has 3 airplanes and about 20 forces who provide ES and EA for all of the Armed Forces and within NATO. In addition, they perform flight inspections of the military navigational network as well as VIP transport. The important benefits of the 717 are that it is small, easily deployable with a small foot

print, and flexible.  The 717 Squadron will terminate in 2024 and the DA-20 and P-3 will be replaced by the P-8.

- Stephanie Benefield

## Session 9
## Technical Session - Electronic Protect

The session was chaired by Steve "Tango" Tourangeau of Warrior Support Solutions. He highlighted two key takeaways: The first is that foreign partners have a different meaning of EP (survivability through use of the EM environment) compared to the US (measures to mitigate or eliminate EM interference). The second takeaway s that US and foreign partners are facing many of the same issues.

The first speaker was Daniela Pistoia of Elettronica on the topic "An Advanced Concept for a SWAP Direct Infrared Countermeasures System". Present IRCM systems have a high Size, Weight, and Power (SWAP) impact, particularly on rotary wing platforms. An opportunity exists for a low SWAP solution using the new technology of a solid state Quantum Cascade Laser (QCL) as a source.  The QCL can provide high power from a compact source that can be mounted directly on a gimbal system, operating off a smaller power supply. The lower power dissipation means less cooling is needed. The QCL approach can provide an effective low cost, high reliability DIRCM capability.

"Countering the Infrared Guided Surface-to-Air Threat- A South African Perspective" was offered by Kevin Gopaul of the South African Council for Scientific and Industrial Research (CSIR). There are a number of older generation manpads on the African continent with 12 documented attacks against aircraft in 1978-2007. There is also the potential for more modern manpads to enter Africa through the middle east. The South African defense establishment has capabilities that run the gamut of threat analysis, signature measurement, modeling and simulation, countermeasures development, and field trials. Future plans are in the areas of DIRCM, an airborne test lab, missile approach warning, modeling and simulation, expanded hardware in the loop capability, and participation in international test and evaluation programs.

"Cyber is the only domain created by humans" remarked Col Josef Schroefl of the Austrian MOD to introduce "Small but Smart-The Austrian Way to Defend its Cyber-Space". Key priorities of the Austrian Armed Forces are national defense in cyber space, protection of its own networks, expansion of the Cyber Defense Center, and assistance in forensics after serious incidents. An innovative recruitment program has been established that brings 700 technically savvy cyber recruits into the Armed Forces for active duty or reserve duty. In addition, an annual Cyber Security Challenge identifies young people with superior hacking skills who are invited to join the government team.

Paul "Haywood" Vavra of DRS Training and Control Solutions presented "EW Threat Range Modernization- Why is it Necessary and What Should It Include?" EW Range Modernization is lagging due to OMS/DMS issues and failure to upgrade older gen

eration threat simulators. It is time for an upgrade in power sources, waveform generators, mounts and transports, and a C3 Range Backbone. This will not be cheap. Simulators must be capable of emulating fifth generation threat systems in a modular, scalable manner. He pointed out that digital injection into an EW system is not a full substitute for radiated emitters on an integrated range and can result in "negative training".

- Arnold Feineman

## Session 10
## EW & Electromagnetic Operations (EMO) - NATO and UK Perspective

Wing Commander John Clifford, Royal Air Force (ret.) chaired the session which was comprised of three separate presentations.

Mr. Clifford was the first speaker and began with a presentation entitled "Operations: An Overview from NATO and the UK." He described various threats, including the cyber and EW threats from China and the Russian Federation. Mr. Clifford pointed out that NATO's EW has been transformed since 2007 with the MCM-0124 which changed the EME framework, capability and organization. Since that time, EME has received more attention but still needs additional joint oversight.

The second speaker was Dr. Robert Pearson of Cobham Antenna Systems, UK, with a presentation entitled "Advanced Technologies for EW Applications: Interoperability, Intelligence and Denial." Dr. Pearson pointed out that the need for EW is increasing and changing as a result of global issues, such as the humanitarian crisis in Syria, the Chinese attempt to control property in the South China Seas and Unmanned Aerial Vehicles (UAVs). The NATO alliance is very important, especially since Russia seems to be thinking that a new Cold War is likely, and we need to continue to share technology for radar, communication and jamming. The nature of the threat depends upon the adversary, but EM threats, in general are increasing and the use of asymmetric tactics is increasing, which leads us to the need for interoperability among the NATO and United Nations members with increased connectivity in coalition operations. He described several trends for EW, but mentioned that the combination of politics and technology will determine the outcome.

The third speaker was Sergeant Major Mark Syms of the Royal Marines with a presentation entitled "Information Exploitation in the EM Environment: The Y Squadron, Royal Marines Operational Experience and Listening Raven Exercises." Mr. Syms explained the history, organization and functions of the Y Squadron, which included arctic and coastal survey, cyber, radio reconnaissance, EW, electronic attack missions, and SIGINT. The Squadron is divided into several groups focusing on specific objectives, broadly defined as "Find/Understand" and "Enable". He described a series of exercises that the UK is conducting with the US and other countries called the "Listening Series" which is strengthening the working relationships between the UK and the participating countries. Mr. Syms said that in the future the Y Squadron will pur

sue innovation, increased cyber capabilities, 5 eyes, land seeker and sea seeker.

- Stephanie Benefield

## Session 11
## Technical Session - EW/Cyber

The session was chaired by Kenneth "Kilo" Parks of Harris Corporation. He spoke of the need to synchronize cyber and EW operations for combined effects; but acknowledged the blurred line between Title 10 and Title 50 rules of engagement.

Brigadier General Patricia Frost, Director of Cyber for HQDA, provided the Army perspective. The Army is in the process of integrating its EW MOS 29 into the Cyber MOS 17. Priority 1 is the integration of IO, EW, and Cyber. The EW objectives are Full Scope ES/EP/EA capability, reintegration of EW with Intel, enabling of mutual assistance between EW/Intel and Cyber, integrated cross functional Intel/EW/Cyber, with periodic adjustments based upon experience as the concept matures.

Lt Col (ret) Johannes Naumann spoke on "How to Protect Critical Infrastructure from Cyber Disaster". A concern is that utilities and industry become vulnerable to cyber attack to the extent that their operations are connected to the internet. He defined Super Critical Infrastructure in Germany as facilities whose failure would create a disaster; such as public transportation and nuclear power. Aspects of an Extreme Risk Avoidance Strategy (ERAS) are that the Super Critical Infrastructure should not be connected to the internet, and that the ability to control these assets manually needs to be maintained.

"EW in Defensive Cyber Operations" was discussed by Jordan "Cancer" Scott of Boecore, Inc. He pointed out parallels between traditional EW functions of ES and EP to the world of defensive cyber. EW Geolocation expertise can be applied to the problem of locating the origination point of a cyber attack. Likewise, the EP technique of frequency hopping can be applied to cyber defense by using port hopping to reduce vulnerability to exploitation. Reprogramming of FPGAs is another familiar aspect of EW that could be valuable in the cyber domain as well.

Graziano Lubello of Elettronica SPA spoke on "Vulnerability of High Value Platforms to Cyber Attacks Throughout the Electromagnetic Spectrum". He gave a hypothetical example of a warship with a radar system. The postulated attack would start with social engineering to identify crew members; through a crew member malware could be unknowingly injected between the radar processor and its display that could be activated when a predefined signal was received. An attacking aircraft's EW system would transmit the predefined signal and the malware would deactivate key features of the shipboard radar.

- Arnold Feineman

## Session 12
## International Perspectives on Warfighting Operations in the EMS

Session Chair Phil Guy introduced Dr Sami Al Humaidi, who described the 2016 emergence of the Kingdom of Saudi Arabia's Prince Sultan Advanced Technology Research Institute (PSATRI) in the context of history, and an initiative to increase local defense procurement from 20% to 50% by 2030. PSATRI has done detailed strategy for EW, merging military with business approaches. Structured EW planning, for which PSATRI has developed a framework, and alignment with the wider Saudi Vision 2030 for defense research are both seen as key.

BG A.J. Coatzee gave an overview of the African battlespace. In the Information Space, he argued that people and training must be treated as important. The trend across both government and its adversaries is toward the use of cellphones and satphones, and the Land battlespace is characterized by unique geography and the rapid deployment of advanced threats. The Air space has a history of small size and high flexibility with the accompanying vulnerabilities, and the sea space is complicated by piracy and human trafficking by a well-equipped enemy.

COL Andrea Sisto described the Intelligence, Surveillance & Reconnaissance (ISR) challenges caused by the integration of electronic surveillance with other data collection, processing and exploitation disciplines. He described the environment a complex, uncertain and unstable, noting that a nuanced situational understanding is vital for success in the European ISR battlespace.
Mr Phil Davies said that we dropped the ball on EW after the Cold War, but that the advent of highly integrated systems now means that we need to pick it back up. Support through training is also essential. He then described the emergence of the Partnered Electronic Warfare Support Element (PEWSO), which is a UK-government and industry partnership to provide UK-sourced Electronic Warfare operational support (EWOS) and EW parametric emitter data to support approved UK defense exports.

- John Kolm

## Session 13
## Technical Session - Spectrum Awareness

Mr. Jason Schuette from DARPA chaired the session which was comprised of four separate presentations.

The first speaker was Mr. Alexander Gruchman of PLATH GmbH with a presentation on "Knowledge Driven Intelligence, The Intelligence Prism." Mr. Gruchman described an object of interest as an entity defined by its measured parameters in the light of spectrum awareness. The situation picture emerges from a cycle of sensors, analysis, evaluation, and operations control. This can be used for filtering, comparison and initial investigation points. The more intricate the description is, the higher the value of the knowledge, but the more complex the data management becomes and greater the time and effort which must be expended.

The second speaker was Dr. Mark Tracy of Lockheed Martin with a presentation on "Achieving RF Situation Awareness, DARPA RadioMap." Low intensity warfare has led us to use RF situational awareness to determine the type and characteristics of active devices and networks. Dr. Tracy described the DARPA RadioMap program which works with existing equipment and does not impact current networks, but offers ways of locating communications. The system is in the testing stage and is scheduled for a demonstration at SOCOM in March 2017.

The third speaker was Dr. Joseph Evans of DARPA with a presentation on "Advanced RF Mapping and Governance of Innovation." Dr. Evans described DARPA's original RadioMap/WALDO development mission which was to design and build a system which promoted end to end innovation at all system levels. This framework can be sued a s a cycle for building partnerships, concepts, new technology innovation and system level design.

The fourth speaker was Mr. Dustan Hellwig of Chesapeake Technology International with a presentation on "Enterprise to the Edge." Mr. Hellwig explained that the objective of the Enterprise to the Edge project is to bring enterprise experience to the end user though the use of data sharing, analysis and automation to operate at high speed, and visualization to understand the spectrum effects. For example, enabling the user to visualize actions in a multi-dimensional way (time/space/spectrum).

- Stephanie Benefield

## Closing Session

### 1st-Ever Electronic Warfare Strategy Headed for SecDef's Desk - Sydney J. Freedberg Jr. via BreakingDefense.com

WASHINGTON: With Russian jammers blasting Ukrainian radios off the air, the US Defense Department's racing to regain its edge in electronic warfare. But there's been no comprehensive strategy to guide all the armed services' efforts — until now.

The first Defense Department-wide electronic warfare strategy is "basically finished" and headed to Secretary Ashton Carter's desk for his signature, along with major plus-ups to EW spending for 2018, Pentagon official Bill Conley said Thursday afternoon. What's more, defense contractors, foreign allies, and perhaps even the press are going to get to see it. While the sensitive specifics will be in two secret annexes — an implementation plan and a "roadmap" of desired future capabilities — the broad strategy itself will be unclassified.

"The base strategy document is very deliberately an unclassified document," Conley told the Association of Old Crows EW conference, "and the reason for that is it allows us to share it broadly on the industry side, with our partners, with our allies, and say this, no kidding, (is) where we are going with our investments into electronic warfare."

"It's way too easy to write these beautiful classified documents which somebody can show you for about three minutes in their office — and then they take it back and you never see it again," continued Conley, who's deputy director for electronic warfare in

the Pentagon's acquisition office. Such a sneak peek "doesn't do you a whole lot of good" if you're trying to ensure your country's or your company's own investments align well with the US military's.

Besides the unclassified high-level strategy, Conley is considering industry day-type events to bring in defense contractors with appropriate clearances for classified, detailed briefings, such as the latest intelligence on threats.

While Conley couldn't provide many details yet on the strategy, he did hit some high notes. As might be expected from its unclassified nature, the document puts a high value on sharing information with industry and allies: If industry develops the wrong technologies, or allies rely on frequencies we plan to jam, the Pentagon's EW plans won't get very far.

The strategy also emphasizes proactively seeking new technologies and the new tactical opportunities they create, rather than just reacting to whatever the latest threat is. (The roadmap specifying what future capabilities are desired will be highly classified). It also emphasizes "cost imposition" approaches that are relatively cheap for the US to implement but expensive for adversaries to counter. It calls for better modeling and simulation of the complex effects of electronic warfare, which are nowhere near as well understand as the blast effects of missiles and bombs; predicting how signals propagate or get blocked in dense urban areas is a particularly tricky problem. The improved models would underlie both new visualization tools for commanders and their planning staffs, who often struggle to communicate what EW can actually do, and improved simulations for training.

The strategy does not settle the debate over whether the electromagnetic spectrum should be considered a "domain" of military operations alongside land, sea, air, space, and cyberspace, Conley said, though intensive study of that question is underway.

The strategy has been prepared in parallel to significant increases for EW programs in the 2018 budget request, Conley said. (Those figures won't be released until February at the earliest). Admittedly, these increases don't add to the $2 billion a year plus-up the Defense Science Board said was necessary in a landmark 2014 report on EW shortfalls. But the Department's electronic warfare community just isn't big enough to absorb that kind of increase all at once, said Conley — "everything in EW (put together) is a smaller program than F-35" — so Pentagon leaders are aiming for "five to 10 percent growth, year in, year out."

Both the money and the strategy are the handiwork of the Electronic Warfare Executive Committee. The EW EXCOM was created in March 2015 by Deputy Secretary Bob Work, the Pentagon's leading patron of EW. It's co-chaired by the Pentagon's acquisition chief, Frank Kendal, and the tech-savvy Vice-Chairman of the Joint Chiefs of Staff, Gen. Paul Selva. Conley himself co-chairs the EXCOM's secretariat.

Breaking Defense has covered the EXCOM since it was announced, and we even ended up being a small part of the story. "Sydney, a year ago, you posed the question (at the AOC conference): 'CSBA said you guys needed a department-wide EW strategy... What's going on with that?'" Conley recounted. "I said, 'we're working on it, we (had)

agreed a week earlier in the EW EXCOM that we need to do that.'"

"That (news) actually made it all the way up to DepSecDef (Work), who said, 'I want to know about this strategy,'" Conley said, "which means the deputy was arguably informed well before he otherwise would have been."

- Sydney J. Freedberg Jr.
*Reposted with permission