

Summary of “EW Vision 2025” by Arctic Roost – Norwegian Chapter of AOC

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Artic Roost, the Norwegian chapter of *Association of Old Crows*, released its second edition of a vision document for electronic warfare on Nov 1st 2014. The document is titled (translated) “**EW Vision 2025 – vision for electronic warfare in Norway year 2025**”. The content is: *A glance into the future on use of the electromagnetic spectrum in Norwegian military operations, and possible contributions from Norwegian defense industry*. For access to the original document (in Norwegian), see the webpage of *Artic Roost* at <http://www.arcticroost.org/>. (Only available for members)

As it is not possible to capture the entire scope of the original 45 pages document into this executive summary, the focus is on the **specific Norwegian aspects** in order to inspire the Norwegian Armed Forces and industrial players to cooperate on current and new effective EW- equipment and support to operations. It is presumed that the readers are knowledgeable about EW in general, including common trends and development - where the 21 points below provide an overview from the original document.

- EW in World War 2 meant jamming the adversary’s radar and using chaff
- Jamming of communication was done long time before jamming of radars
- Communication frequencies now overlap radar frequencies; communication also applies infra-red (IR) and lasers!
- EW now encompasses electro-optics (EO), IR and lasers - an enormous frequency-range in the Electromagnetic Spectrum (EMS)
- EMS plays an ever more important role in conflicts, also for civil participants
- Encryption has hampered our ability to read intercepted messages
- Digital technology is overtaking analog technology, and will still do so in EW
- Increased computing power and memory capacity is also important for EW capability
- Miniaturization has meant a lot for EW capability and will continue to do so
- EMS is becoming more congested; further coordination and local re-use is required
- The gaming market is currently a big driver for EW-related technology
- Modular design and software defined radios (SDR) enables a flexible use of the EMS
- Antenna technology is governed by laws of physics, not Moire’s law
- Noise jamming and chaff are generally deemed ineffective, “smart jamming” using Digital RF Memory (DRFM) is required
- The increase in computing power will get a boost by utilizing optical technology
- Adaptive emitting systems will use minimum necessary power, being hard to detect
- Analog/Digital Converters (ADC) with increased sampling rate and bits will improve dynamic range and detection
- Adversaries are harder to positively identify, they often operate at a lower technical level and are organized in a non-hierarchical way
- EO, IR and lasers will probably be used for weapon guidance, also in “cheap” versions
- Imaging techniques used in weapon guidance systems are hard to jam/cheat
- **Effective control of the EMS include the ability to detect, classify, identify, and localize actors in the EMS, and also the ability to deny these actors their use of the EMS**

Background and current EW

The different services within the Norwegian Armed Forces have through their history and nature differing attitude towards EW, and thus different EW capabilities.

The Royal Norwegian Air Force includes the Norwegian EW Centre (NEWC), which is a tri-service EW resource, a handful of different air platforms, and air surveillance systems. The NEWC manages the national EW data bases and represents Norway in a multitude of military partnership programs with respect to EW. All flying platforms have some element of EW.

The Royal Norwegian Air Force operates a few platforms which are focused on both ES (Electronic Support) and EA (Electronic Attack: jamming/ chaff/flare). These platforms are manned by highly trained personnel.

The Royal Norwegian Navy is focused on radars. Only the larger naval ships have trained personnel manning their EW equipment.

The Norwegian Army was focused on EW in relation to communication up to 2007. In 2007 the threat from Radio-Controlled Improvised Explosive Devices (RC-IED) in Afghanistan demanded a broader approach towards EW. The resulting procurement and use of RC-IED jammers made EW a “layman knowledge”.

Norwegian Defence Research Establishment (FFI) is not a part of the Norwegian Defense Force, but indirectly supports military operations through updating and implementing applicable research. There is a strong mutual beneficial support and cooperation between the services and the FFI.

The reorganizing of the Norwegian Defense Force in 2007 when the National Joint HQ (NJHQ) was established, terminated the Joint EW Coordination Cell (JEWCC) from the organization, meaning EW was no longer integrated into operations on the joint level. The reorganizing came at a time with increased EW-requirements for the operations in Afghanistan. The increased requirements were mainly linked to jamming of RC-IEDs. In yet another organizational change in 2009 the Information, Network, and Infrastructure command (INI) was established as a service of its own. INI was given the responsibility of the entire technical information infrastructure; INI was also given a formal responsibility for EW. In 2012 INI was renamed to *Cyber Defense* and is currently responsible for Computer Network Defense (CND). In 2013 the process of having a single national authority for EW was stated, and a subject authority on EW was established within the Royal Norwegian Air Force in 2014. Part of the requirement for the EW authority is to improve coordination between Cyber and EW, possibly starting with Spectrum Management (SM).

Norwegian Armed Forces units have provided robust EW-capabilities in operations in Kosovo, Afghanistan, Iraq, Gulf of Aden/Somalia, Libya, and Cyprus/Syria. These experiences have revealed a need for better interoperability and data exchange between units and services.

Nearly 10 years after 9/11, Norway experienced a national trauma on July 22th 2011 (22/7). A rightwing terrorist killed 77 people; eight by an improvised explosive device at the government quarters and then he subsequently killed 69 people by shooting, mainly youngsters at a political youth rally at the island of Utøya. The dual attack in July 2011 spurred a range of inquiries, all commenting on the need for improved coordination between the Norwegian Police and the Norwegian Armed Forces. The contemporary threat from both rightwing and Islamic terrorists require capabilities beyond those of the police.

Recent observations and trends

Maintaining and development of EW-equipment and competence in Norway (and among allies) seems driven by military conflicts that requires new equipment and concepts. Updates in regards to EW issues are often only available some time into the conflict, rather than proactively available at the start. This inevitable delay might not be acceptable in the future.

Norwegian forces have become more profession-oriented and require up to date modern equipment in support of ongoing operations. The threshold for deploying Norwegian Armed Forces seems to be lowering at the national political level.

It is feared that the ongoing procurement of F-35 Joint Strike Fighter (JSF) will affect EW in a negative way. The Norwegian successful detailed technical insight and quick reprogramming of EW-equipment seems challenged by the restricted availability of F-35 JSF information. The high cost of F-35 JSF might also affect other existing important capabilities as well as future capability programs.

The trend of using the same antenna, front-end, and computing hardware (HW) for different functions, including both passive and active techniques, brings benefits in several respects, and are expected to be further applied. SDR is a good example of this trend.

The power consumption requirements of mobile systems will still be a challenge despite the current miniaturization.

The use of RC-IED-jammers in Afghanistan produced implications for own communication equipment and thus highlighted the need for better coordination of the use of the EMS!

NATO has already defined the EMS as a warfighting domain, but this is not fully recognized within the Norwegian Armed Forces. As so, EW lacks an overarching unified description, meaning the services to a large degree operate independently, thereby not utilizing the potential of coordinated Joint EW.

A unification of EW and Cyber is being established in the US; the relevance in a Norwegian perspective remains an open question. The only interaction currently observed is the transfer of data through radio-communication, with the inherent vulnerability to jamming. However, as Cyber Command has become a service, a further clarification and cooperation between cyber network operations (CNO) and EW will be required.

In regards to Norwegian EW-related industry the prospects are good. There are significant plans for EW-investment in the period from 2014 through 2022, including the development of Networked Enabled Capabilities and the integration requirements relating to the F-35 Joint Strike Fighter Program.

Visions for EMS and EW in operations in 2025

Civil or commercial communication is mainly done through 4G (LTE and LTE+) and 5G networks with an expected capacity of today's net multiplied by 1000 (however, the technical solutions and the capabilities are not clarified now in 2016). Such nets are by 2025 common in the private sector like industry, transportation, and homes.

The EMS is fully recognized as a warfighting domain at the joint level within the Norwegian Defense Force. EW is an integral part of all military operations at all levels. SM, EW, NAVWAR, and CNO are by then complementary capacities which are closely coordinated in order to achieve the operational goals.

SDR-based systems are widespread and constitute the core of all EW-systems. The majority of SDR-systems are capable of both ES and EA simultaneously by seamless reprogramming, which in effect is a reactive EW-suite.

Modular systems can be built and configured according to operational requirements. This encompasses both ES and EA, but also in terms of frequency ranges and effects.

Emissions from communications and radars will be continuously detected by equipment also storing and analyzing the signals in real time over a wide frequency band. Continuous detection will provide the Norwegian Armed Forces with a heightened awareness in relations to EMS activity.

Responsive electronic countermeasures will distinguish between own and other emitters, thus denying others the use of EMS through jamming or other types of denial of service (DoS).

Manned EW aircraft or “man-in-the-loop” systems are still important for near real time classifying of detected EMS activity, shared awareness among own forces, and transferring information and knowledge into actions (jamming).

The Norwegian Defense Force and Norwegian Police operate the same systems for better interaction and coordination as urged after the 22nd of July-incident in 2011.

How to get there – suggestions and recommendations

The Norwegian Defense Force is small, which again is reflected on the EW community. Building EW-knowledge is important for producing the right decisions towards 2025; especially knowledge about better utilization of the EMS in operations.

Some parts of the EMS will be especially important, like those related to sensors as Joint Intelligence, Surveillance and Recognizance (JISR), and those for communications that connect sensors with appropriate weapon systems.

A continuous ambition should be to develop a robust EW service for collection, protection, and attack. A sufficiently quick OODA-loop is crucial, involving SM-coordination at the operational level to achieve the best utilization of the EW-capabilities across the services.

Areas of focus:

- 1) Develop EMS management applications
- 2) Adaptation of legacy EW systems to new weapon platforms
- 3) Maintenance and life cycle extension of EW systems
- 4) Support to extend National EW Data Bases
- 5) Support to utilization of SDR-based EW systems in the field
- 6) Modeling and simulation of EW-systems for education and training
- 7) Research and Development into modulations and processing techniques

Reccomentations:

- a) Recognize the EMS as a warfighting domain within the Norwegian National Joint Doctrine
- b) Include EW as a core functionality at the joint level for all operations.
- c) Establish an EW staff at the NJHQ to ensure EW planning and coordination for exercises, training and operations with sufficient manning
- d) Maintain NEWC with sufficient manning to support daily operation and support of joint EW functions.
- e) Maintain and strengthen EW knowledge in the services and at FFI; deep and broad knowledge at FFI is especially important for future utilization of EW.
- f) Establish a position in The logistic organization of the Norwegian Defense (NDLO) with responsibility for coordination of procurement of EW material
- g) Establish a long term acquisition plan for EW
- h) Task FFI to describe smart networking of existing and future EW systems
- i) Provide equipment for automatic spectrum management

Conclusion with recommendations

From a history of severely decreased focus on EW and a fragmented knowledge both within industry and the military services, the recent experiences from operations abroad (Kosovo, Afghanistan, Iraq, Gulf of Aden/Somalia, Libya, and Cyprus/Syria) point towards the importance of EW and robustness of Norwegian EW units. The current situation with complex threat scenarios and the ever increasing rapid technological development brings opportunities to a small but technologically focused country being open to international cooperation. In addition to the above presented focus areas and recommendations, there are three final advices:

- a) Carry out the planned military procurements for EW and put priority on the national knowledge being built through cooperation between industry and military
- b) Invest in industrial competence building for EW and continue development of EW related products and services
- c) Facilitate export of Norwegian EW products and services