An Approach to Electromagnetic Spectrum Evaluation and Control for Situational Awareness

4th Biennial Conference

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Electromagnetic Spectrum (EMS) Overview
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Chart of the Electromagnetic Spectrum

Size reference

- man's height
- baseball
- paperclip thickness
- paper thickness
- cells
- bacteria
- viruses
- water molecule
- atom
- subatomic particles

wavelength (λ) (m)

10^3 10^2 10 1 10^-1 10^-2 10^-3 10^-4 10^-5 10^-6 10^-7 10^-8 10^-9 10^-10 10^-11 10^-12

frequency (Hz)

10^5 10^6 10^7 10^8 10^9 10^10 10^11 10^12 10^13 10^14 10^15 10^16 10^17 10^18 10^19 10^20 10^21

Bands

- Radio Spectrum
- Broadcast and Wireless
- Microwave

- Terahertz
- Infrared
- Ultraviolet
- X-ray
- Gamma

Visible wavelengths (nm)

- 700
- 625
- 575
- 540
- 470
- 440

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Electromagnetic Spectrum (EMS) – RF Band Only

Radio Spectrum

Broadcast and Wireless
- AM radio
  600kHz-1.6MHz
- FM radio
  88-108 MHz
- Mobile Phones
  900MHz-2.4GHz
- TV Broadcast
  54-700 MHz
- Wireless Data
  ~2.4 GHz
- Ultrasound
  1-20 MHz
- Sound Waves
  ~20Hz-10kHz
- Microwave Oven
  2.4 GHz

Microwave
- Radar
  1-100 GHz
“The perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future” - Endsley
Electronic Warfare (EW) Concept

Electronic Warfare (EW)
Any action that allow Control of the Electromagnetic Spectrum

EW Support (ES)
- search for
- intercept
- identify
- locate sources of intentional and un-intentional radiated electromagnetic energy
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Electronic Attack (EA)
Attack:
- personnel
- facilities
- equipment

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Electronic Attack (EA)
Attack:
- personnel
- facilities
- equipment

Electronic Protection (EP)
Protect:
- personnel
- facilities
- Equipment

EW Support (ES)
- search for
- intercept
- Identify
- locate sources of intentional and un-intentional radiated electromagnetic energy
Goal of Talk

“An Approach to Electromagnetic Spectrum Evaluation and Control for Situational Awareness”
Goal of Talk

Sensors

Observe

Orient

Act

Decide

EMS

Situational Awareness

Air
Space
Land
Sea

Cognitive “Space”

OODA Loop – John Boyd

www.csir.co.za
**Digital Radio Frequency Memory History**

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1st Gen | 2nd Gen | 3rd Gen | 4th Gen | Complex targets | Clutter | 5th Gen
IBW: | 400 MHz | 500 MHz | 800 MHz | | | 2 GHz
User Benefits

- Support Smart Buyer and Doctrine Development
  - CSIR provides EW related advise to the SANDF
  - CSIR provides inputs for Doctrine development by the SANDF

- Operational Support
  - EW Facility can be used for Situational Awareness
  - CSIR performs the actual evaluations
  - Examples of major platform support includes:
    - SAAF – Gripen Radar
    - SA Navy – Frigates Radars
User Benefits

- CSIR Industry Collaboration
  - Communications EW
    - Peralex
    - GEW Technologies
  - Radar evaluation
    - Reutech Radar Systems
  - Missile sensor technology
    - Denel Dynamics

- SANDF Exercises and Operations
  - CSIR is involved in regular scheduled EW camps – Force preparation
  - Operation Corona
Conclusion

- ES role is crucial to establishment of Situational Awareness
- Adversary changes approach regularly
- CSIR aims to enhance the survivability of platforms and personnel
Thank you