



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

Directed Energy Weapons



Firepower and Engagement

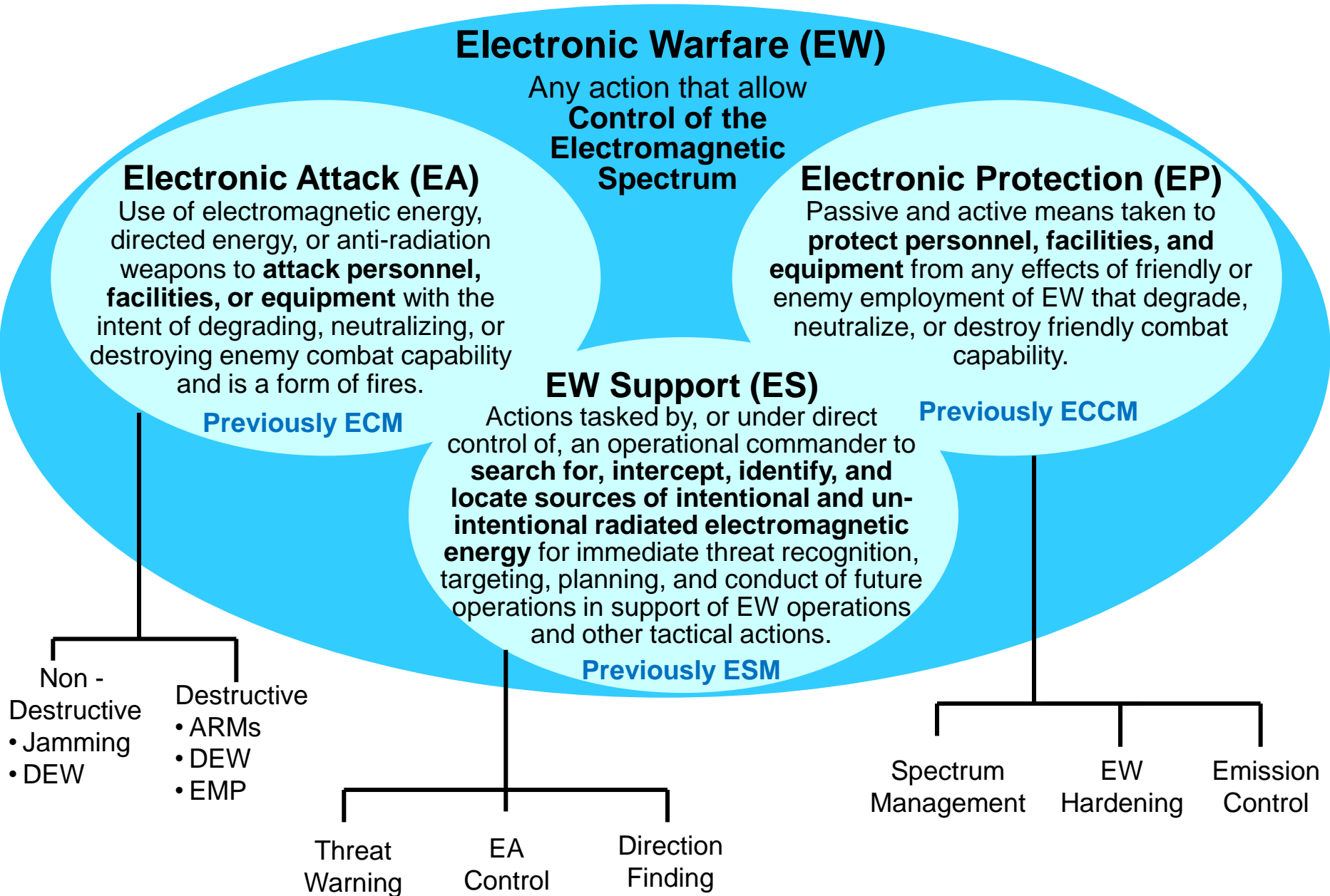
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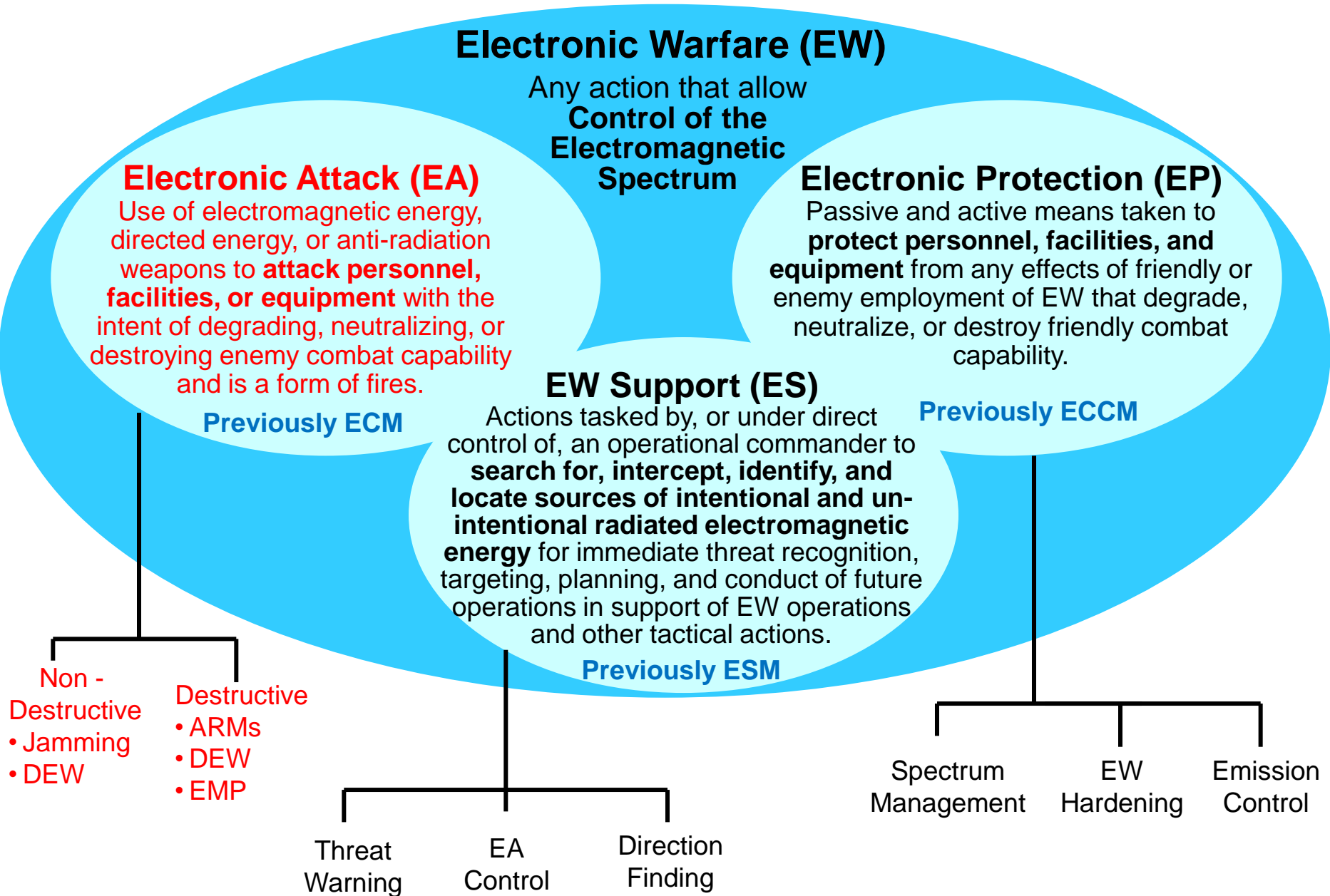
Outline of presentation

- Introduction
- Operational Effects
- Non-Lethal Directed Energy Weapons
- Lasers
- Electromagnetic Pulse
- RF Weapons
- Audio Weapons
- Conclusion

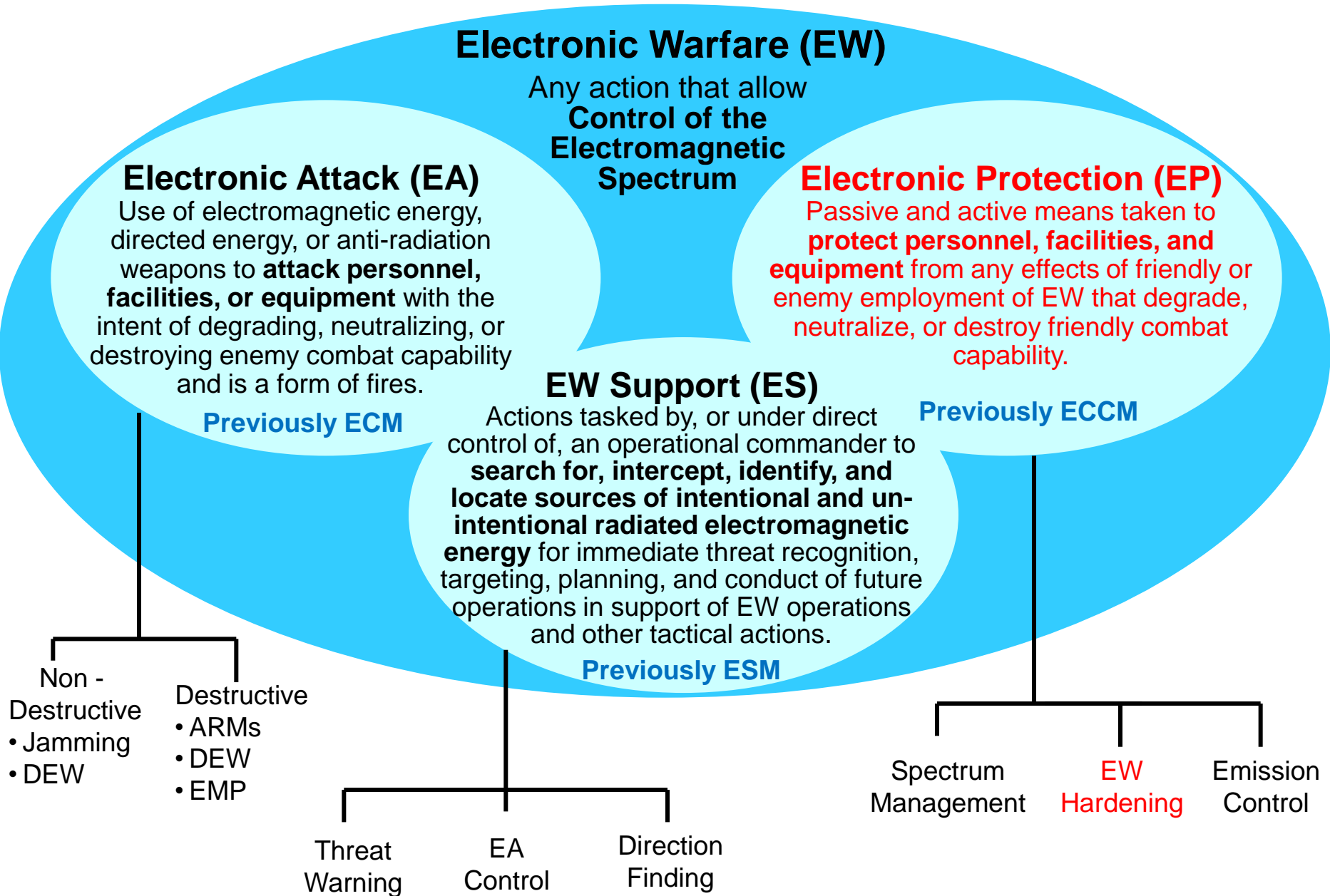
Electronic Warfare Concept



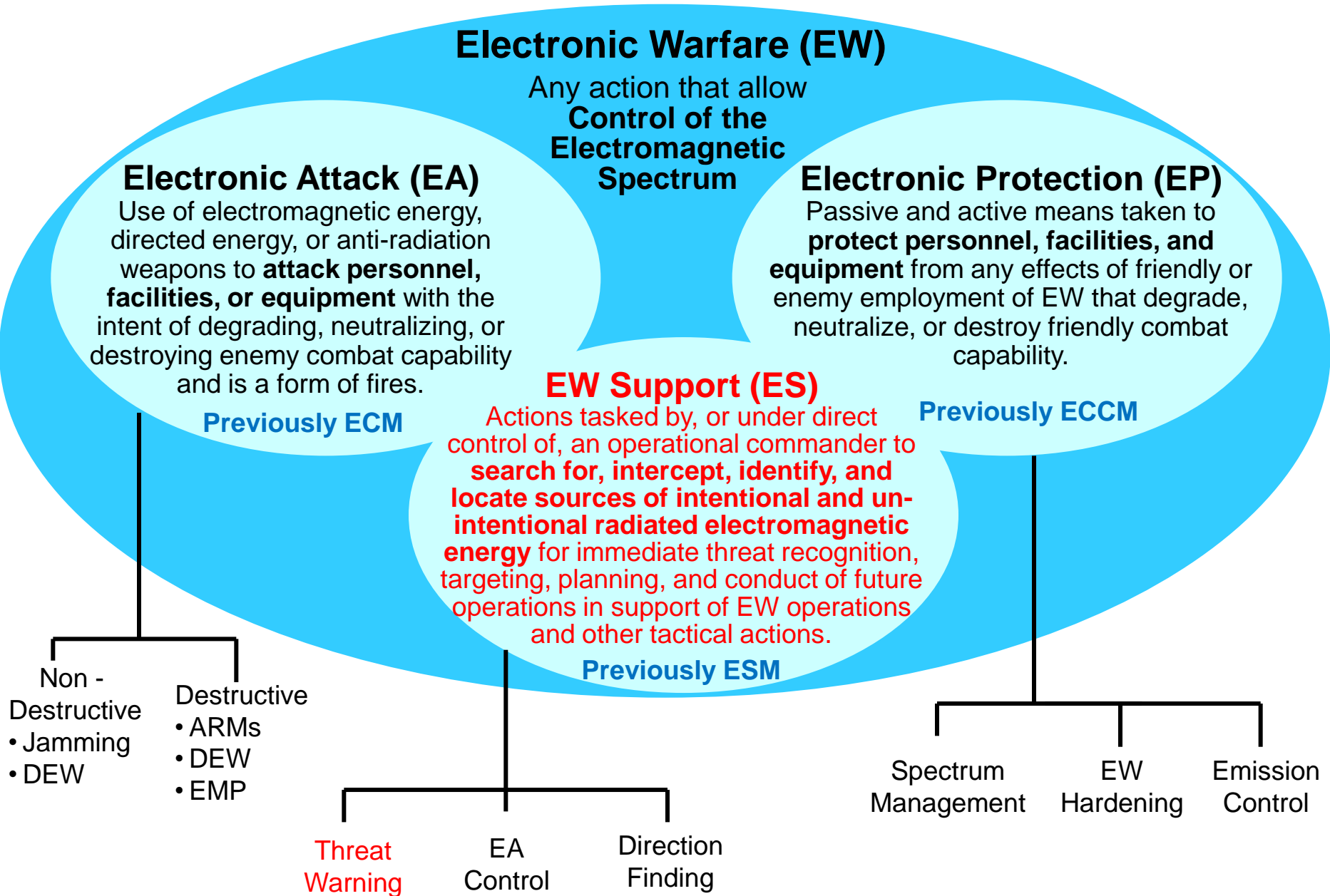
Electronic Warfare Concept



Electronic Warfare Concept



Electronic Warfare Concept



Introduction

- Directed Energy Weapons - technologies that produce a beam of concentrated electromagnetic energy or atomic or subatomic particles
- Targets:
 - Electronics
 - Platforms
 - Personnel
- Directed Energy Technologies
 - Lasers:
 - High Energy (HEL)
 - Low Energy (Dazzlers)
 - Radio Frequency (RF):
 - High Powered Microwave (HPM)
 - High Powered Millimetre Waves
 - Acoustics
 - Particle beams (PB)
 - Plasma
- Electromagnetic Pulse (EMP)

Introduction ...

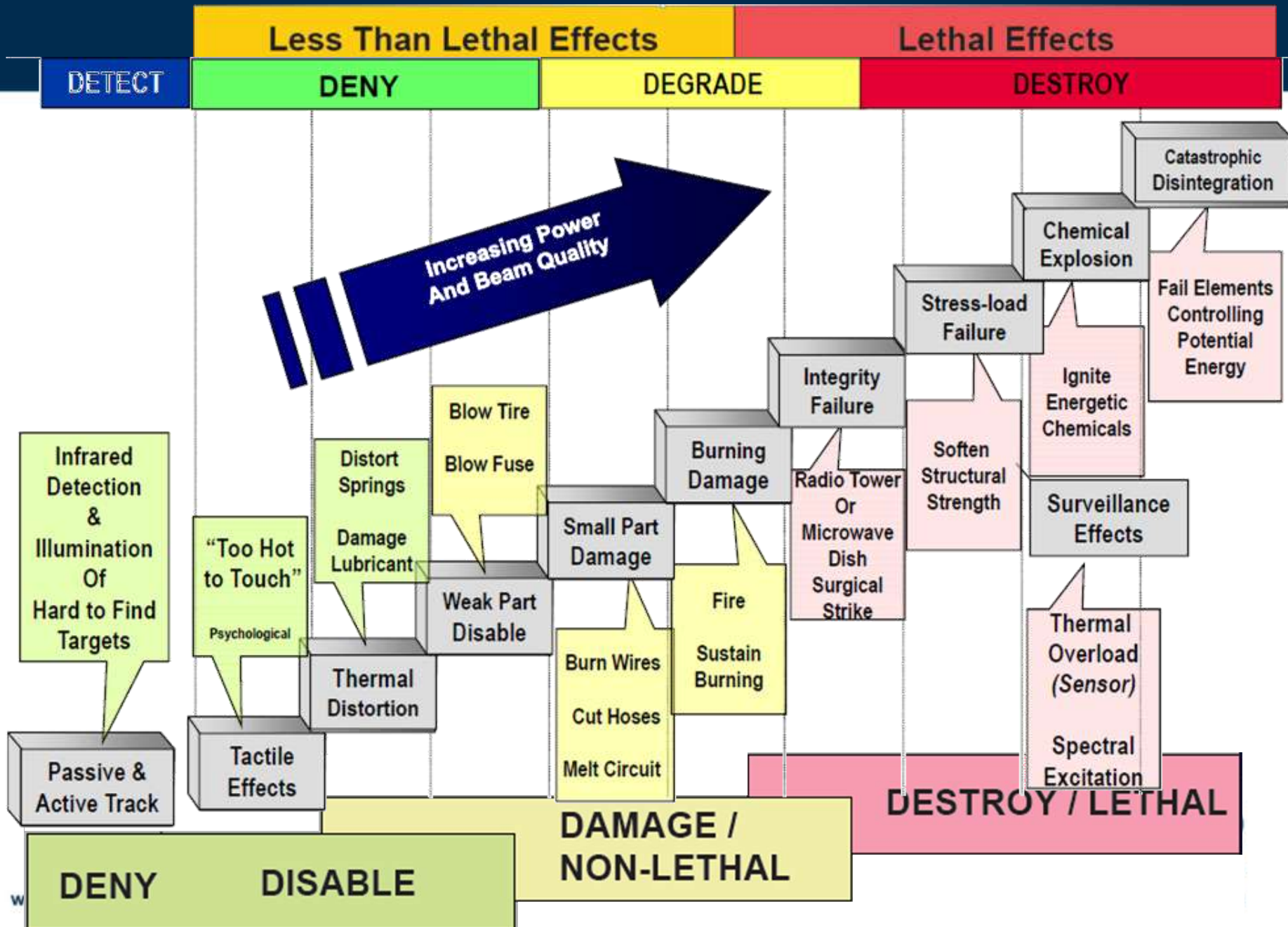
- Advantages
 - Operate at speed of light
 - Unlimited Magazine
 - Low power devices have low SWaP
 - Scalable effects
 - Lethal
 - Non-Lethal
- Disadvantages
 - Atmospheric propagation effects
 - High energy devices require high prime power
 - Physics – the higher the frequency, the more focussed the beam
 - Lasers require precision aiming
 - RF weapons has wider beams
- Applications:
 - C² Warfare
 - Air Defense
 - Irregular Warfare

Introduction ...

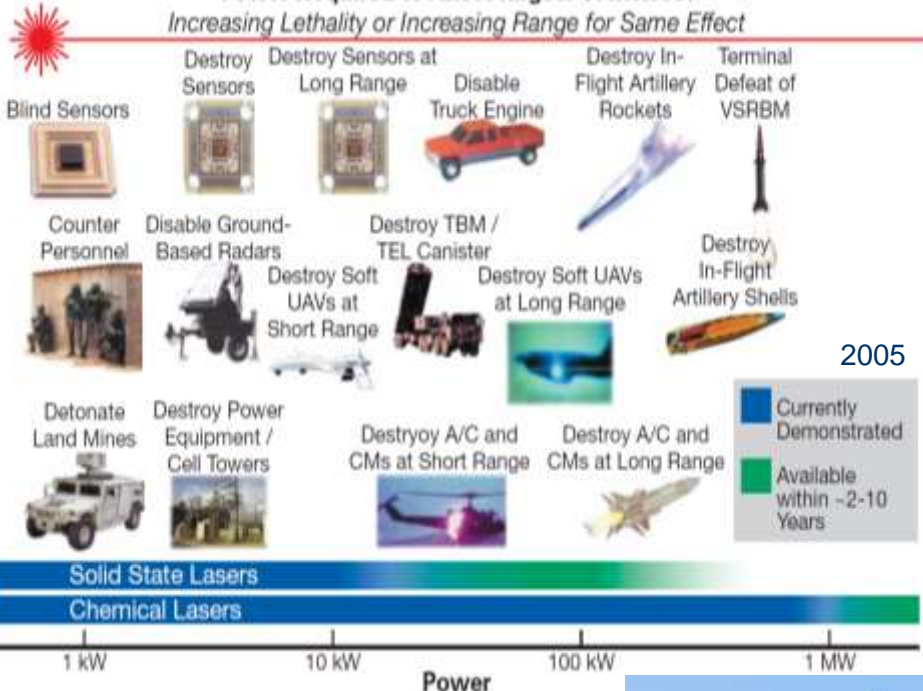
- HPM penetration mechanisms:
 - Front-door
 - Back-door
- Non-Lethal Weapons (NLW):
 - What differentiates DE NLWs from other NLWs:
 - Influences the actions of potential adversaries and non-combatants without applying physical force
 - DEW NLWs biggest issue is that of ethics - Verification that it is truly safe can take many years



Operational Effects



Increasing Lethality or Increasing Range for Same Effect



High Energy Lasers (HEL)

- Issues:
 - Atmospheric effects (blooming, absorption, scattering)
 - Shading (target evaporation)
 - No indirect firing capability
 - No Countermeasures

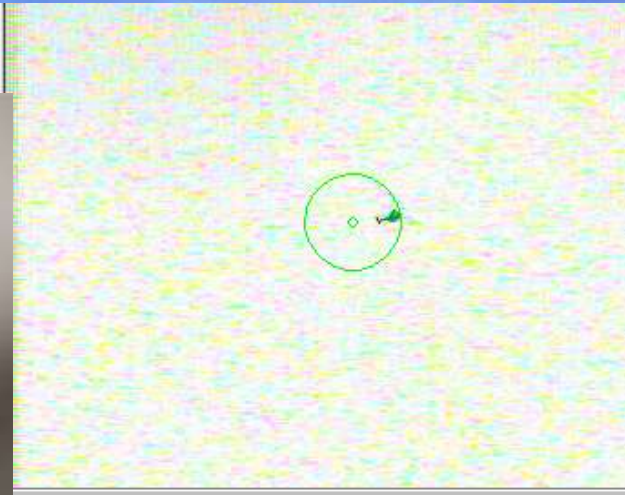
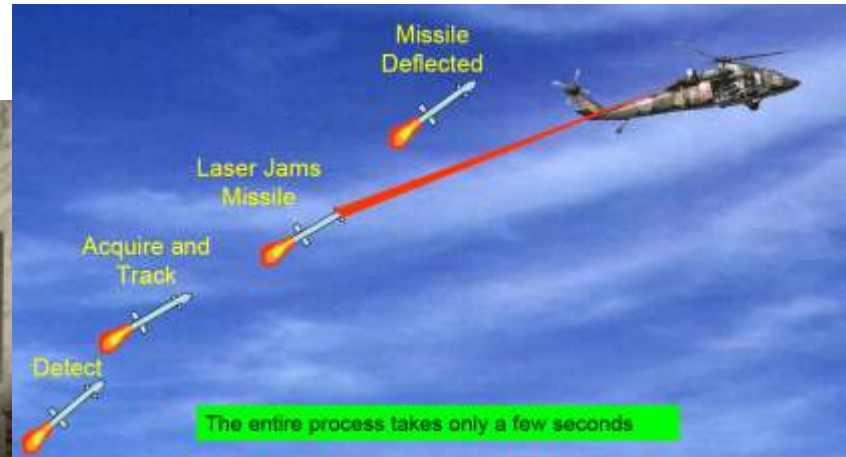


Low Energy Lasers



LASER SAFETY

- Issues
 - Eye safety
- Anti-missile - DIRCM



Low Energy Lasers



LASER SAFETY

- Anti-personnel & EO Sensors - Dazzlers



4 meter diameter beam at 1 km

8 meter diameter beam at 2 km



HAZARD DISTANCE (NOHD)

VISUAL EFFECTS

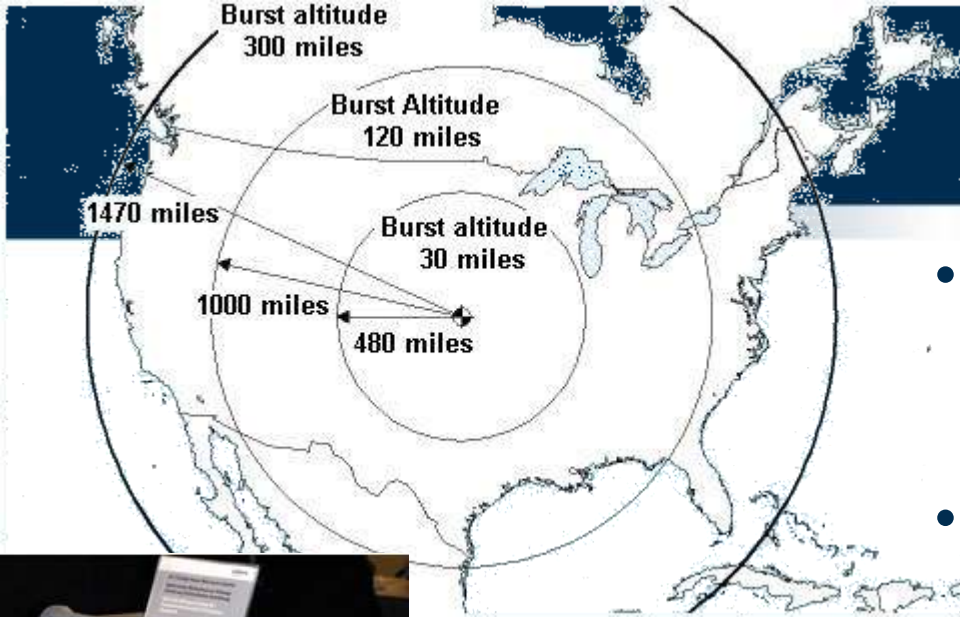


AFTERIMAGE
FLASH BLINDING
NAUSEA

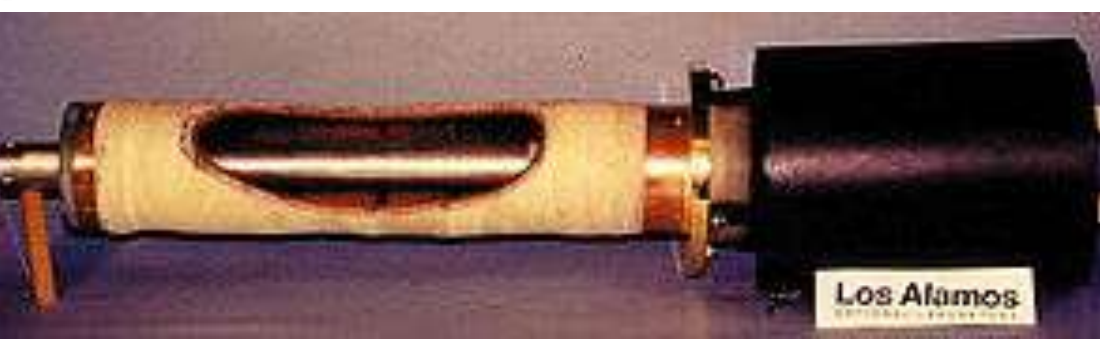
GLARE

STARTLE

Electromagnetic Pulse (EMP)

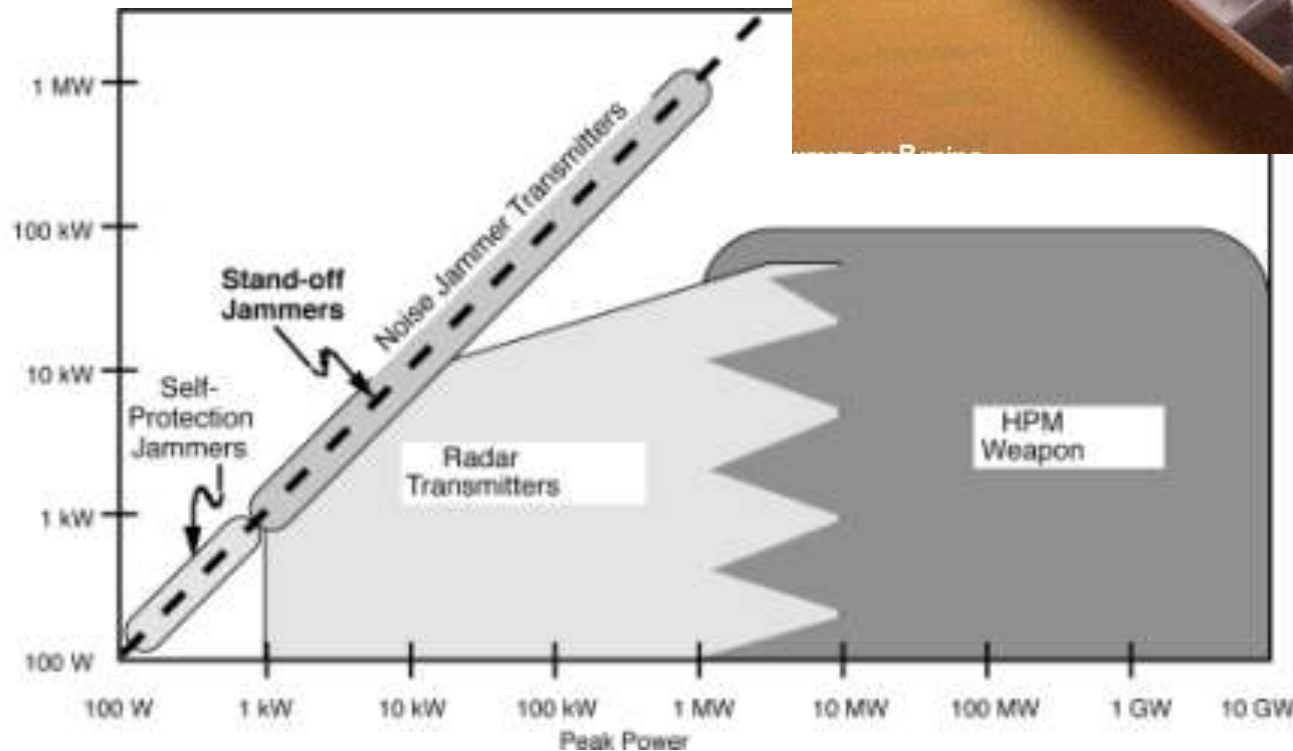


- EMP is a burst of electromagnetic radiation
 - Nuclear explosion
 - Suddenly fluctuating magnetic field
- Couple with electrical/electronic systems to produce damaging current and voltage surges
- High Altitude EMP (HEMP)
 - Non-Lethal
 - Ionosphere
- Non-Nuclear EMP (NNEMP)
 - Explosive
 - Non-Explosive

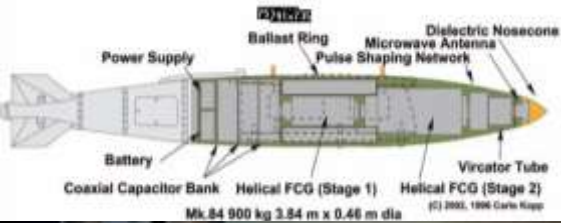


RF Weapons

- Difference between RF Jammers and HPM weapons



RF Weapons

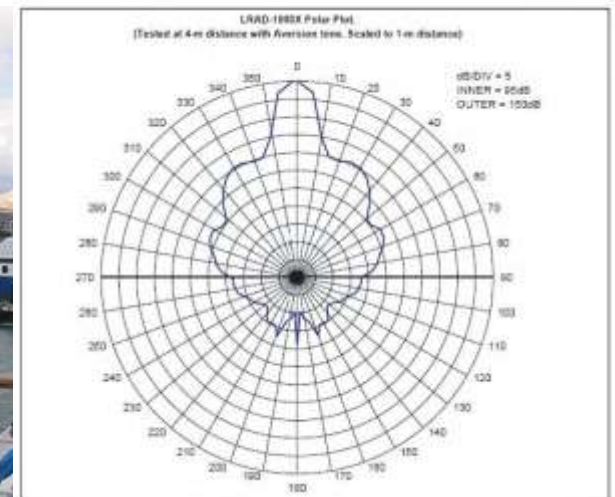


- Wave-shaping circuits and microwave generators are added for optimal coupling into the target
- Non-Lethal Disabling Technology (NLDT)
- Two classes:
 - High Power Microwave (HPM) (incl. mmW)
 - Ultra-Wide Bandwidth (UWB)
- Frequency – 50 MHz to 100 GHz
- Power up to 40 GW



Acoustic Weapons

- Not very effective as a weapon
- Useful for crowd control because it can be used as a direction public address system
- Can cause permanent damage at close proximities
- Increase effectiveness by combining sound and light - stimulate two sensors simultaneously



Conclusion

- Laser technology is mature as is HPM in some cases
- Lasers high precision, but LOS only
- HPM broader beam – Non-LOS capability
- Directed-energy technologies can offer a range of applications, from crowd control to disabling an enemy's electronics to performing destructive strikes at the speed of light with little or no collateral damage
- With improvements in weapons, platforms and missiles Electronic Protection (EP) measures, combined with the missile trends towards higher velocities and multi sensors, DEW is the most viable attack solution
- Platforms, systems and personnel must be able to survive and continue to perform their missions, even in the presence of intense microwave and laser radiation – this will effect both equipment, doctrine and training



Thank You

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