THE DEFENCE PERSPECTIVE

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Wind EUROPE

NATO ENERGY SECURITY CENTRE OF EXCELLENCE

Offshore Wind farms & Defence implications at “Wind energy, Defence, and Aviation” 25 November 2021, Copenhagen

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ENSEC COE Roles

- Evaluate lesson learned and experiment in order to test and verify concept.
- Distribute in-depth knowledge related to Energy Security through publication, training, conference, seminar, concept and doctrine.
- Assist transformation of the Alliance, especially on green energy.
- Develop interaction with academia and industry.

RLLD FOCUS

Pillars

- Assessment of energy security risks & energy innovations
- Producing ENSEC COE's publications
- Leading the COE's Lessons Learned process

Guidance

- Steering Committee

Research papers (selected)

- *The Future Role of Nuclear Propulsion in the Military*
- *Hybrid warfare against Critical Energy Infrastructure: The Case of Ukraine*
- *The Future Role of Small Modular Nuclear Reactors (SMRs) in the Military*

Studies and Reports (selected)

- *Guide for Protecting the NATO Pipeline System from Cyber Incidents*
- *Cybersecurity of smart-grid technologies employed in operational camps*

- *Offshore wind farms – challenges, risks and opportunities for building more resilient national energy system*
- *Role of wind farms for national grids – challenges, risks and chances for energy security*

The main topics

- Offshore wind farms study
- Military vulnerabilities
- Impact on aviation and navigational safety.

Offshore wind farms study

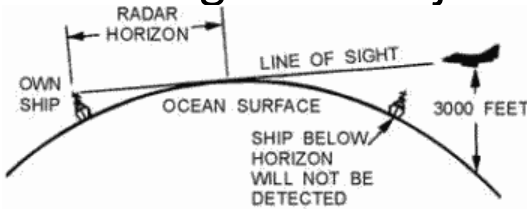
- In 2020, Estonia requested the NATO Energy Security Center of Excellence to conduct a comprehensive study on offshore wind farms.
- It is followed by the onshore wind farms study that was completed in November 2020.
- Besides the overview of the wind turbine technology, the study touches upon military vulnerabilities, energy storage (green hydrogen production) and the role of smart grids and cyber security aspects.

Military vulnerability

- The construction of offshore wind farms can have effect on civil and military aviation and navigation safety at sea.
- The construction of offshore wind farm will affect the observation of both shipborne radar and shore-based which will affect navigation traffic of waters.
- Wind farms could produce radio interference such as shadowing, reflections or phase changes, marine positioning, navigation or communications including AIS (Automatic Identification Systems).

Radar coverage

- Radar coverage describes controlled by radar or radar network airspace.
- There are limits to the reach of radar signals. At the frequencies normally used for radar, radio waves usually travel in a straight line. The waves may be obstructed by weather or shadowing and interference may come from other aircraft or from reflections from ground objects.



Active & passive radars

- An active radar actively sends out a radar pulse, in which it listens for the return signal.
- A passive radar does not do anything but listens for the return pulse from other radars.
- The passive radars have some advantages as sources of information for air defence systems.
- Radar data as an output information from surveillance radars are delivered to air defence systems, where after data fusion represents Recognized Air Picture (RAP).

Impacts on aviation

- As developments move further offshore, the use of aviation is expected to increase, driven by safety and efficiency grounds.
- Helicopters cover distance quickly and allow the transfer of personnel and equipment to and from offshore.
- The location, size and irregular shape of offshore wind farms presents new challenges to safe navigation and communication of shipping and emergency rescue.

Impacts on aviation

- Besides impact on different types of radars (e.g. air traffic control, aid defence), it also impacts SAR operations.
- While looking for the persons in distress at sea, search and rescue operations also need radar information on the location of these people.

Impact on navigational safety

- OWFs presence means more obstacles in the water that ships have to avoid.
- Current risks options include vessel traffic system (VTS), mandatory pilotage, traffic separation schemes.
- Certain buffers are needed between the turbines to avoid collision risks and the use of improved on-board navigational equipment (e.g. forward looking sonars).
- Safety distance is proposed – a minimum distance or buffer between the wind turbines and the boundary of a shipping route.
- This is a result of stakeholders consultations and navigational risk assessment (NRA).

Navigational safety

- Wind farms could produce other adverse effects:

a) Vessel to vessel;

b) Vessel to Shore;

c) Vessel Traffic Service Radar to Vessel

d) Radio Beacons (RACONS) to/from Vessel

e) Aircraft and Air Traffic Control.

- More wind turbines the greater the number of potential false targets.
- Mitigation could include reducing the radar cross section of the turbines, and increasing RCS of a vessel in a farm.

Vessel Traffic Service (VTS)

- A vessel traffic service is a marine monitoring system established by harbor or port authorities, similar to air traffic control for aircraft.
- Traffic Separating Scheme (TSS) is a maritime traffic-management route-system ruled by IMO.
- Within a TSS there is normally at least one traffic lane in each main direction, turning points, deep-water lanes and separation zones between the main traffic lanes.

Challenges

- The images produced by marine radars detect not only hard targets such as ships and coastlines, but also from the sea clutter.
- Sea clutter refers to signals returned from the wavy and turbulent rough sea surface.
- The radar returns from small targets, like submarine periscope or small boats, will be obscured by the sea clutter, which makes the straightforward detection of targets, with small RCS, a difficult task.
- Given a wind speed of more than approximately 3 m/s, the backscatter from the sea surface becomes visible.
- Such reflections of waves are mostly due to resonance between the radar waves and the features at the water surface.

Sea clutter

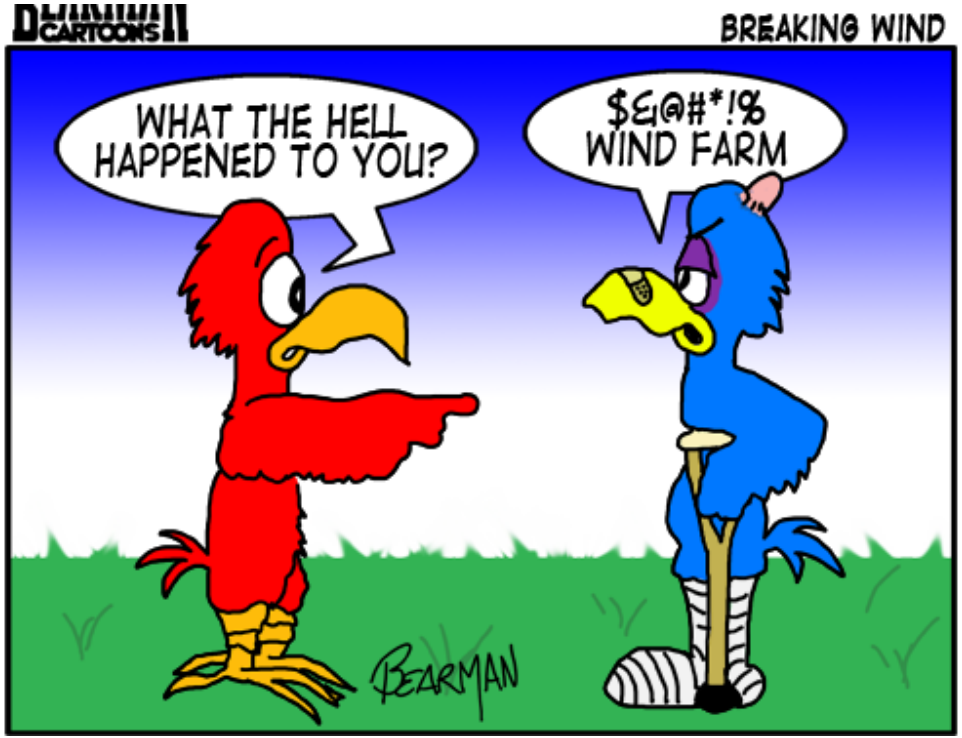
- For navigational purposes, this sea clutter is treated as a nuisance.
- Sea clutter echoes may make it impossible to detect some targets, while the presence of others may only be revealed with the assistance of some form of signal processing.
- Difference between target being visible and that target being noticeable.

Mitigation options

- **Operational** (training);
- **Modification** (antenna location)
- **Addition** (radar features ARPA, AIS).Marine radar with ARPA (Automatic Radar Plotting Aid) capability can create tracks using radar contacts. The system can calculate the tracked object's course, speed and closest point of approach.
- **Replacement** (new generation pulse compression radars). Radar manufacturers develop radars that would be impacted minimally if not all by wind farm.

The key takeaways

- Wind farms have come to stay, therefore mitigation measures are to be found how to ensure co-existence.
- Better co-operation is needed to find compromises between different uses of sea (defence and energy sectors).
- Co-existence is possible (the examples of the UK and Belgium.



Questions?

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