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

Communications EW

Communications and Signal Intelligence in the Battle space

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CSIR Defence, Peace, Safety and Security

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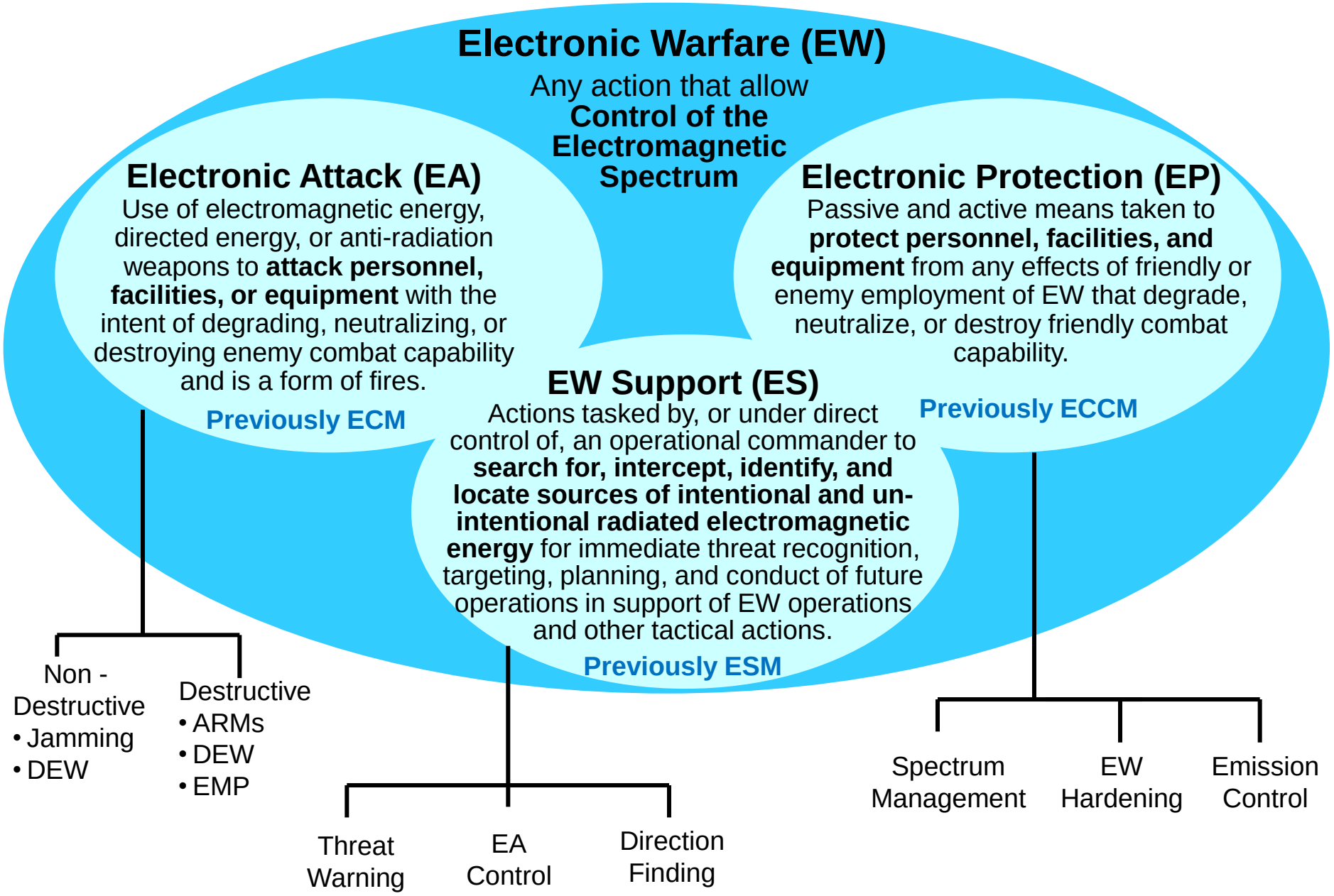
our future through science

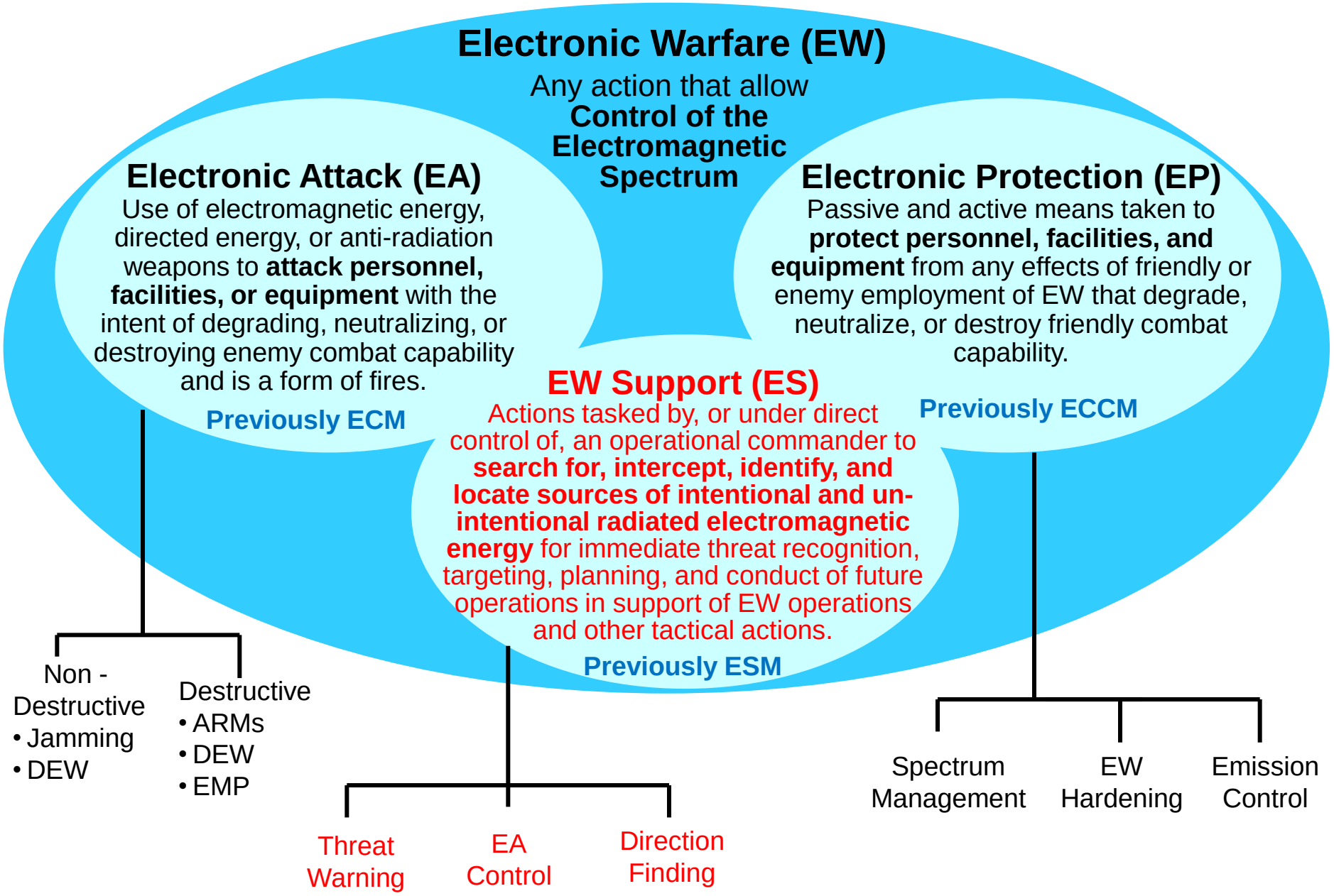
Outline of presentation

- Introduction
- Environment
- Communications Intelligence
- Communications Jamming
- Conclusion

Electronic Warfare Concept



Electronic Warfare Concept



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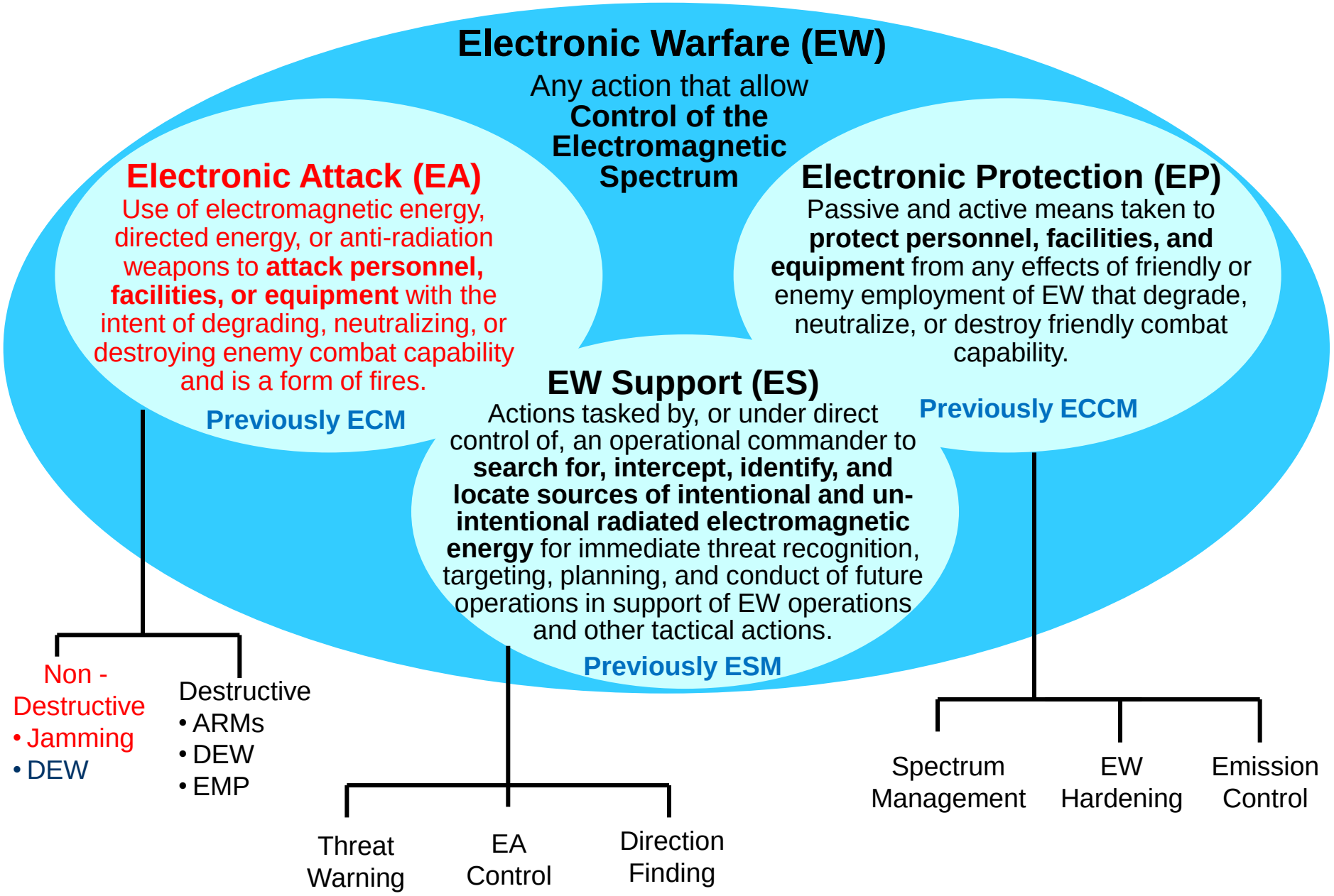

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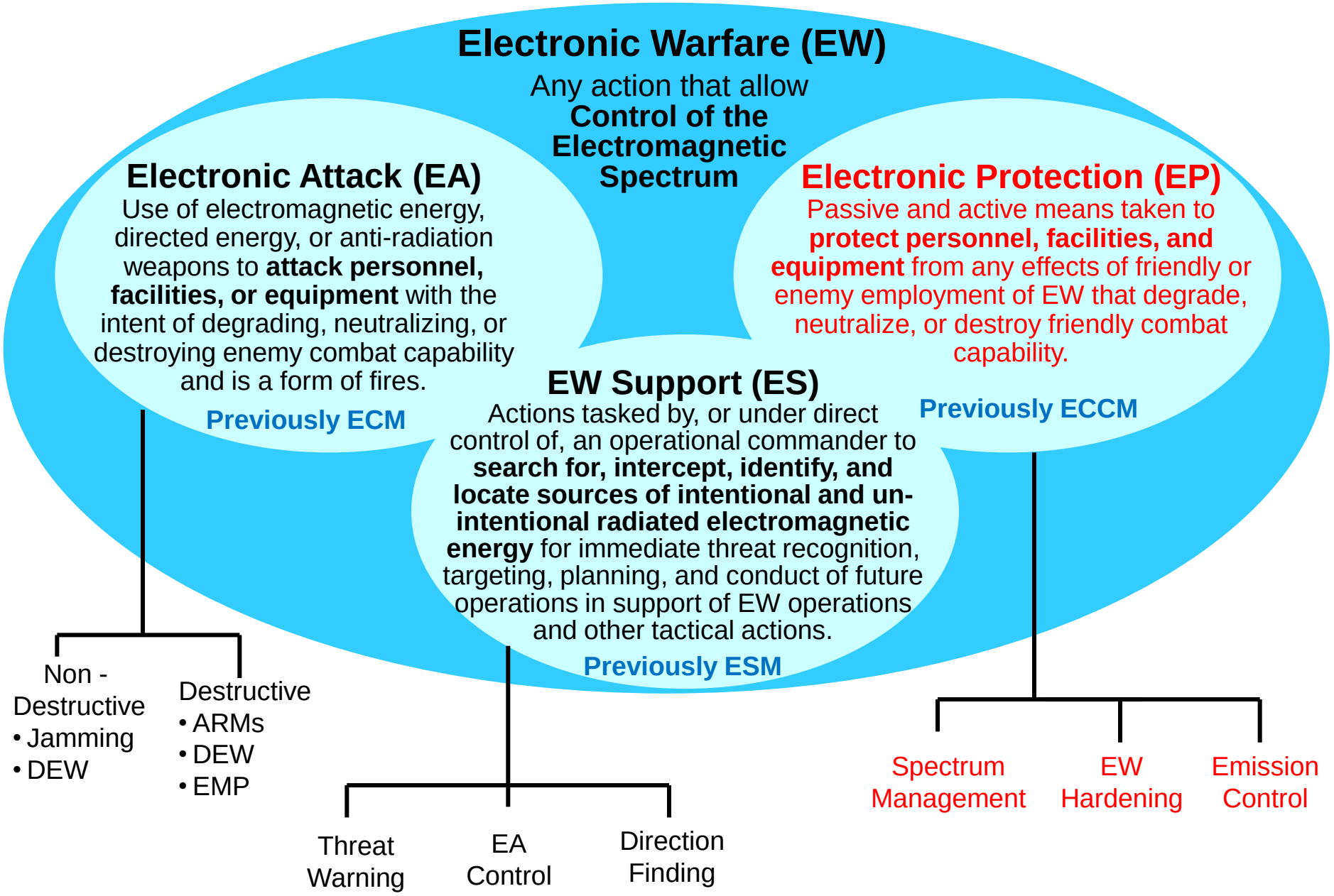
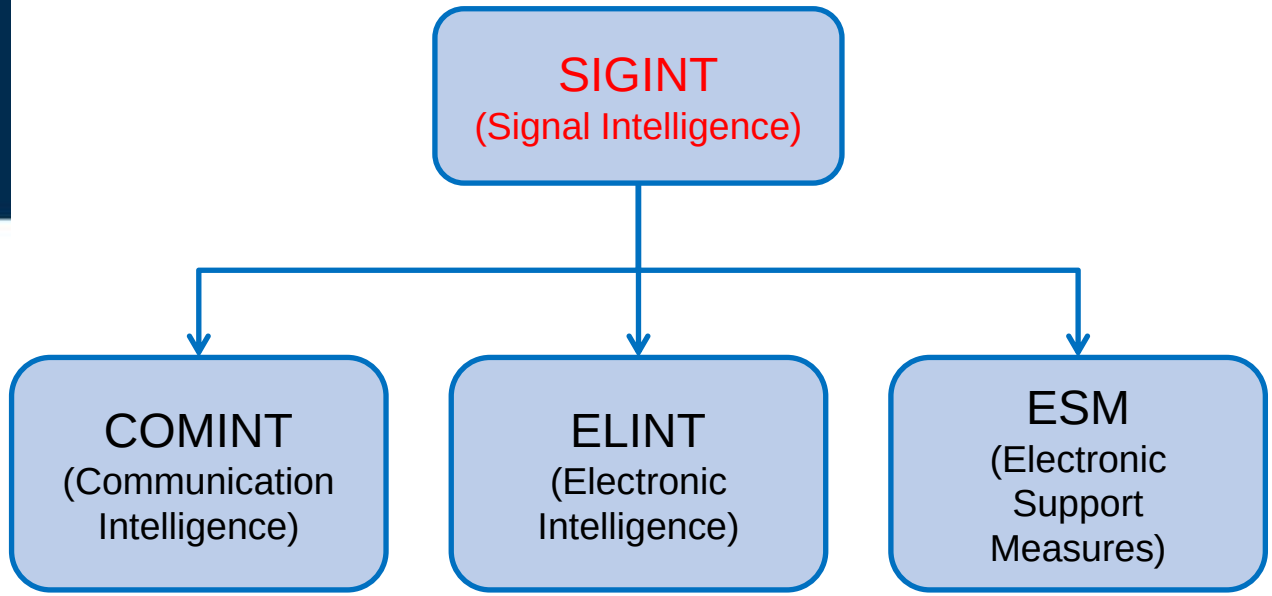


Introduction



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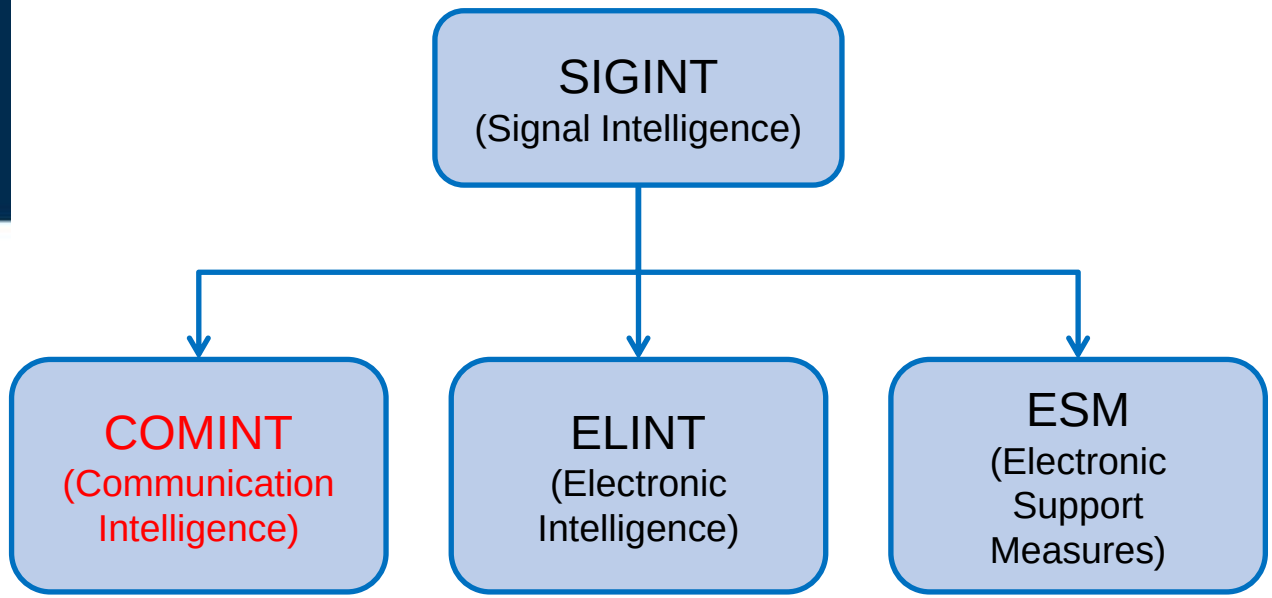

- **SIGINT** is intelligence-gathering by interception of signals
- **COMINT** deals with technical information as well as messages or voice information (translation) derived from the interception of communications. Includes traffic analysis - the study of who is signalling whom and in what quantity. Decryption falls outside the scope of COMINT

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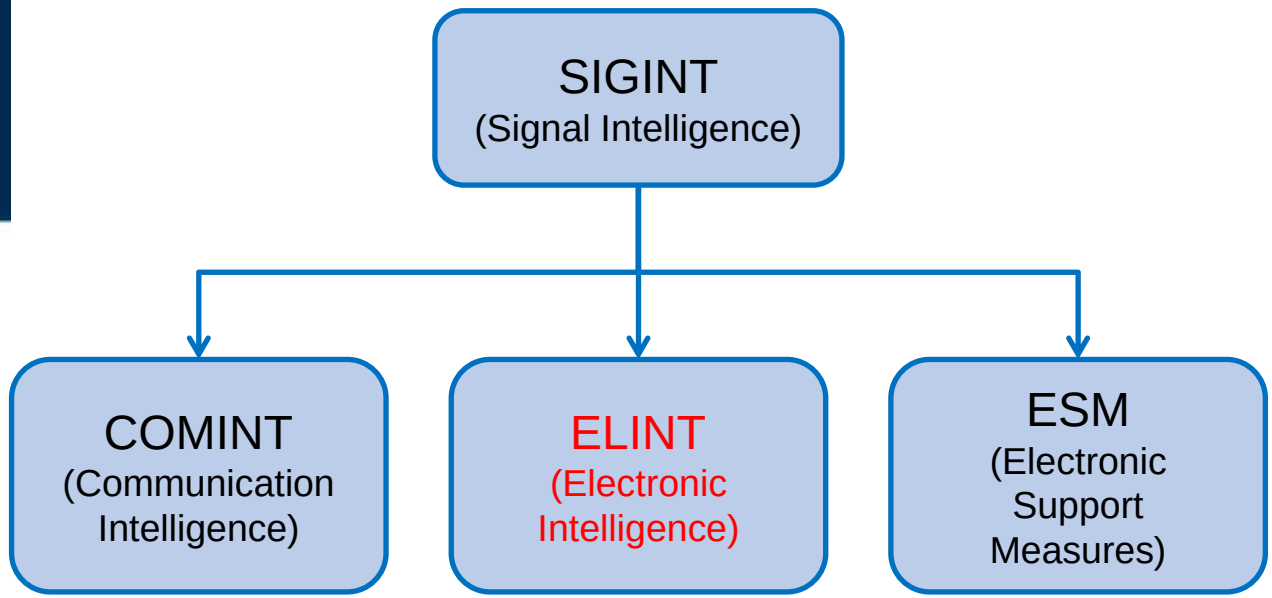

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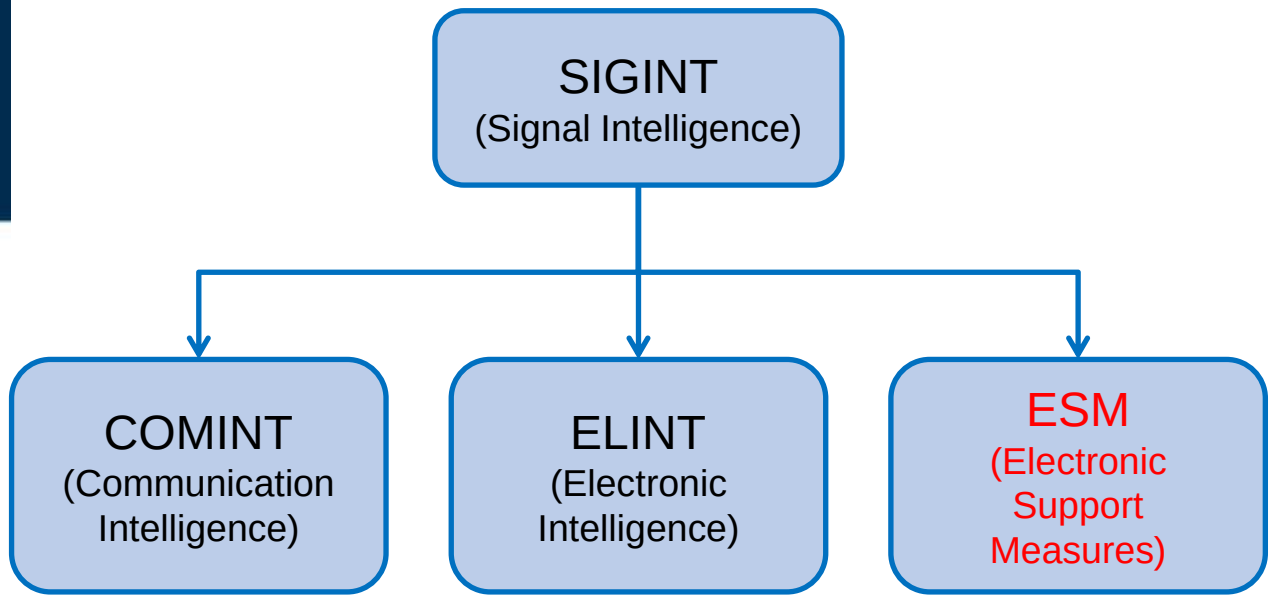

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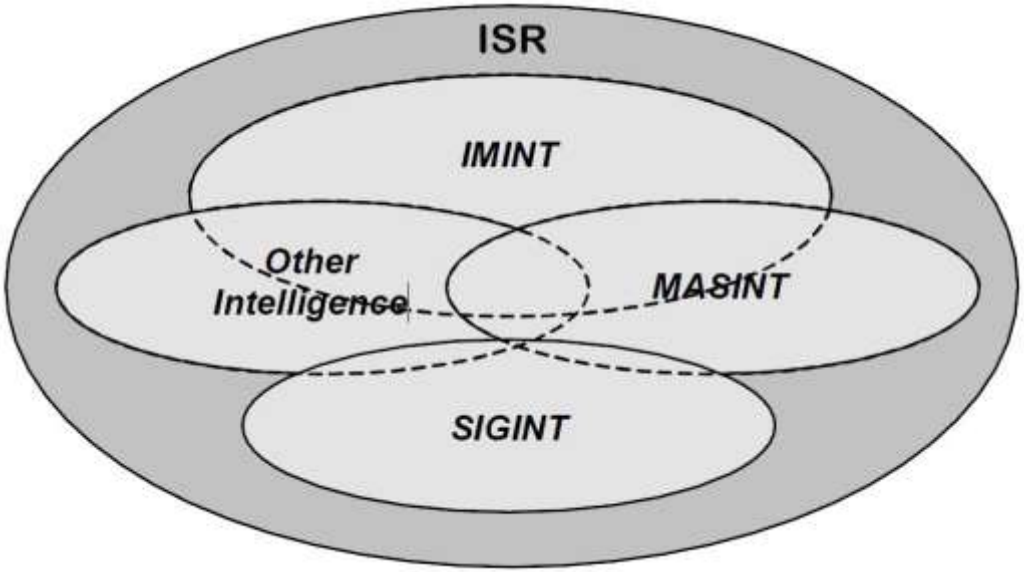
- **ESM** deals with time critical data - warnings and EA system control



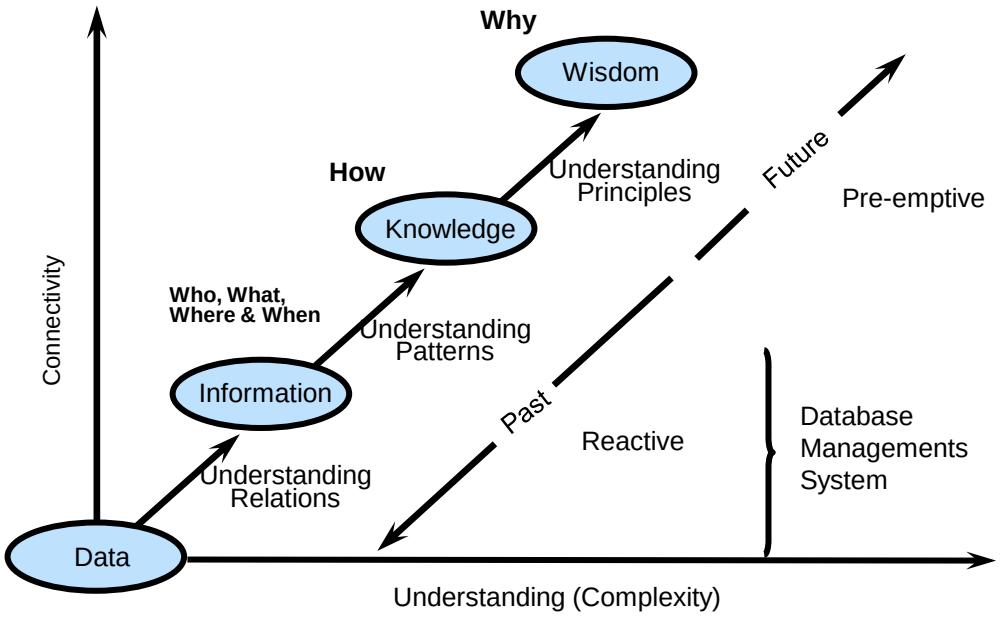
SIGINT

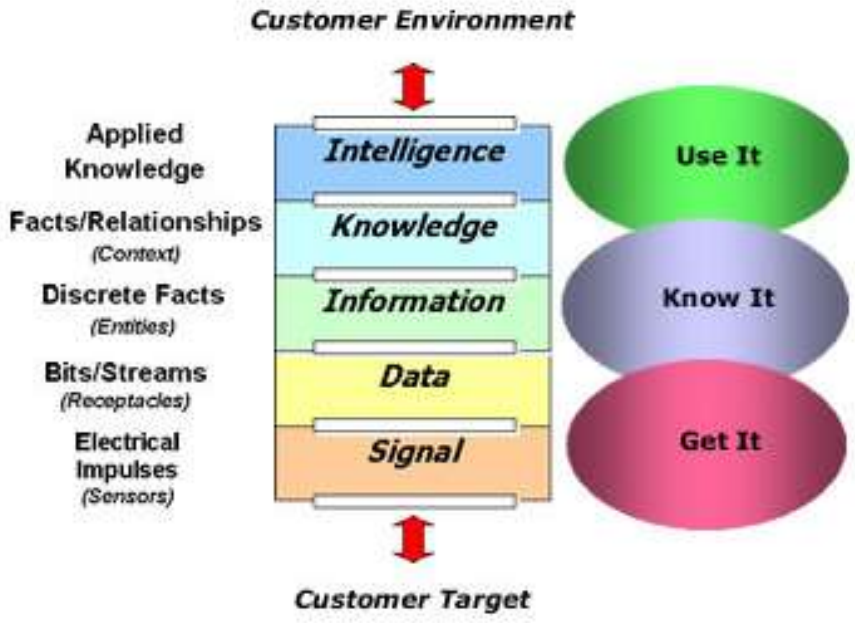
Operational environment

- Advantages of SIGINT:
  - Passive - no active transmissions
  - Enemy's Organizational structure, EOB and Intent can be obtained
  - Equipment capability can be learned (e.g. frequency range, power, etc.)
  - Can sometimes reveal specific information on enemy equipment (SEI)
  - Emitter location can be approximated and targeting support (kinetic and non-kinetic) delivered
  - Provide Indications and Warnings (e.g. GNSS jamming)
  - Can cue other systems (jammers, EO systems, radars etc.)
  - Support Battle Damage Assessment (BDA)
  - Support Tasking and Mission Planning

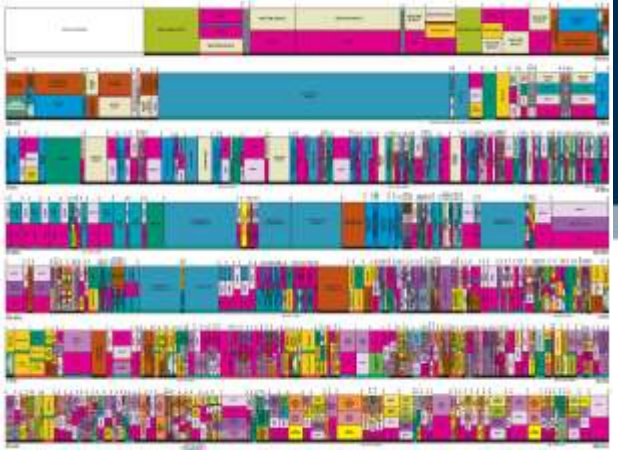
SIGINT ...

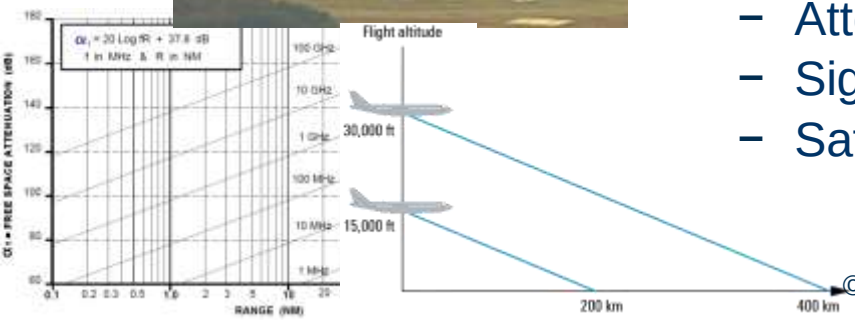
- Limitations of SIGINT:
  - Requires active transmissions
  - Data may be denied (e.g. secure communications or denial jamming)
  - False information may be passed by the enemy – deception
  - Dense environment - too much data - Probability Of Intercept (POI)
  - Collection subject to atmospheric conditions (Probability Of Detection)
  - Locations derived from SIGINT may be imprecise
  - Quality of emitter Identification and Attack efficiency is directly linked to quality of EW Information System (database)





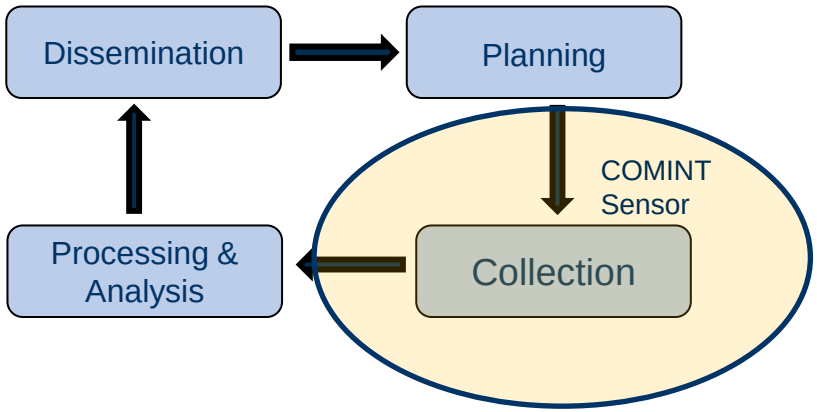
Environment

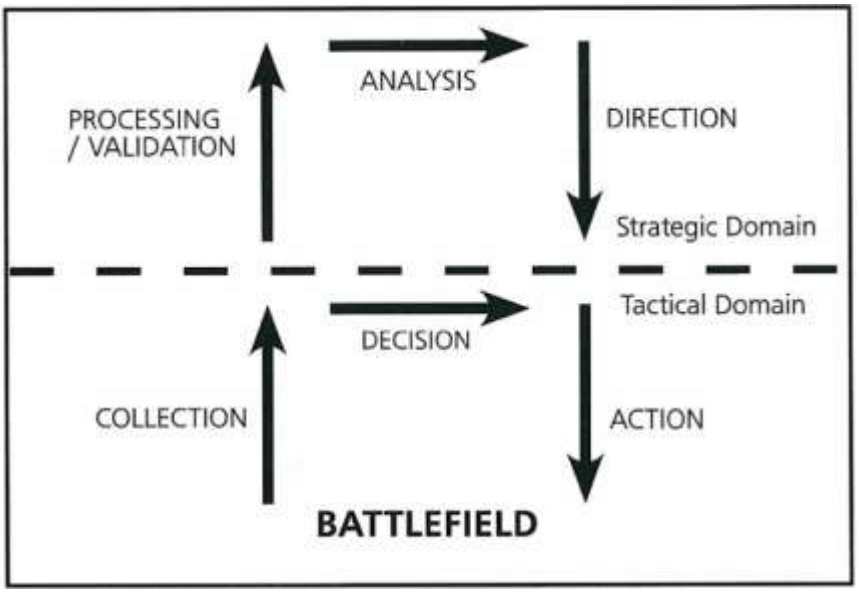




- Communications extends from 100 kHz to 300 GHz and the visible and IR part of the EMS
- Commercial communications rapid growth
- Communication signals are interleaved/shared with other EMS users:
  - Navigation, data-links, radars, proximity fuses, etc.
- Very dense EM environments - number of signals that can be intercepted, analysed & stored grows exponentially as a function of altitude
- SIGINT systems may be Surface-based, Airborne or Space-based
- EM Propagation:
  - Obscuration (LOS)
  - Attenuation (receiver sensitivity)
  - Signal delay (time/frequency hopping & jamming)
  - Satellite revisit time (POI)

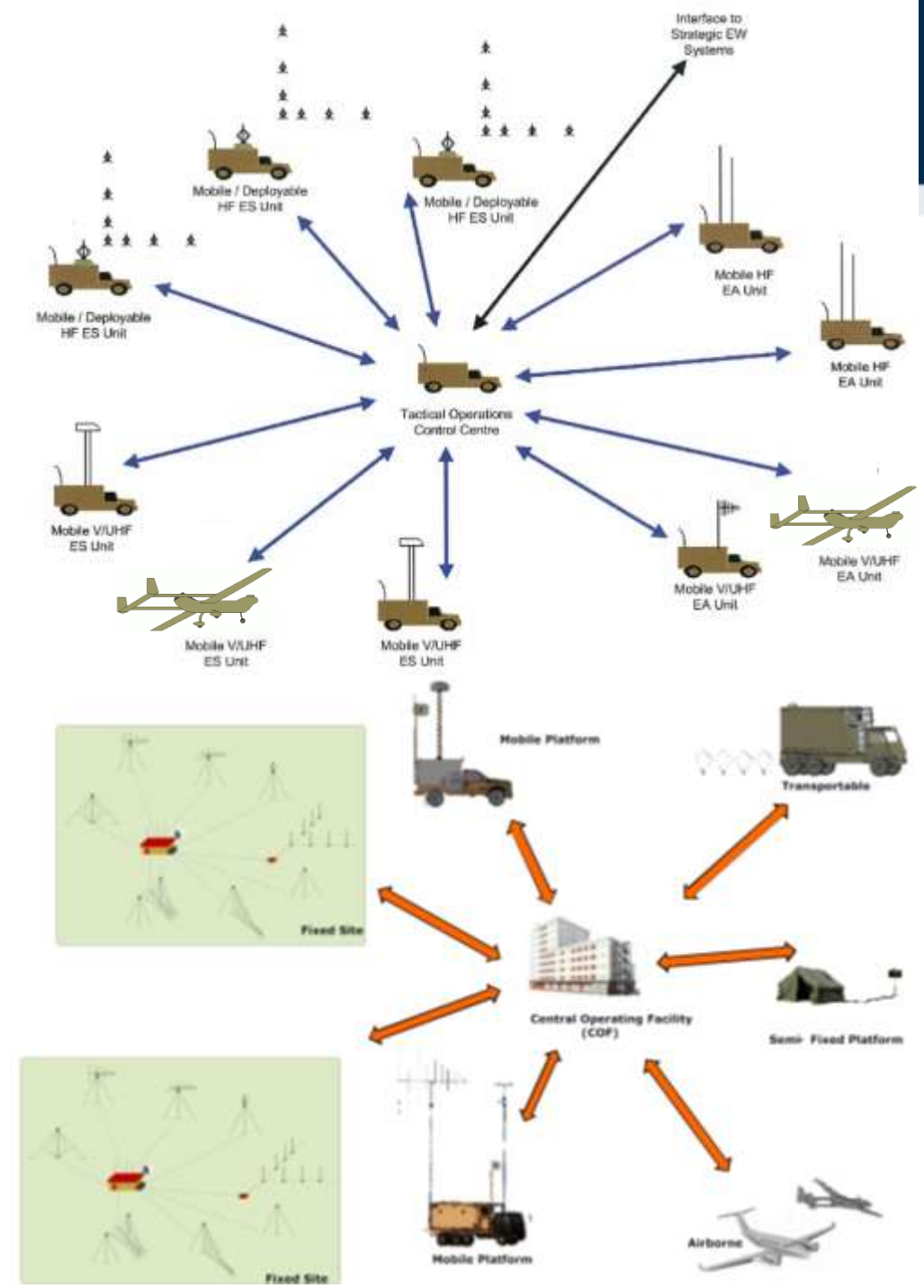
COMINT





- COMINT Sensor Functions:
  - Detection, Location, Discrimination, Classification, Demodulation & Decoding
- COMINT System Functions:
  - Decryption, Extraction, Transcription & Dissemination
- Distinction between COMINT & ELINT blurred - communications can be:
  - Analog or Digital,
  - Voice, Message or Data,
  - Between People or Computers
- Communications is becoming less COMINT-friendly - encryption
- Intelligence Cycle
  - Strategic Intelligence cycle
  - Tactical/Strategic Intelligence cycle

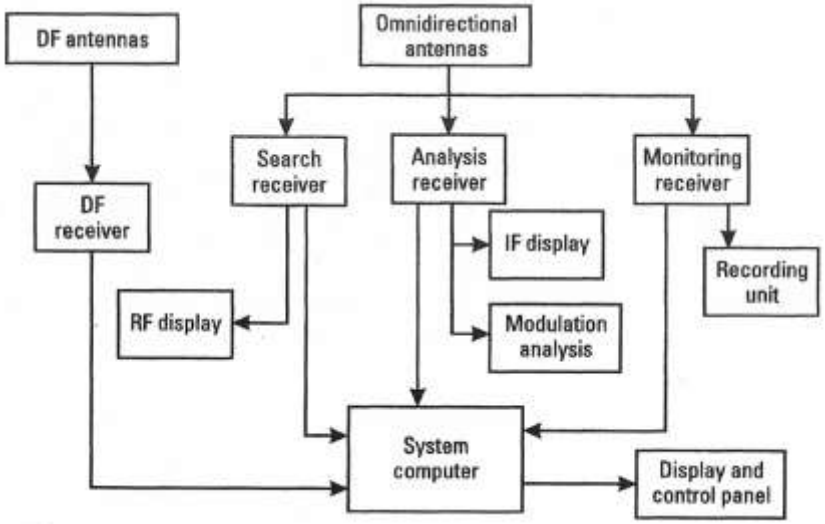
Tactical vs. Strategic COMINT

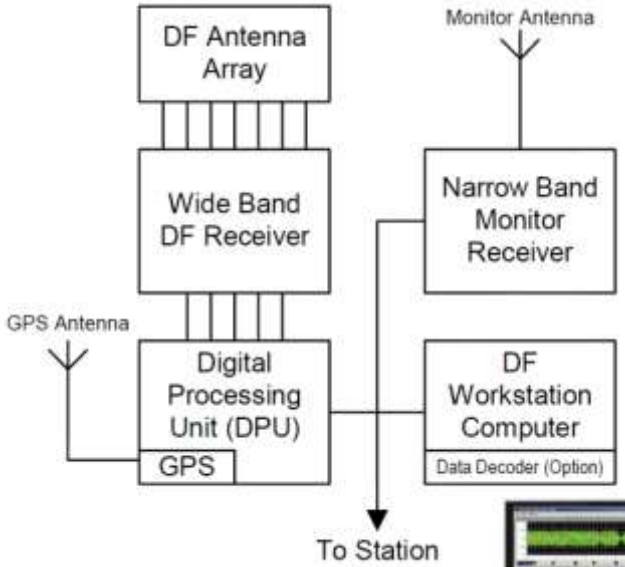


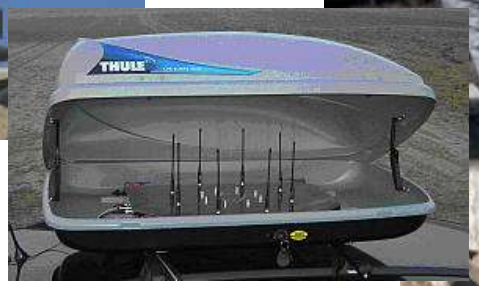
- Tactical
  - Support the battlefield commander in his tactical decision making through the collection of enemy communications information
  - Deny the enemy the utilization of the EMS for communications
  - Supply intercepted information to the strategic domain for further processing, validation, analysis and decision making
- Strategic
  - Typical integrated Strategic COMINT System
- Strategic jamming
  - HF and selected satellite communications only

COMINT Systems

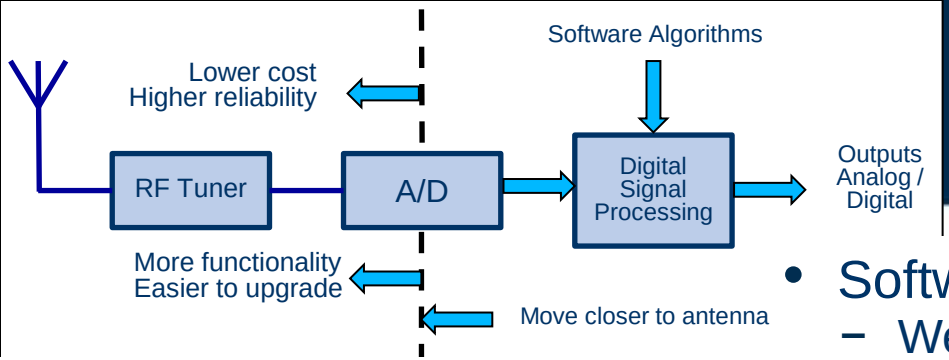
- Previous generation COMINT system
- Current generation COMINT system



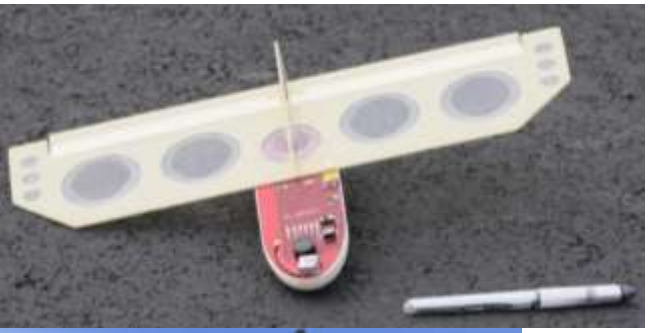


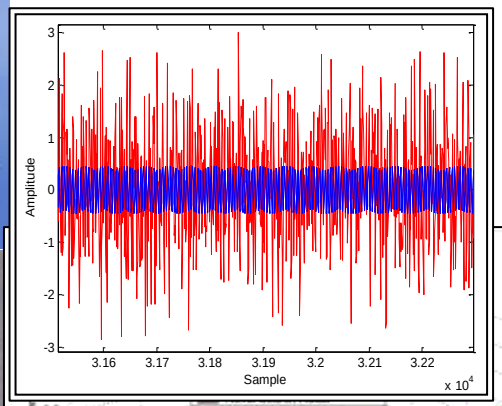


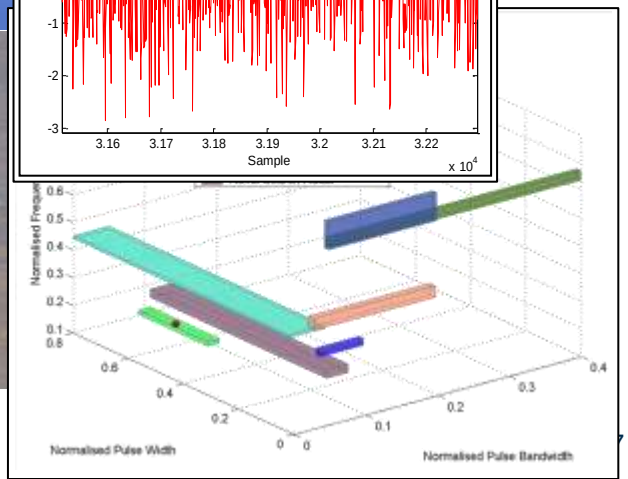
COMINT Trends

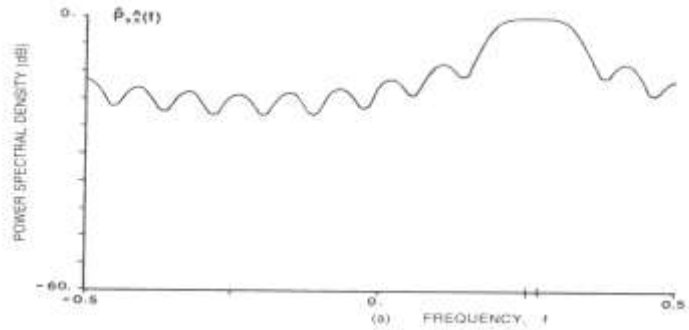


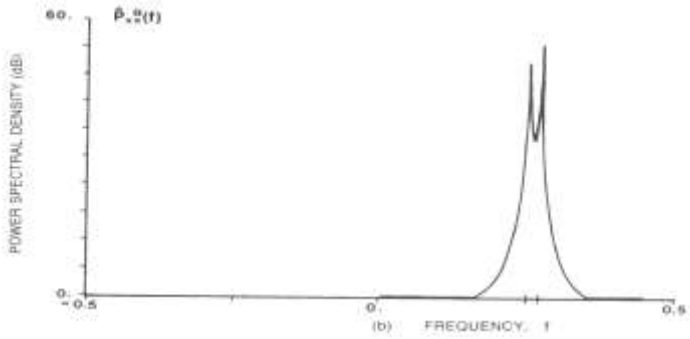
- Software Defined Receiver (SDR)
  - Weak Signal Detection & Parameter Estimation
  - Specific Emitter Identification (SEI)
  - Super Resolution Direction Finding (DF)
  - Statistical Classification
  - Compressive Sensing
- Optimization (Search, Parameter Estimation)
- Unmanned Arial Vehicles (UAV)



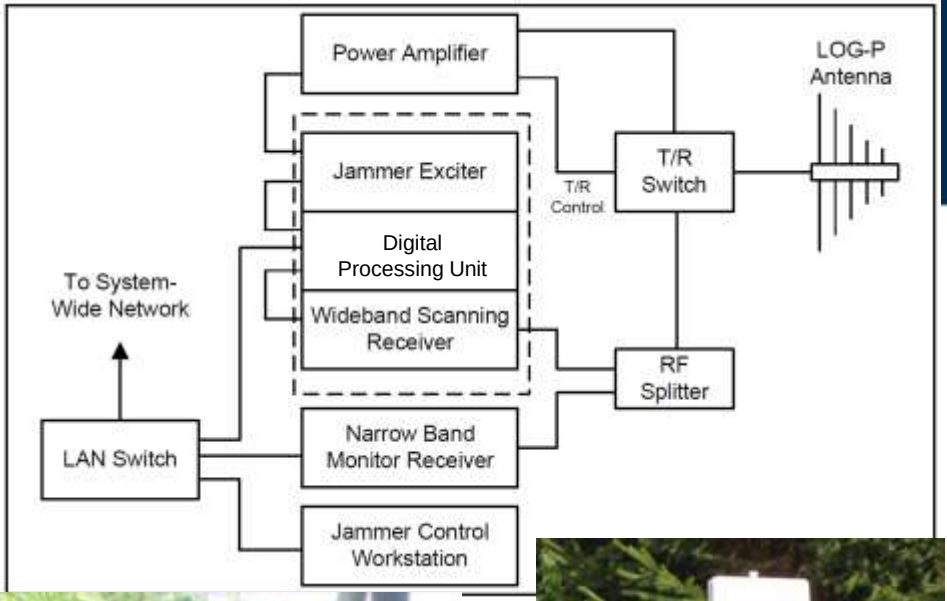


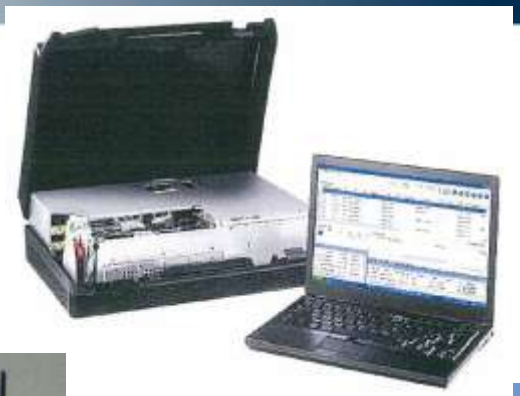






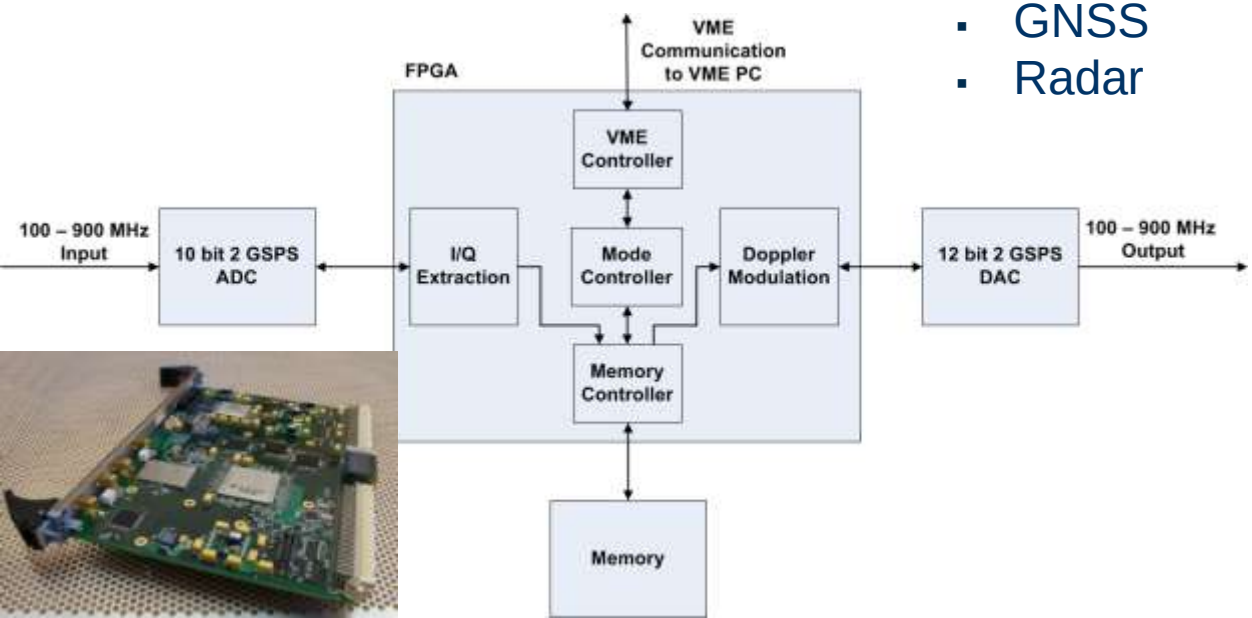
Current Generation Communication Jammers





Jammer Trends

- Active Electronic Steered Antenna (AESA)
- Unmanned Arial Vehicles (UAV)
  - Electronic Attack (EA)
  - Battle Damage Assessment (ISR)
- Digital Radio Frequency Memory (DRFM)
  - Inherent ESM capability – low latency
  - Techniques (Denial & Deception)
    - Analogue
    - Data-links
    - GNSS
    - Radar



- Optimization
  - Jamming Techniques
  - Look-through
  - Mission

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Conclusion

- Communications EW requirements must be driven by the actual operational needs and missions
- The dynamic commercial communications market and infrastructure will remain the largest single driving force behind the development of new COMINT and Communications Attack equipment
- EW Information Systems is essential for interoperability, Battle Management and EM spectral planning
- As you can exploit the EMS, so can and will the enemy
- If the emission is detected, it can be jammed or deceived
- It is essential to plan in the Electronic Protection measures (equipment, antennas, waveforms, placement and doctrine) in the development and specification of communications networks - not retrofit
- Spare stored (Faraday cage) communications only guaranteed protection against EMP & HPM attacks
- Need EW knowledgeable people

Thank You

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