

# **DIRECTED ENERGY WEAPONS**

## **Non-Lethal Warfare**

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# Raytheon Missile Systems

• 10,361 Employees



**Air-to-Air**

- AMRAAM
- ASRAAM
- Sidewinder
- AIM-9X



**Strike**

- UK-1248
- Paveway
- JSOW
- Tomahawk
- ACM
- HARM / HTS(E)
- Maverick



**Land Combat**

- Stinger
- TOW 2A / 2B
- TOW F&F
- Javelin
- BAT- Seeker



**Surface Navy Air Defense**

- STANDARD Missile
- LASM
- ALAM
- RAM
- LEAP
- Phalanx
- ESSM
- Navy TBMD
- SEA RAM
- Sparrow



**EKV & Projectiles**

- EKV
- ERGM
- Excalibur (XM982)
- AGS - LRLAP



**Ballistic Missile Defense Advanced Programs**

- AIT Sensor Technology
- Advanced KV Technology
- ADLT



**Directed Energy Weapons**

- HPM
- HEL

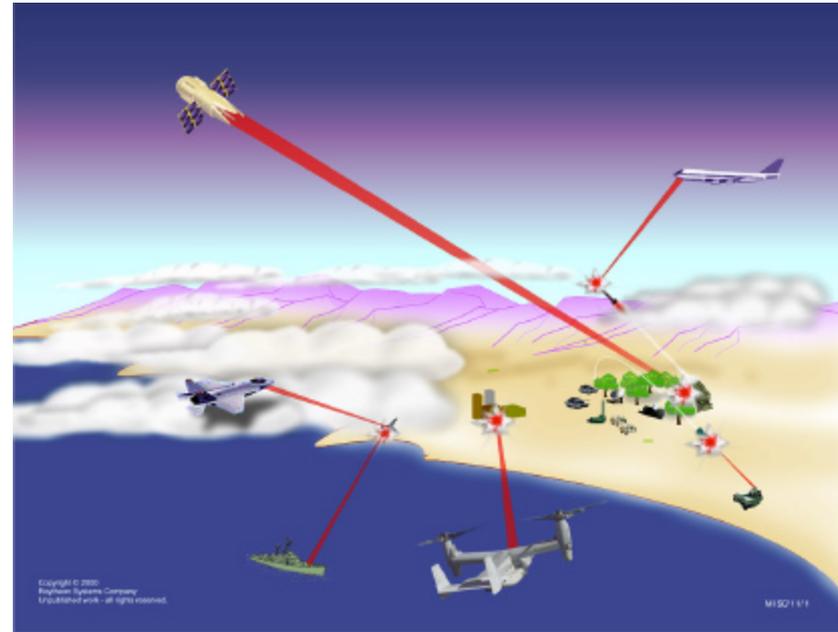


**Advanced Programs**

- NETFIRES
- EGBU-15
- TERM
- AT3
- AGS
- APKWS
- FCS
- DASSL
- MQM
- SST

# Directed Energy Weapons - A Leap Ahead Technology -

- **Speed-of-Light Delivery**
- **Rapid Servicing Rate**
- **Line-of-Sight Maneuverability**
- **Surgical Precision (HEL)**
- **Broad Area Coverage (HPM)**
- **High Lethality**
- **Measured Response**
- **Low Cost-per-Kill**
- **Will Supplant Traditional Weapons (Offensive/Defensive)**



**Ablation of Steel with  
1 mm Pulsed HEL  
- A Bullet of Light -**



**RF DE  
Enabling New Tactics**



# Raytheon Builds RF DE Systems



**Active Denial Demonstrator  
(In The Field Dec 00 – Oct 01)**

- **Sponsored by JNLWD & AFRL**
- **Demonstrations, Effects by AFRL**

## Active Denial Systems

- **Non-Lethal Military Force**
- **Platform Independent**
- **Causes Non-Lethal Intolerable Pain**

## Successful Demonstration

- **Necessary Power Density at Range**
- **Repeatable, Reliable Performance**
- **Stabilization/Performance in Wind & Snow**

## ACTD Approved

- **HUMVEE application**
- **Repackaged**
- **Favorable ops utility assessment**

## Warfighter Benefits

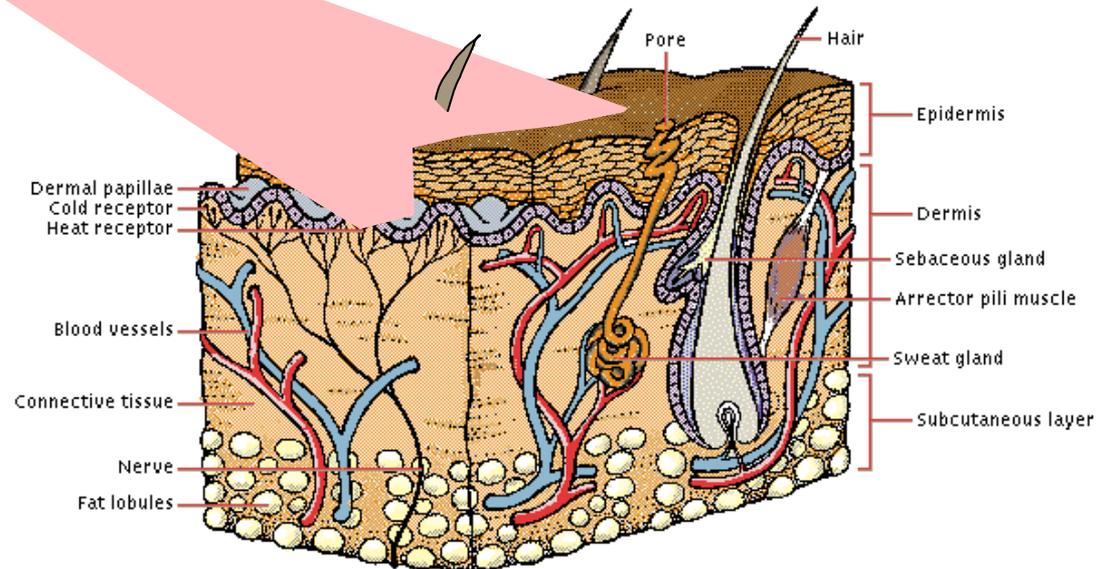
- **Defuse Situation Through Non-Lethal Means**
- **Offensively Shape Battlespace**
- **Justify Timely Use of Lethal Force**
- **Avoid Collateral Damage**

# How Active Denial Works

Millimeter Waves Heat Skin Causing  
Thermally Induced Intolerable Pain

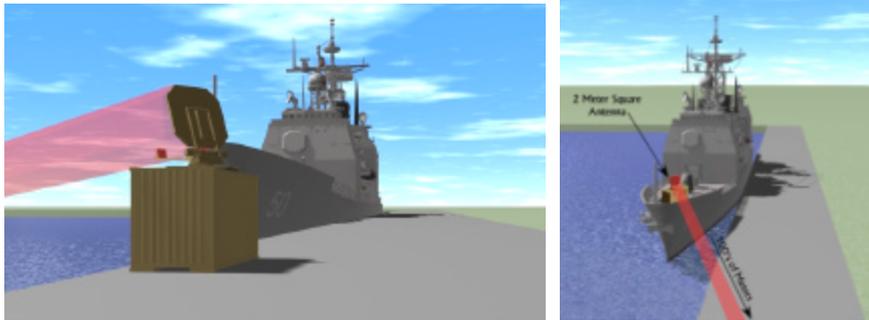


Skin Penetration  
is ~ 1/64<sup>th</sup> of an Inch



# Active Denial Applications

## Naval Harbor Defense



## Marine Force Protection Embassy Defense



## Air Force Airborne Applications



## Army/Marines Urban Warfare



Military Operations in Urban Terrain (MOUT)

# From The Receiving End

**“All the glossy slide presentations in the world cannot prepare you for what to expect when you step in the beam.”**



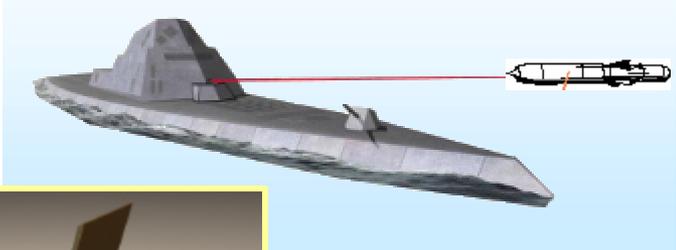
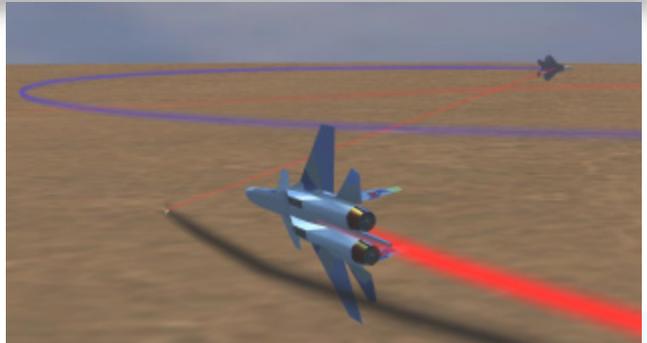
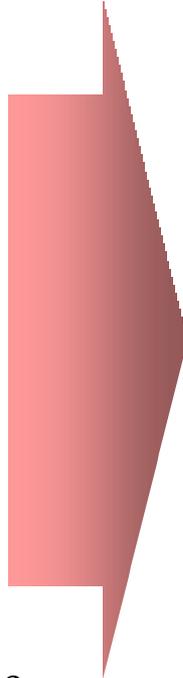
Flag Officer's Comment After  
Experiencing Effects at  
Significant Range



# DEW Changes The Game...



Response at the *speed of sound - Mach 1*



Response at the *speed of light - Mach 1x10<sup>6</sup>*

“Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.” - Douhet