Technology Work Session for the South African Army; Hosted by the CSIR

Full Spectrum Protection

Electromagnetic Spectrum Protection

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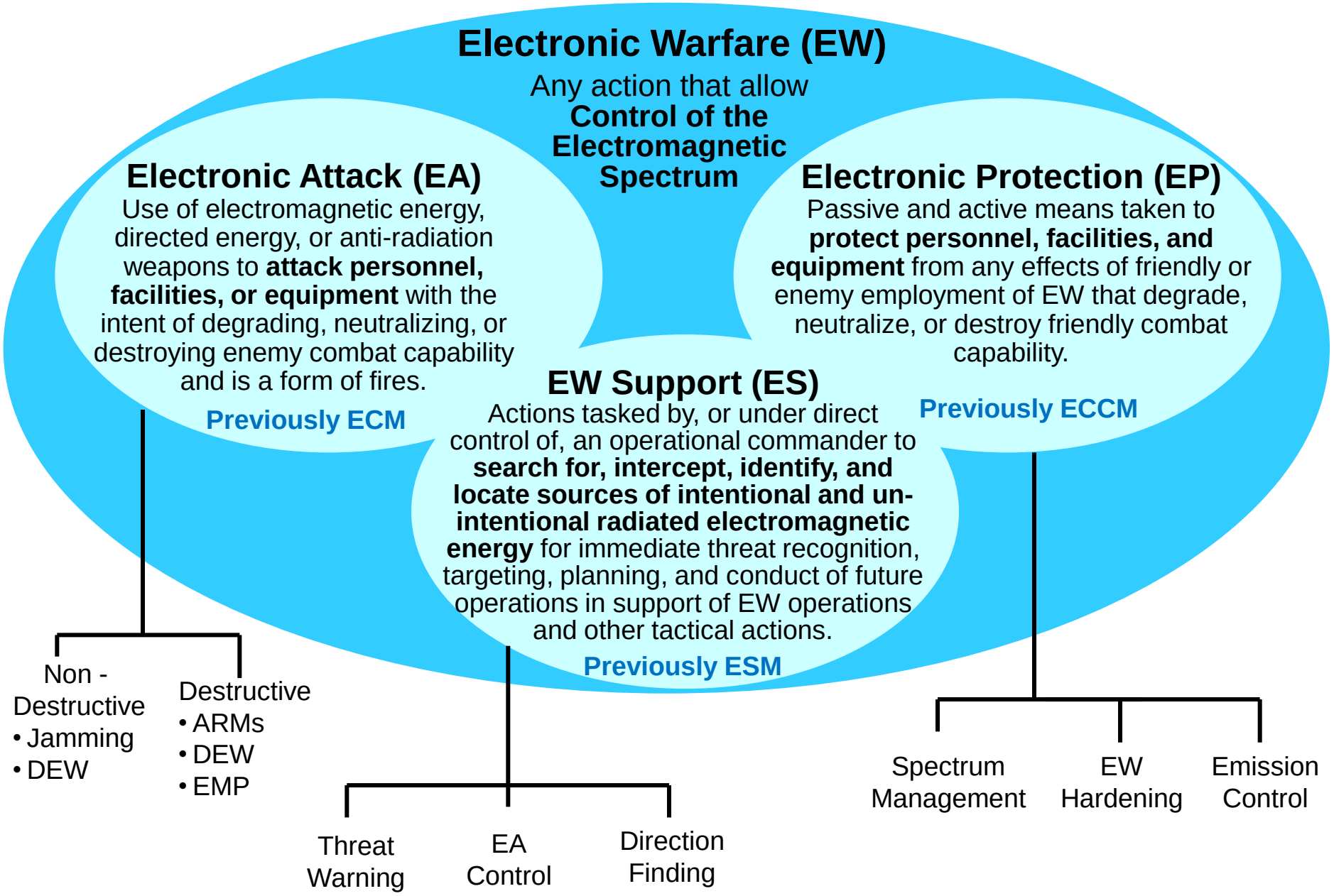
Outline of presentation

- Electronic Warfare
- Communications
- Satellite Navigation
- Radar
- Electro-Optical Systems
- RF Jammers
- Anti-Radiation Missiles
- Signal Intelligence
- Passive Coherent Location
- Hostile Fire Indication
- Improvised Explosive Devices
- DEW (next session)
- Conclusion

Electronic Warfare Concept



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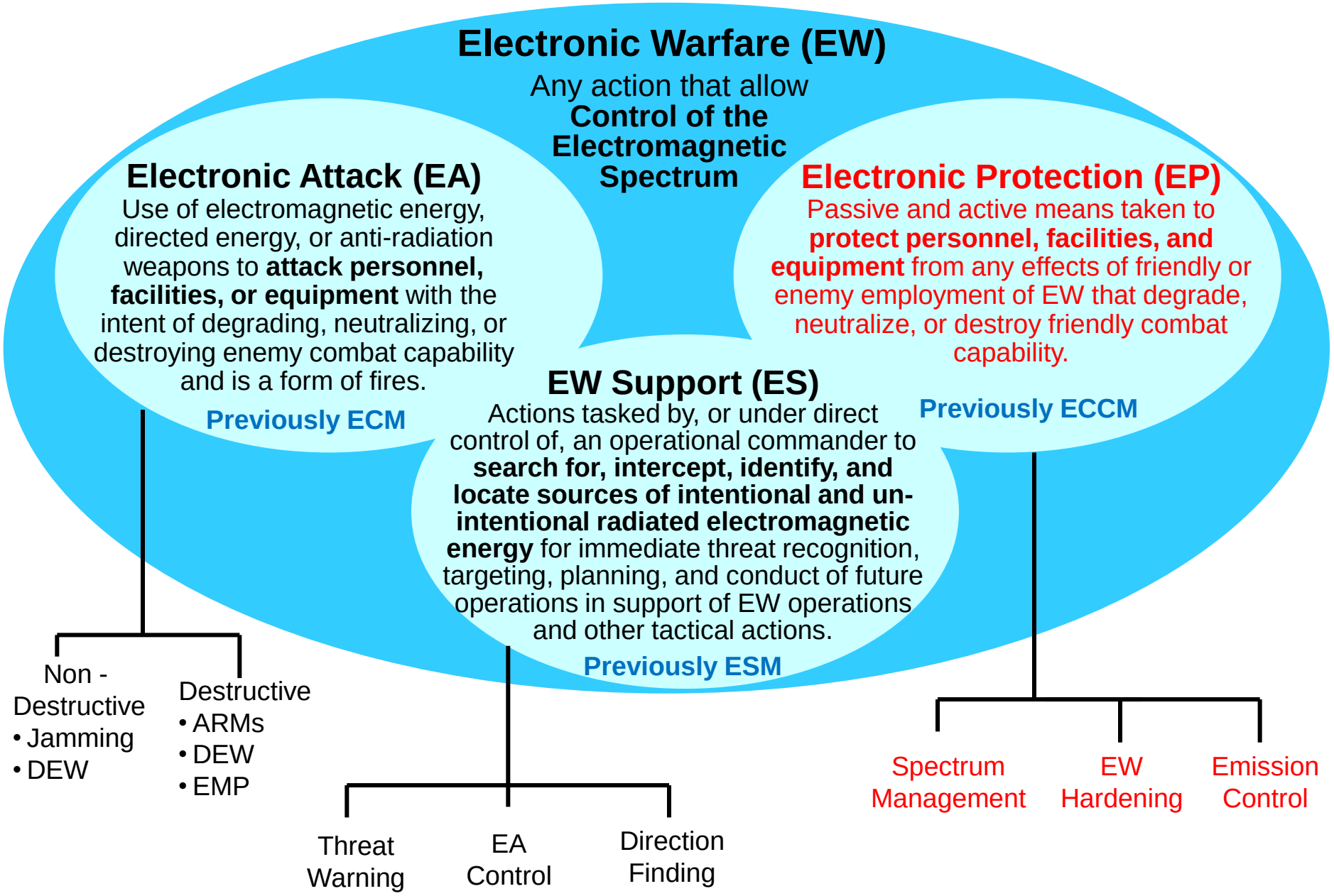

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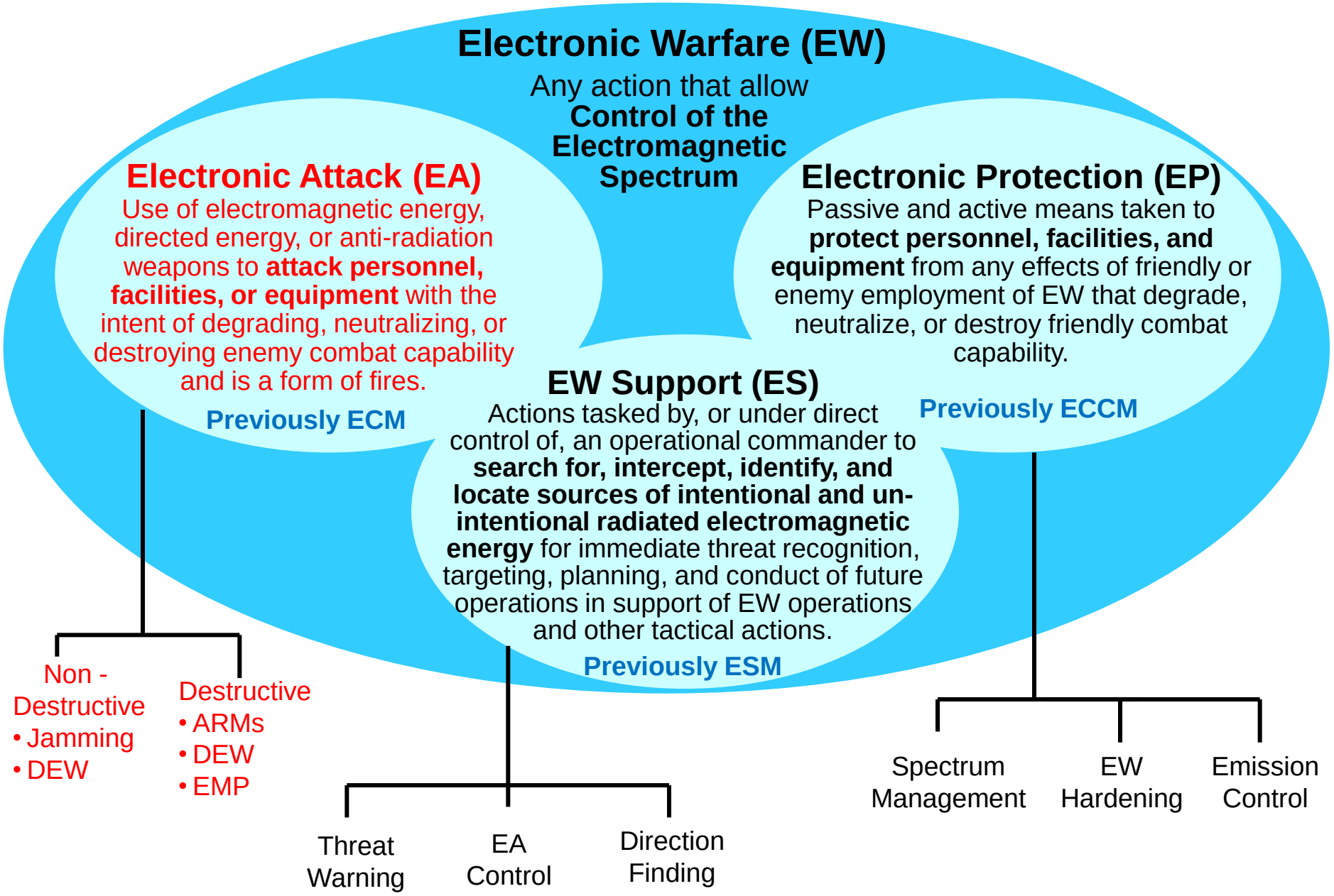

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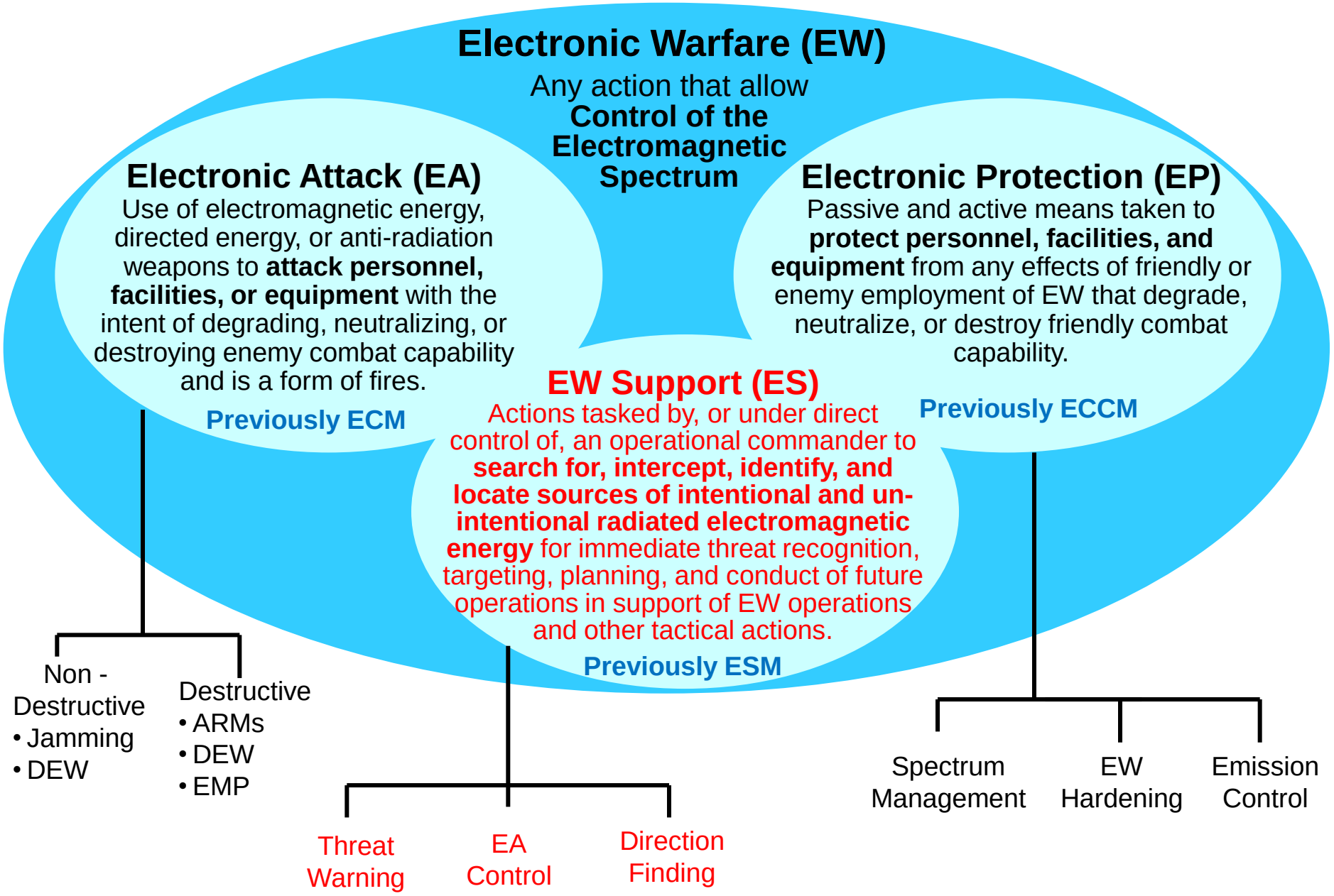
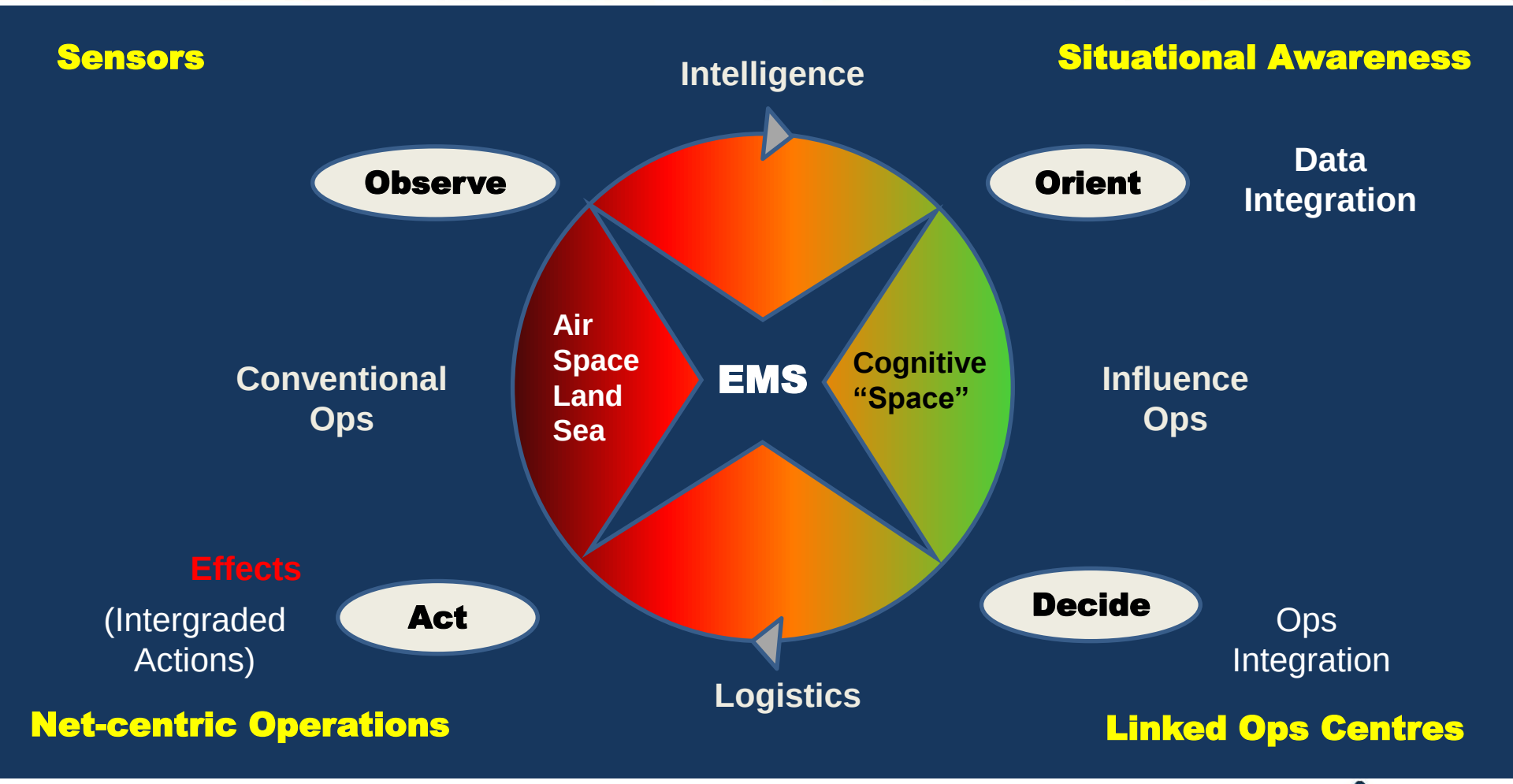
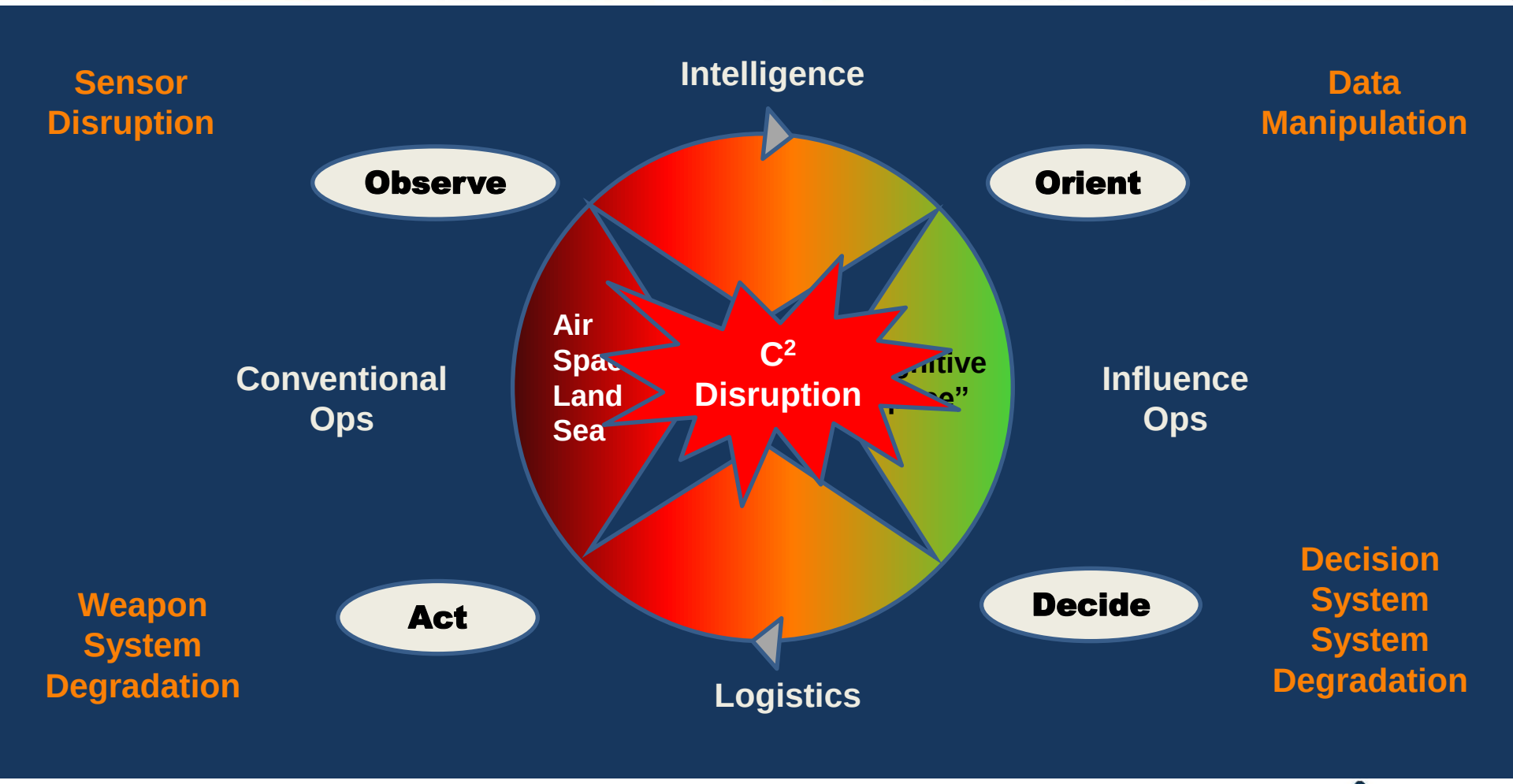


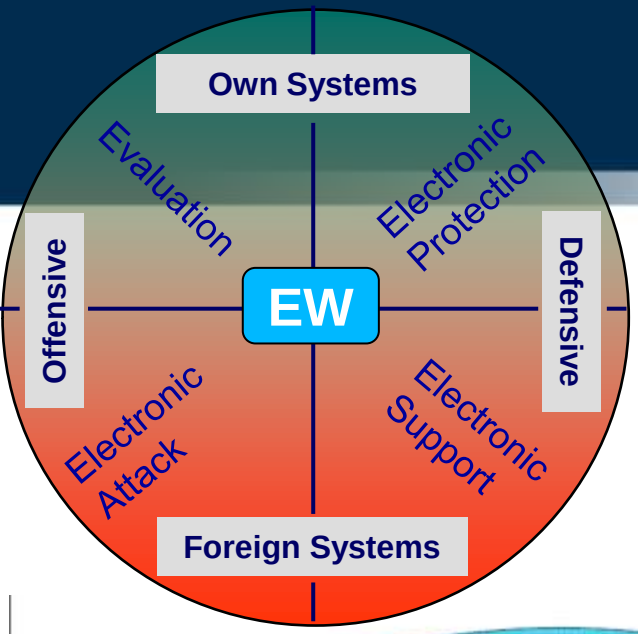
Operations (Net-enabled)

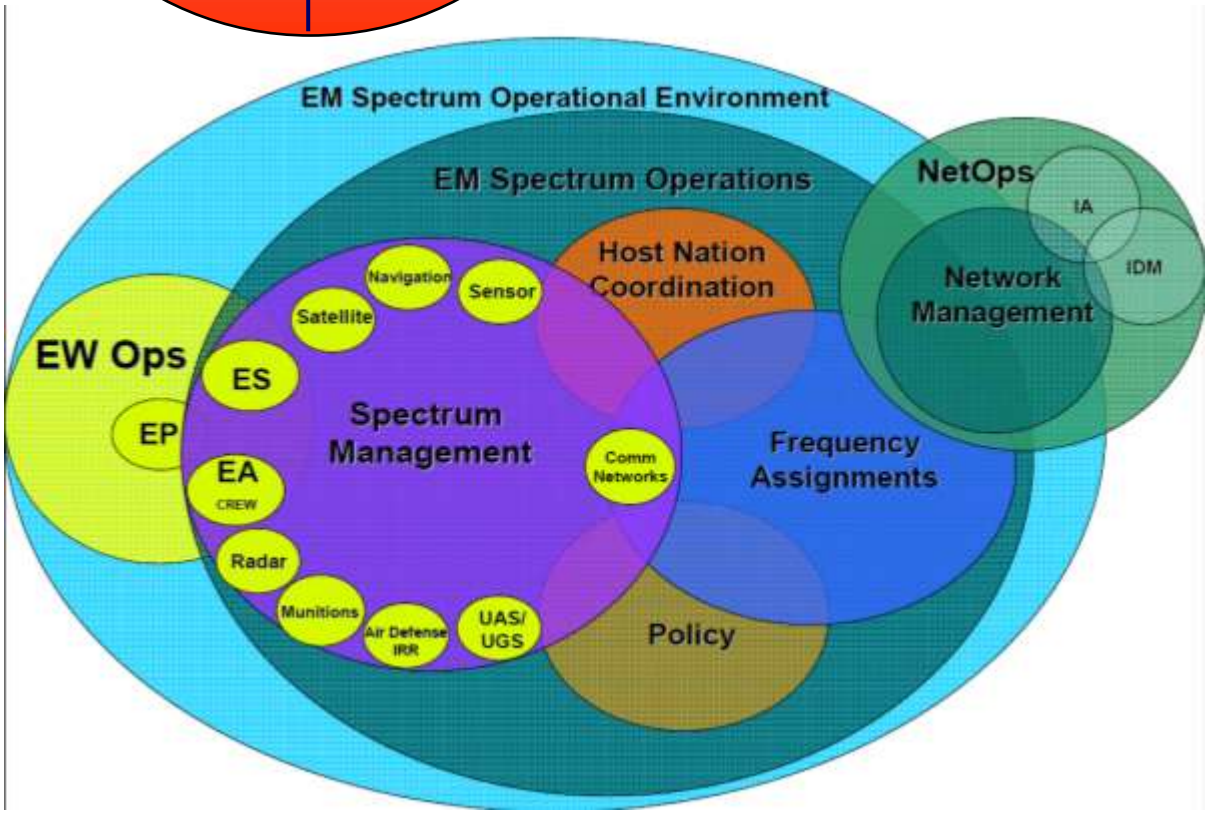


EW C^2 Attack



Main EW Activities to enable Control, Attack and Protection of EMS

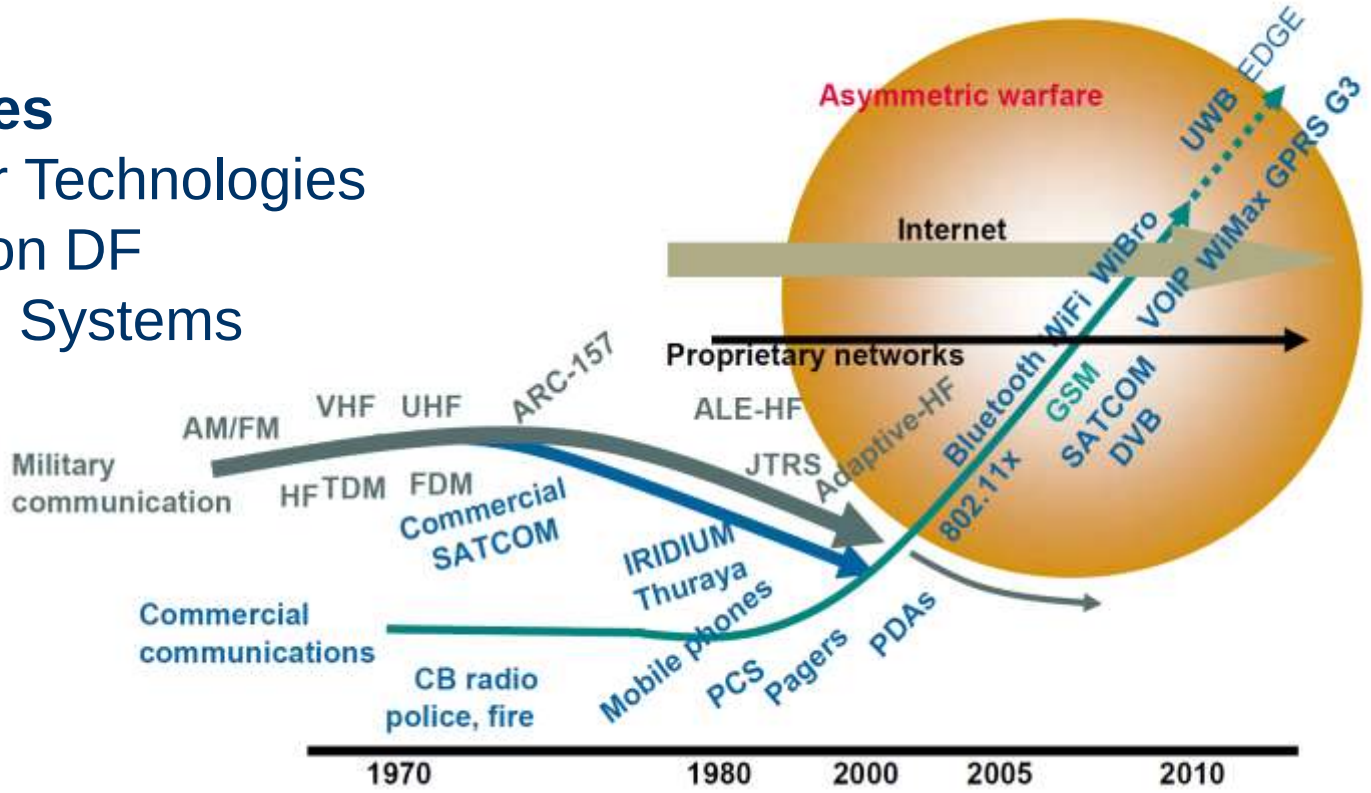




- Electronic intelligence
  - Detection
  - Classification
  - Demodulation
  - Identification
  - Geo-Location
- EM reconnaissance
- EM threat avoidance
- EM hardening
- Emission Control
- EM countermeasures
  - EM masking
  - EM deception
  - Directed Energy
- EMS management

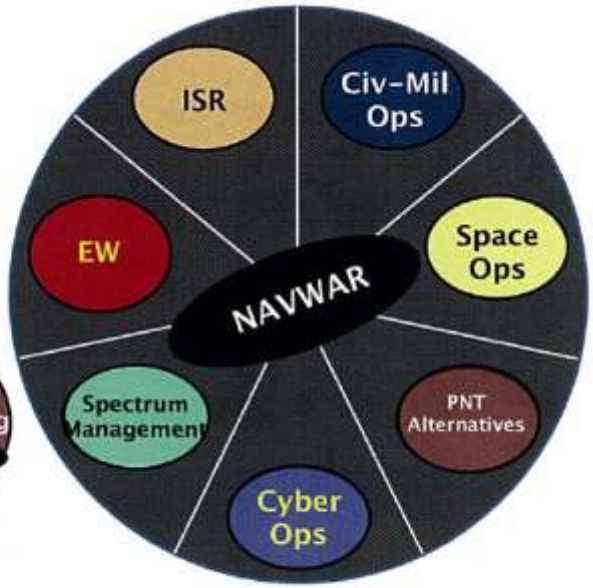
Communication

- **Threats**
  - Commercial Communications
  - Occupy large part of the EMS
  - Dynamic Frequency Allocation
  - Stealthier Waveforms (LPD, LPI)
  - Networked (Dynamic/Ad hoc networks)
  - Encryption
- **Counter Measures**
  - Digital Receiver Technologies
  - Super Resolution DF
  - EW Information Systems
  - SEI



Global Satellite Navigation Systems

- Navigation Warfare (NavWar)
  - Deliberate defensive and offensive action to assure and prevent Positioning, Navigation and Timing (PNT) information through coordinated employment of space, cyberspace, & EW operations
- Desired PNT Effects:
  - Assure Blue access to high-integrity PNT
  - Perform counter-PNT (deceive, deny, disrupt, degrade & destroy Red PNT)
  - Identify, characterize or geolocate sources of Red interference with Blue PNT information ("PNT Exploit")
  - Resolve interruptions to PNT information, including unintentional Blue-on-Blue interference



Radar

- **Threats**
  - Active Electronically Scanned Arrays (AESA)
    - SAR, search, multi target track, weapons guidance - LPI
    - Communications data-link
    - Jammer
  - Multiple Input Multiple Output (MIMO)
  - Modeless and adaptive waveforms
  - Low transmit power - LPD
  - Bi-static and networked
  - High range and Doppler resolution
    - **Counter Measures**
      - Digital Radio Frequency Memories (DRFM)
      - Advanced EA techniques (e.g. X-Eye & AOD)
      - Advanced Detection techniques (digital receiver)
      - Reduce Signature (RCS & Doppler)
      - EW Information Systems

Electro-Optical Systems

- **Threats**
  - Low-light and daylight systems
  - Laser communications and range finders
  - Laser Guided / Beam-rider munitions
  - IR and Imagery guided missiles
  - Trends
    - Increase spectral bandwidth – hyperspectral
    - Increase special resolution (more pixels)

- **Counter Measures**
  - Decoys (spectrally matched flares, pyrophorics, Visual & IR) & obscurants
  - DIRCMs

RF Jammers

- **Threats**
  - Denial (noise) as well as deception (spoofing) of:
    - Communication (voice and data-links)
    - Radar (Synthetic Aperture Radar, Early Warning, Weapons allocation, Tracking, personnel, etc)
    - Missile guidance links
    - RF Navigation Systems (GPS GLONASS, Galileo etc.)

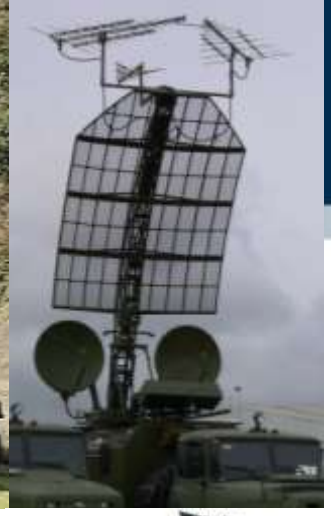
- **Counter Measures**
  - EMCON
  - EM Spectral plan - Interoperability

- **Utilisation**
  - Stand-Off
  - Escort
  - Self-protection / Stand-in

Anti-Radiation Missiles

- **Threats**
  - Supersonic speed and a range of more than 60 nm
  - GPS and inertial navigation system
  - Active millimeter wave (MMW) radar seeker
  - Digital anti-radiation homing seeker
  - Integrated Broadcast Service Transceiver receive targeting information from various platforms, and reports fusing status just prior to impact
- **Counter Measures**
  - Low power and/or intermittent transmissions or short-burst communications
  - Bi/multi-static or networked emitters
  - Passive Radar (PCL)
  - Use synchronised geographically spaced dummy transmitters
  - EM Spectral plan - Interoperability

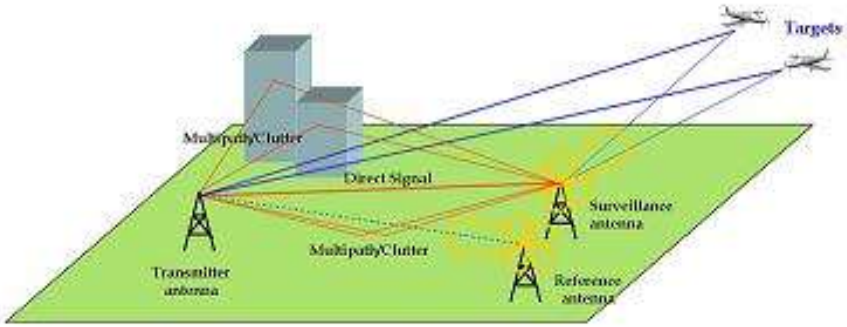
Signal Intelligence Systems



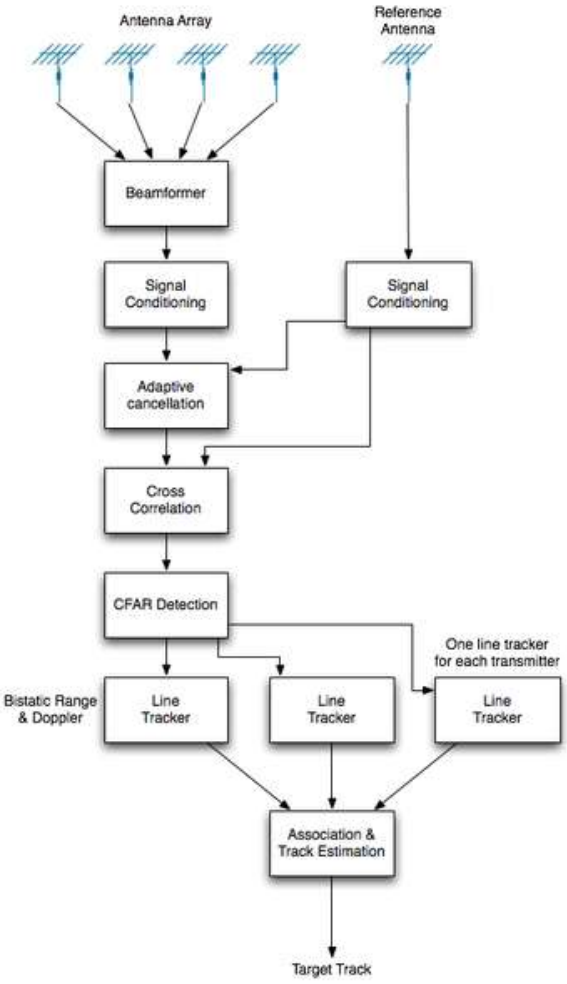
- **Threats**
  - Communications Intelligence (COMINT)
  - Electronic Intelligence (ELINT)
  - Direction finding (DF)
  - Specific Emitter Identification (SEI)

- **Counter Measures**
  - Reduce the peak transmit – in desired direction only
  - Emission Control & Doctrine
  - Use waveforms that is inherently more difficult to exploit

Passive Coherent Location (PCL)



- **Threats**
  - Low cost
  - Passive
  - Detection of stealth platforms
- **Counter Measures**
  - None



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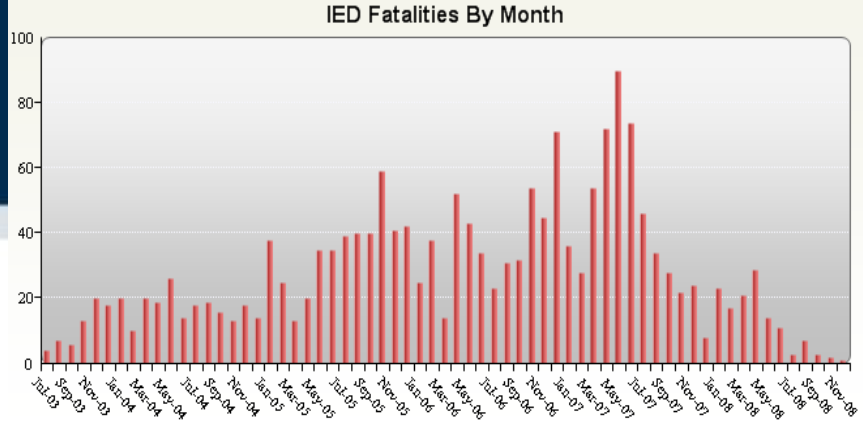
Hostile Fire Indication (HFI)

- **Threats**
  - Acoustic – low sensitivity
  - UV/IR (MAW)
  - Pulse Doppler Radar

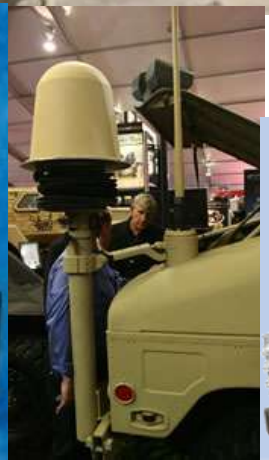
  } Low False Alarm

- **Counter Measures**
  - None except for acoustic based systems

IEDs



- **Counter Measures**
  - RF Jammers
  - Airborne surveillance (UAVs)
    - EO/IR sensors - spotting IED teams
    - SAR detect recently disturbed soil
  - Ground Penetrating Radar (GPR)
  - New generation IED Jammer (JCREW 3.3):
    - Broader frequency spectrum
    - Interact with other jammers and communications systems
    - Collect information & Send for post-mission analysis secure datalink
    - Threat direction-finding and geo-location
    - Focus jamming energy - increase protection range



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Conclusion

- Irregular warfare caused a paradigm shift in EW, both in the equipment - required capabilities, as well as in the way operations are conducted
- EW can no longer operate as a stand-alone entity - it must be closely integrated with the intelligence community in order to achieve the desired effect and accomplish proper Battle Management
- Hardening of own equipment (communication, radar, electro-optical systems, navigation etc.) against intentional jamming by adversaries, but also unintentional interference by own systems
- Interoperability within a force, but even more so for joint and coalition operations, requires proper EM planning and control (EWIS)
- EW works both ways, and can be used and exploited by both sides
- A proper understanding of EW is essential to all warfighters who use the EMS as part of their missions. We need to educate the warfighters, as well as the leaders, in the utilization and vulnerabilities of the EMS & equipment
- EW training must be matched to the operational environment - realism as well as accommodating emerging technologies

Training

Thank You

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