



# USA AMCOM

U.S. Army Aviation and Missile Command



## *ENABLING TECHNOLOGIES FOR MISSILES AND ROCKETS*



*Presented to*

*The 2<sup>nd</sup> Annual  
Missiles and Rockets  
Symposium*

*Presented by*

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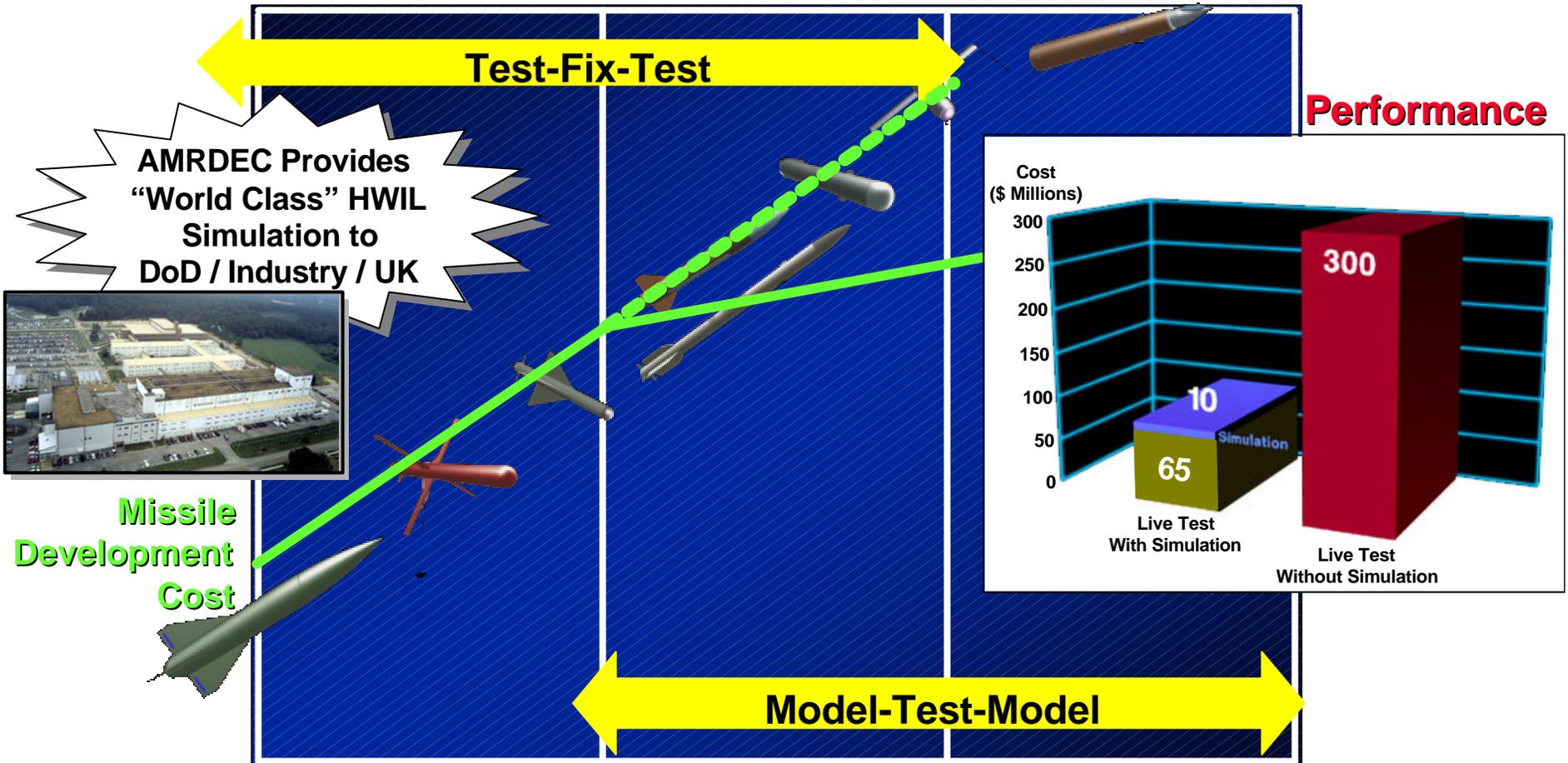
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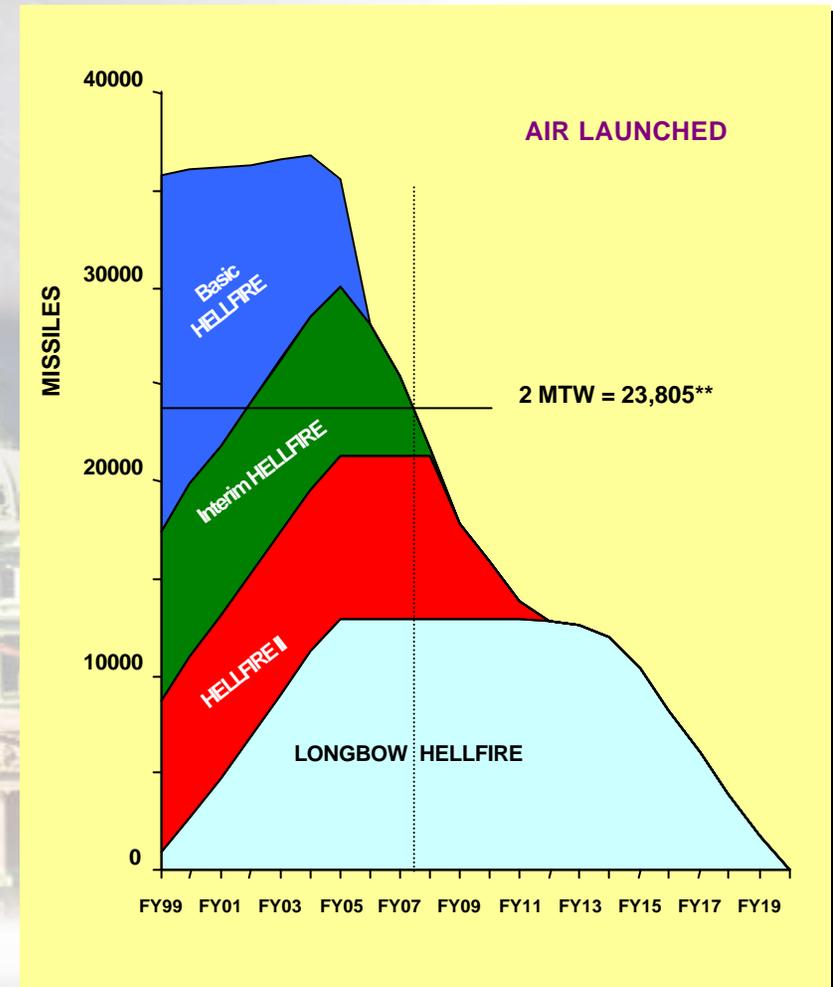
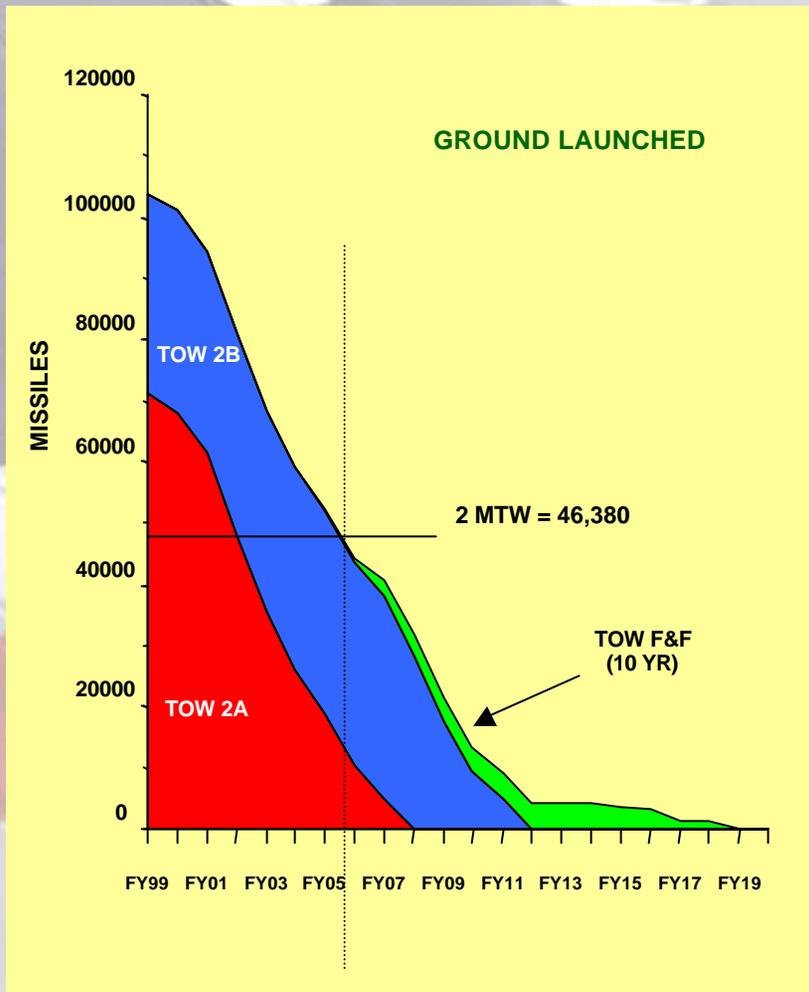
# Hardware in the Loop Simulation A Powerful Tool for Simulation Based Acquisition



**Simulation Based Acquisition Reduces Development Cost**

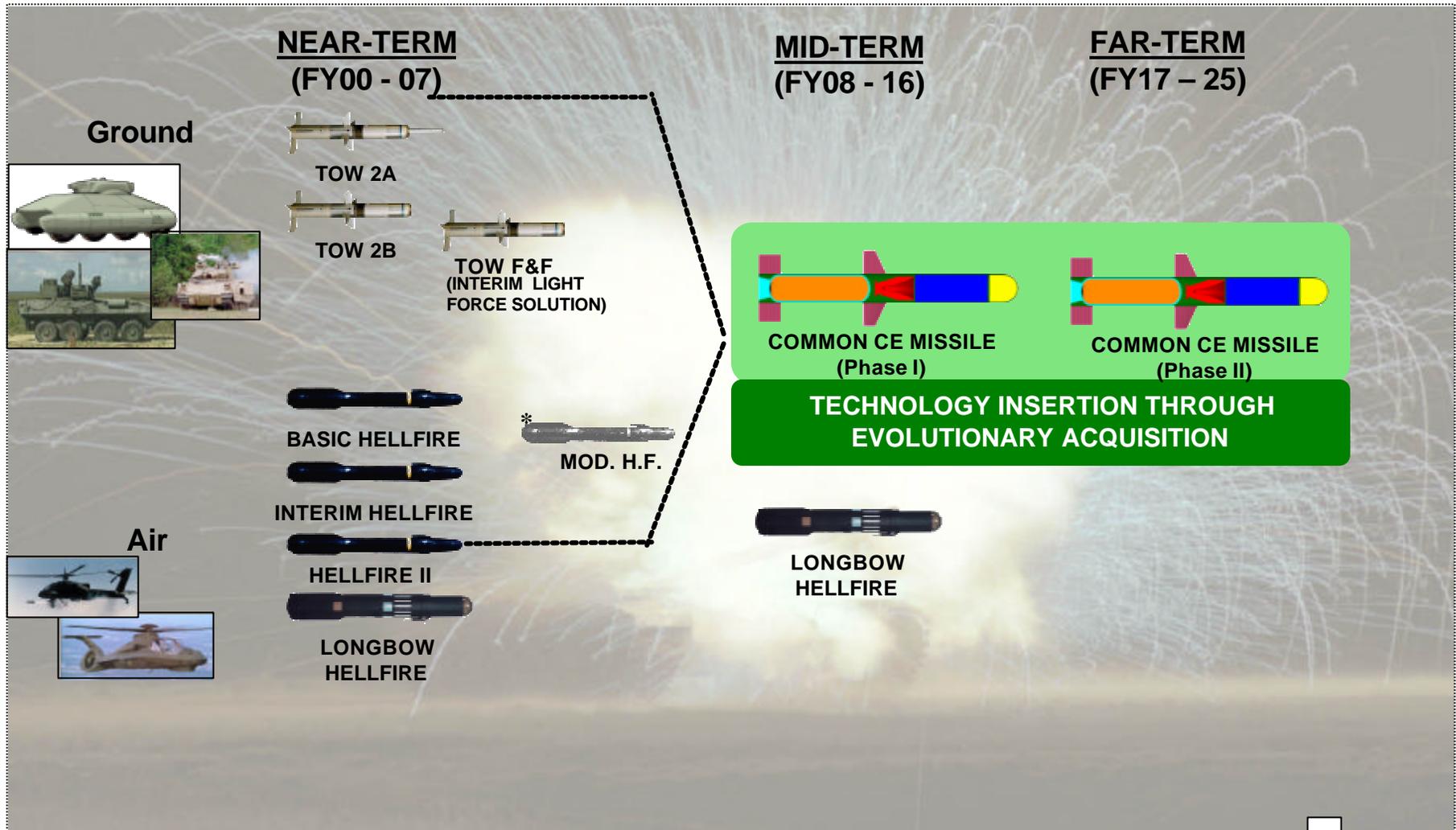


# AGING MISSILE INVENTORY





# EVOLUTION OF MANEUVER & AVIATION MISSILES



\* Will be executed as part of CM Program.





# COMMON MISSILE ENABLERS/LEVERAGING TECHNOLOGY

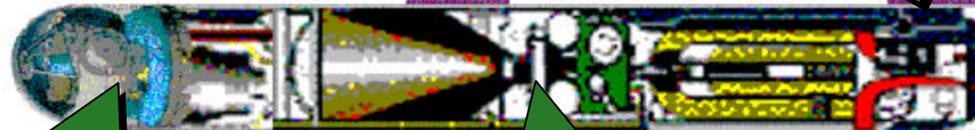


## Platform Integration

- AMRDEC Common Launcher
- AMRDEC Common Fire Control
- Future Combat System (FCS)
- Legacy Platforms

## Propulsion

- DARPA NETFIRES-Pintle, Dual Pulse
- AMRDEC FMTI-Gel
- NAVY- Pintle
- NASA - Non-Carcinogenic Fuel



## Seeker

- AMRDEC FMTI (FPA)
- DARPA NETFIRES (SAL/FPA)
- ARDEC TERM (SAL/MMW/FPA)
- USAF - IR CM Hardening

## Warhead

- ARDEC
  - Short Stand-off Warhead
  - ADV Warhead
  - GEN2 EFP

**Aggressively Seeking All Technical Opportunities  
Across Government / Industry Spectrum**



# COMMON MISSILE PERFORMANCE PAYOFFS

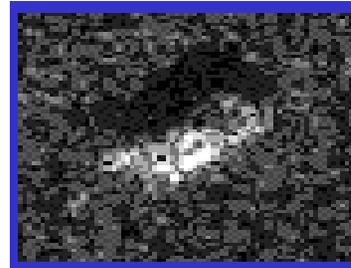


## Multimode Seeker Technology

- Selectable multi-spectrum sensors provide
  - expands operational effectiveness.
  - improved countermeasure performance.
  - greater adverse weather capability.
  - increased detection & acquisition.
- Enables sensor fusion technology (leap-ahead).



Semi-Active Laser  
**SAL**



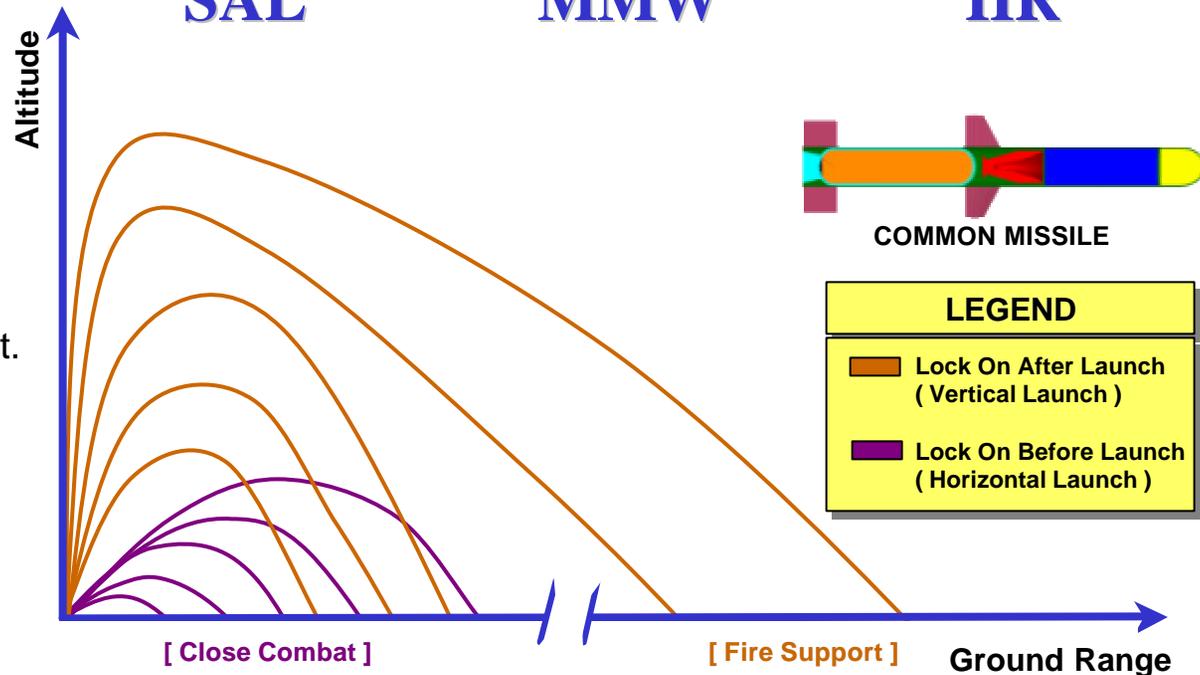
Millimeter Wave  
**MMW**



Imaging Infrared  
**IIR**

## Controllable Thrust Propulsion

- Enables programmable mission profiling through fuel management.
  - scenario specific (*range, target...*).
  - tailorable flight profile (*TOF*).
  - extendable maximum range.
  - accommodates multi-launcher requirements (*horizontal & vertical*).





# NetFires System Concept



## New Military Capability

- Immediate firepower
- 5x-10x kills per ton vs current ordnance
- Large zone of influence
- Multimode seekers
- In-flight targeting
- Duration weapon



## Family of Missiles



- Loitering Attack Missile (LAM)



- Precision Attack Missile (PAM)  
(Others possible)

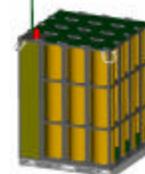
## Designed for Deployability

- Logistic efficiency through containerization
- No platform or crew required



## Low Cost

- Reduced personnel and vehicles  
- LCC reduced > 50%
- CAIV design process
- Commonality of components and assembly



## Modular Vertical Launch

- Self locating / orienting
- Unmanned operation
- Not platform specific
- Can be vehicle appliqué

**Containerized vertical launch provides immediate heavy firepower for early entry forces**



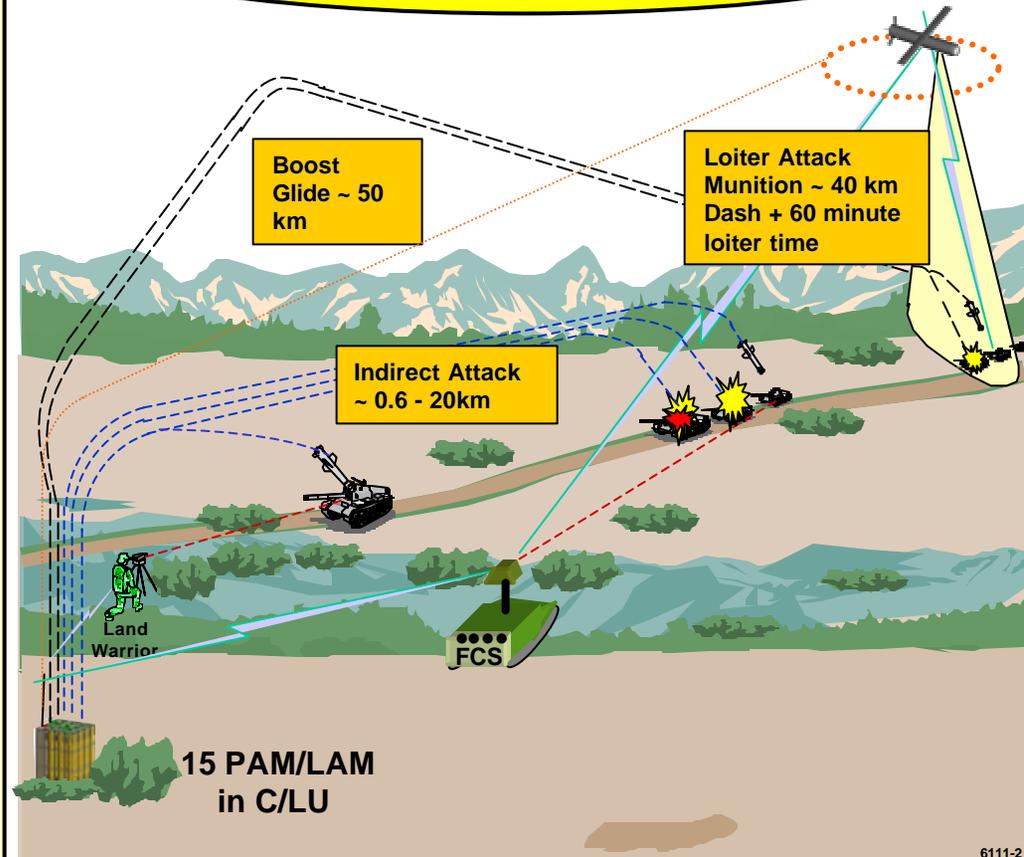
# NetFires Goals in FCS



## Demonstrate two LOS/NLOS weapons

- Rapid Response PAM (“virtual direct fire”)
  - Short time of flight in “direct fire” mode (100s/20km)
  - Multimode terminal guidance
  - Low cost configuration
  - LOAL to 50 km
- Hunter Killer LAM
  - 3-D LADAR seeker w/ATR
  - Significant loiter
  - Multi-mission including BDA
  - Can update / coordinate PAM/LAM attacks
- Common features
  - GPS/INS guidance
  - Variable propulsion
  - Terminal guidance
  - Midcourse update through networked 2-way data link
- Platform independent launcher
- Container command and control

This fundamentally  
“reengineers close combat.”





# NETFIRES



## TECHNICAL CHALLENGES

- **Networked Missile Communications :**
  - **Line-of-Sight and Range Limitations**
  - **Performance in Presence of Jamming Environment**
  - **Bandwidth Sharing**
    - **In intense communications environment (voice & data)**
    - **Imagery from Multiple Missiles in Flight**
- **Distributed automated fire control:**
  - **Coordination within FCS and Objective Force C3 Architecture**
  - **Techniques to employ networked NLOS remote robotic fires**
- **Cooperative engagements and target acquisition:**
  - **Methods for missile engagements**
    - **PAM + LAM, PAM/LAM counter air, PAM/LAM + UAV, LAM MTI, LAM counter ECM, AJ, etc**
  - **Optimization of Missile Sensor Package and ATR./ATA for targets in Clutter**
- **Command /Launch Unit (C/LU) and platform integration:**
  - **Techniques for integrating C/LU into the force**
    - **(Air assault, HMMWV, fighting vehicle, logistics and transportation)**



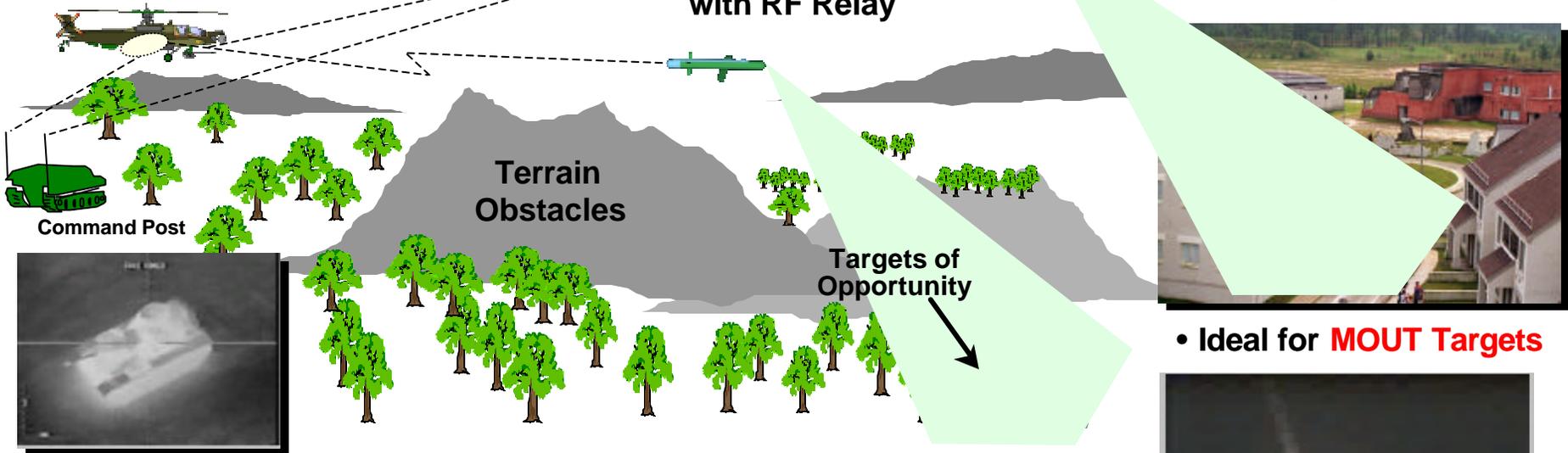
# Loitering Attack Munition for Aviation (LAM-A) (NETFIRES DERIVATIVE)



Helicopter-Launched Long-Range Precision  
Strike Munitions for the Objective Forces

Optional UAV  
with RF Relay

• **Joint Program** with  
DARPA Networked-  
Fires LAM



• **Ideal for MOUT Targets**



• **Launchers:**

- Apache
- Comanche
- Cobra
- Future Rotary Wing Platforms (Manned or Un-manned)

• **Increases Helicopter Standoff:**  
40-60 Km

- **Turbojet Engine** - Optimized Speeds
  - Search / Combat ID
  - Loiter / Attack / BDA
- **Networked RF Datalink** for Fast Target Image Updates and BDA
- **In-Flight Re-Direct** / Target Override / Regret Avoidance
- **FY03 Transition** to Aviation Hunter-Standoff Killer ACTD

- **Surgical Kill** at Long Range
  - High Pk – Minimizes Collateral Damage
- **Meets Joint Common Missile Block II Objective Loiter and MITL Datalink Requirements**



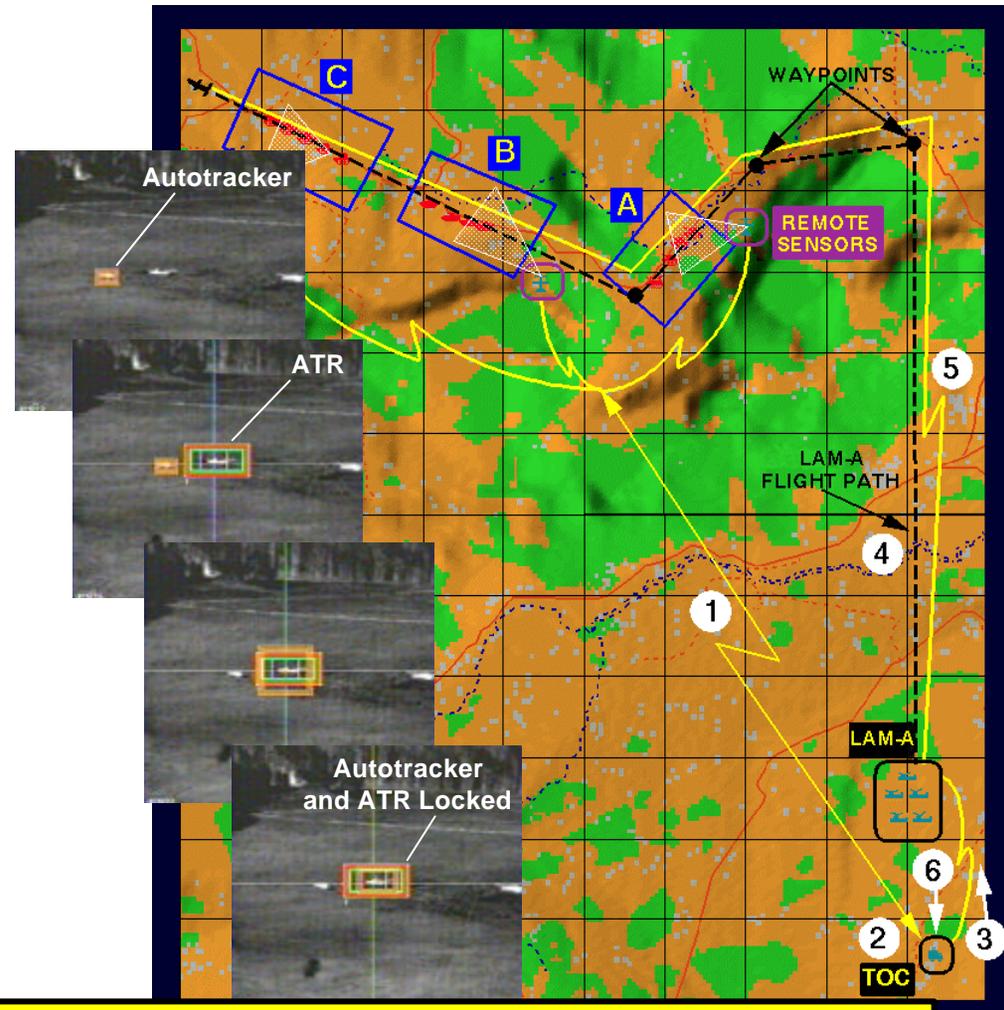
# LAM-A

## Warfighting Impact



### Need for LAM-A based on High Apache Attrition in Wargame Analysis

- **40-60 Km Range** Covers Aviation Operational Area of Responsibility
- **Enhanced Objective Force Crew Survivability** – Greater Standoff Range for Helicopter Launch Platform
- **Non-Direct Flight Paths** for High Target Detection Probability
- **Minimized Timelines** for Targeting to Accelerate Battle Tempo
- **Built-in Loiter Capability** for Fast Targeting / Combat ID / BDA on Targets which may be Fleeting
- **Real-time ATA / ATR Target Cueing** Reduced Gunner Workload
- **Missile Imagery** Transmits to Launcher, Airborne Commander (A2C2S), or Forward Observer over Tactical FCS Network
- **Enhanced Loss Exchange Ratios**



**LAM-A Serves as Eyes for Helicopter Forces in Areas Where Low-level Flight is High Risk.**



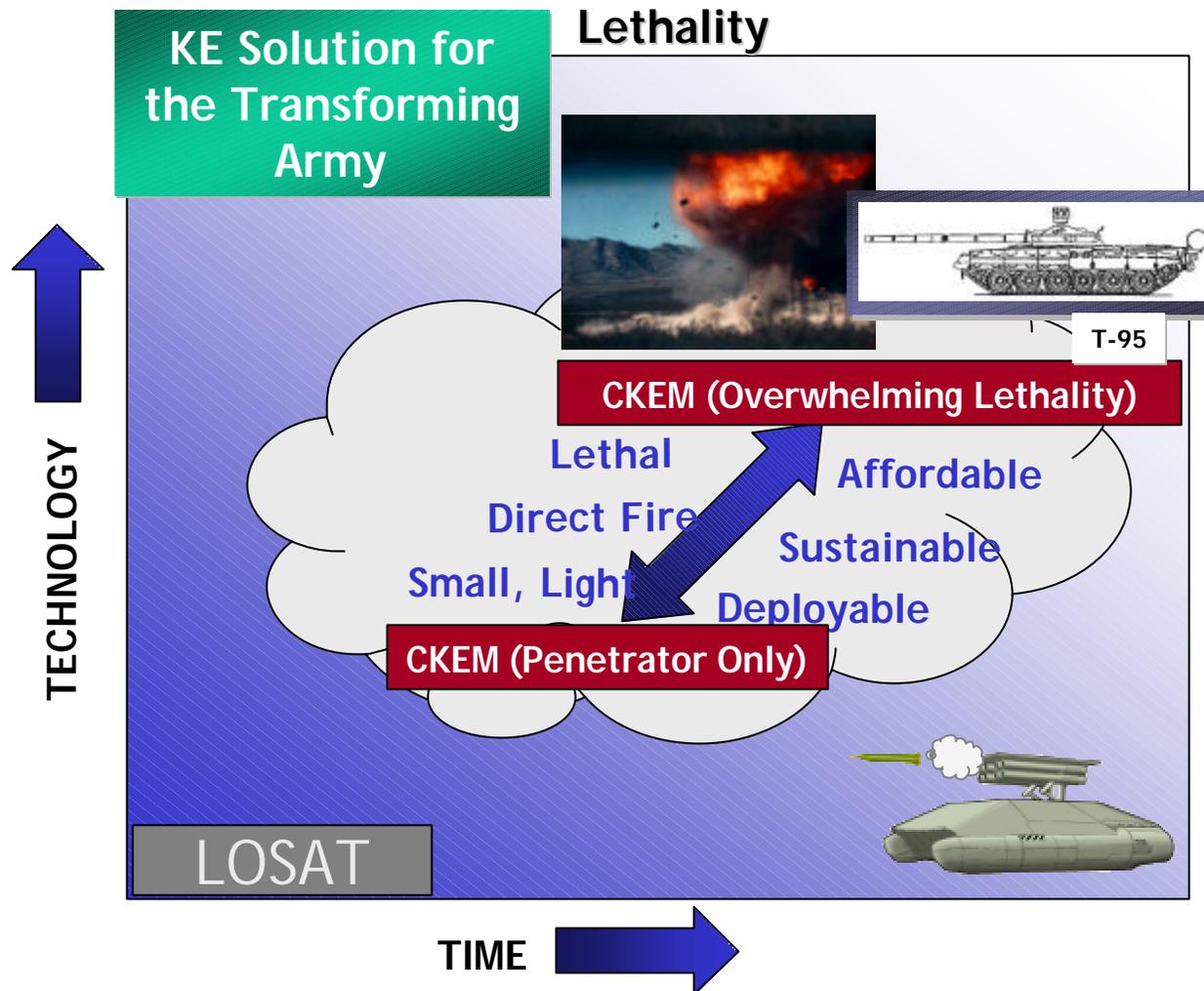
# FUTURE COMBAT SYSTEM AND THE FUTURE TRANSPORT ROTORCRAFT DILEMMA



- Future Combat System weight is determined by the C-130 lift capability ( Max 20 tons)
- Critical vertical envelopment operations require the FCS to be transportable by rotorcraft
- Cost of the FTR for 20 ton FCS lift is estimated at \$100 Billion
- Improvements to existing heavy lift rotorcraft (CH-47F +) will allow about 10 tons of lift
- Achieving a 10 ton FCS is strongly dependent on minimizing the weight of the main anti-armor weapon system

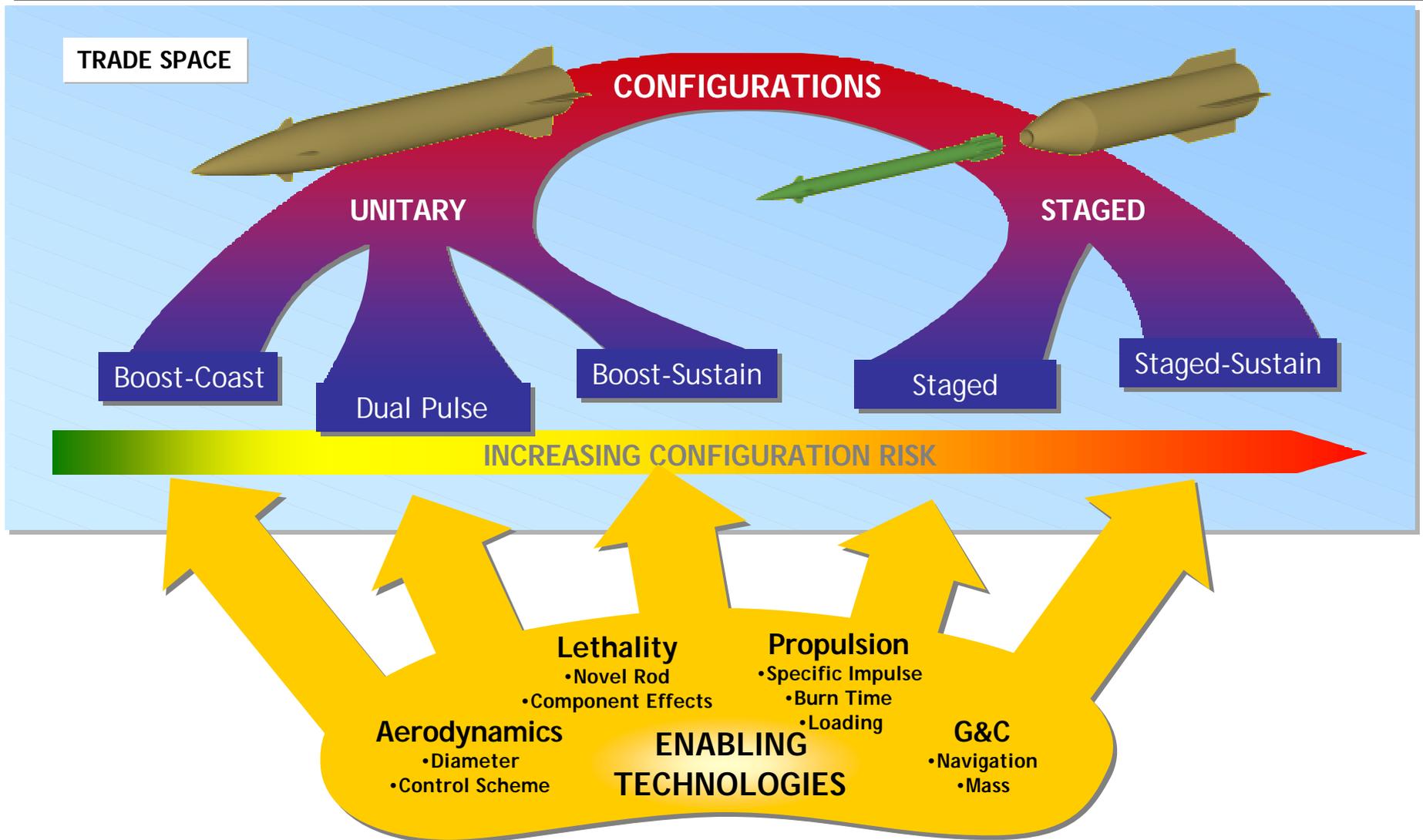


# CKEM Approach



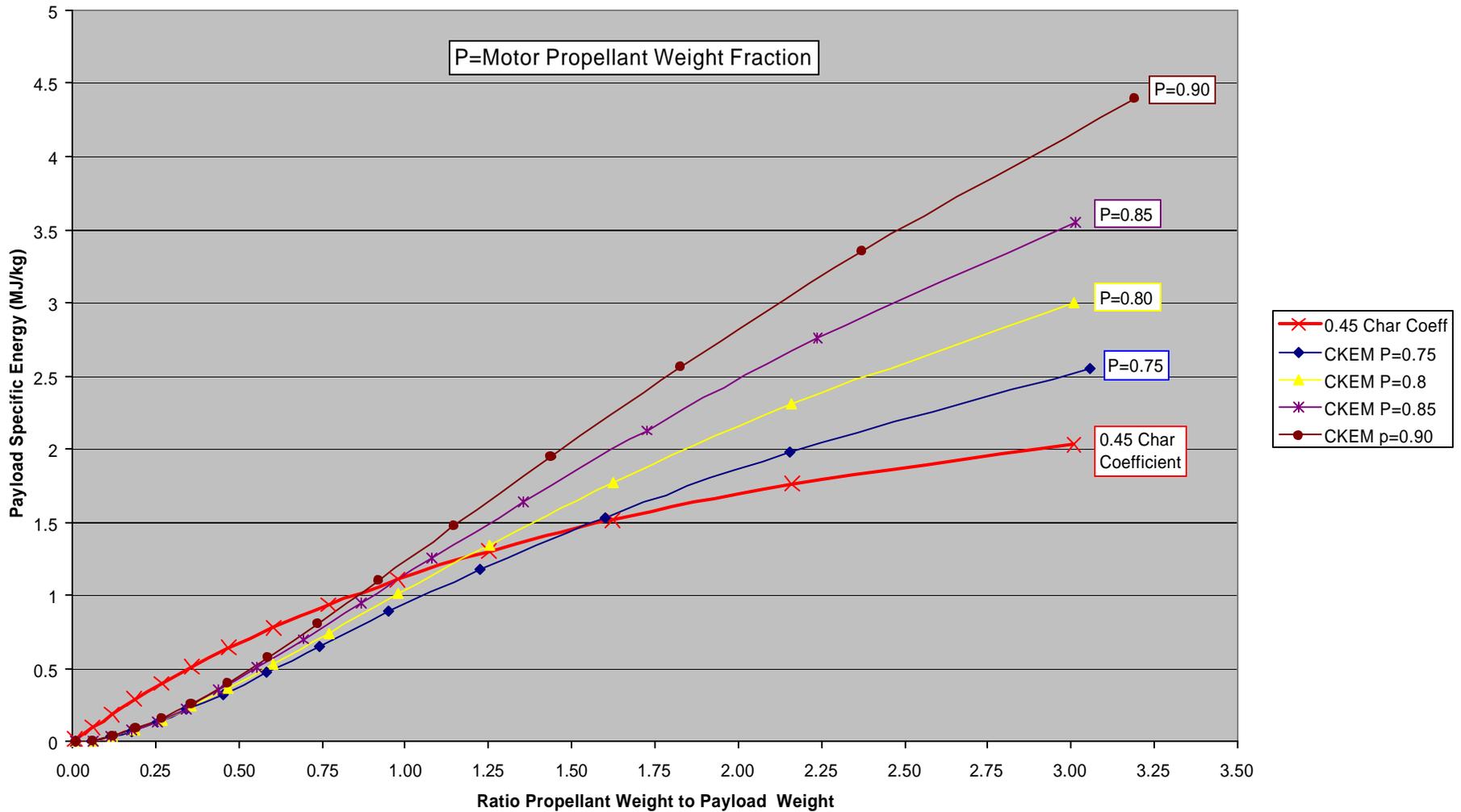


# Trade Study Hierarchy





# Payload Specific Energy Comparison

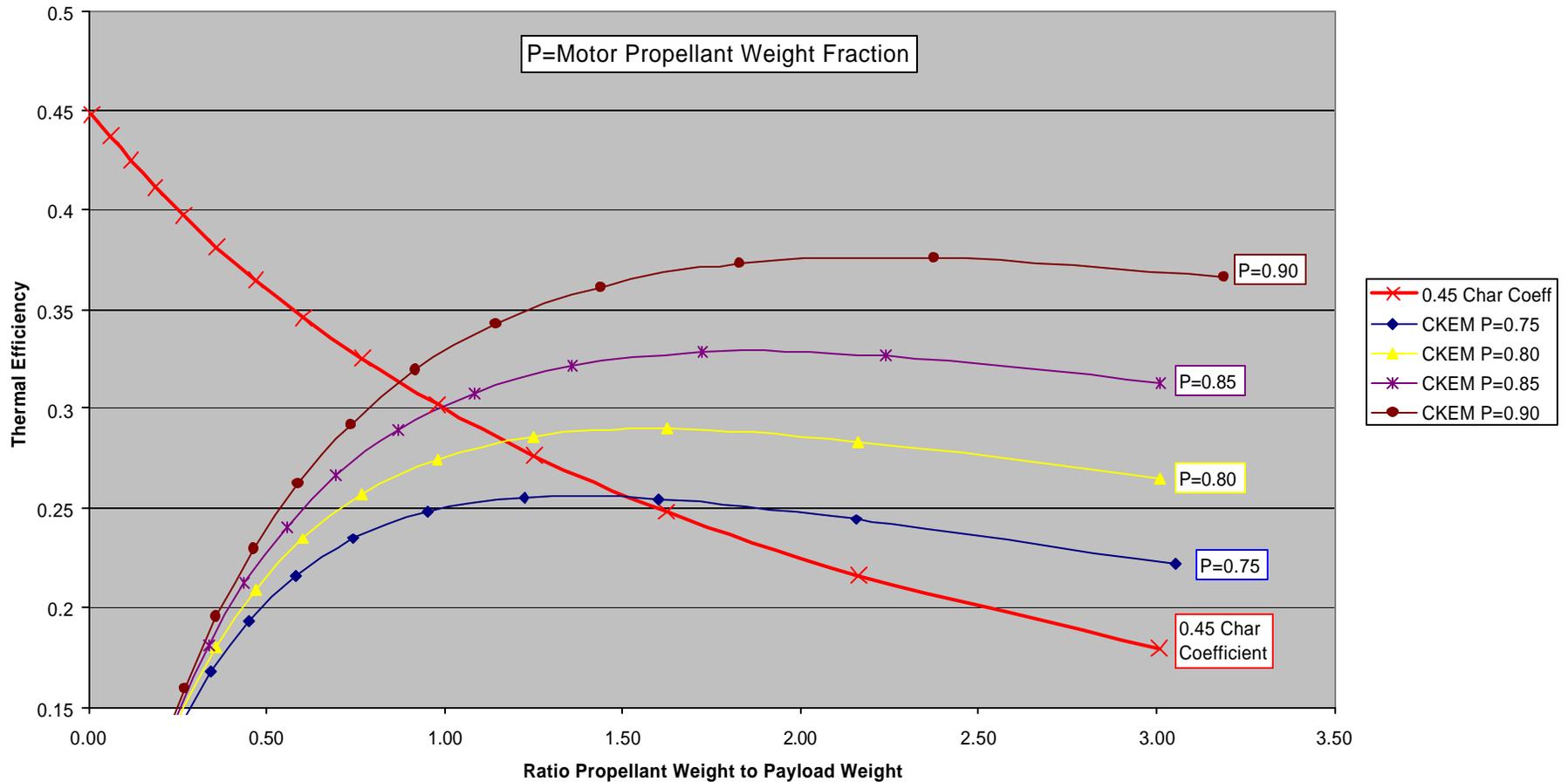




# Thermal Efficiency Comparison



Fraction of Propellant Energy Converted To Payload Kinetic Energy





# Conclusions for CKEM VS Canon for the FCS



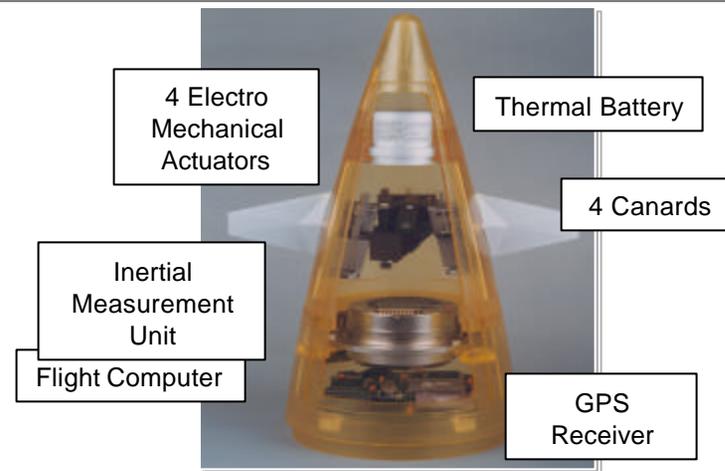
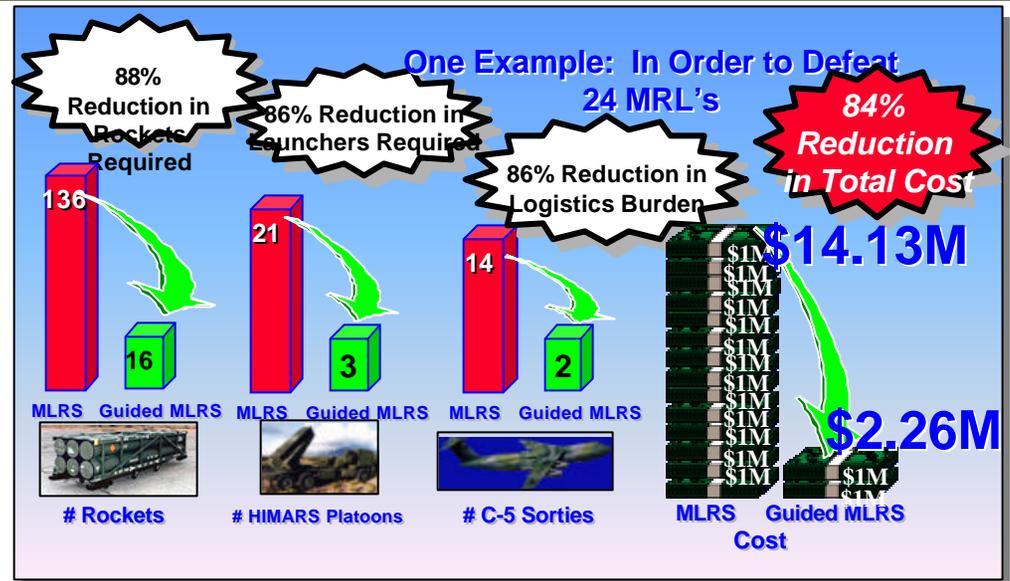
- **Given:**
  - **Munition weights per MJ of penetrator energy are approximately equal**
  - **Missile Launcher and Autoloader are comparable within a few hundred Kg**
- **Big Difference is:**
  - **Weight of the Cannon**
  - **Weight of the Cannon Mounting and Recoil System**
- **Demand for Robust Overmatch Capability and Transport Capability by C-130 and Heavy Lift Helicopter:**
  - **Places premium on Lightweight Armament System**
  - **Requires substantially greater than 120 mm Cannon equivalent performance**



# The Guided MLRS Role



- GMLRS is fired from C-130 Transportable HIMARS
- Use of FCS Vehicle Optional
- Highly improved accuracy (2.1 meters @ 49Km)
- Order of Magnitude Reduction in Logistics Burden
- Guidance Section is compact, simple, inexpensive





# Summary



- Transformation is presently focused on reducing logistics burden via the Future Combat System
  - The role of aviation and the FTR is yet to be developed
- Precision Tactical Munitions must play a major role
  - Munition probable kills per logistic ton, plus high favorable Loss Exchange Ratios will be critical metrics
  - Precision Missile Systems are essential to achieve a “Responsive, Deployable, Agile, Versatile, Lethal, Survivable, Sustainable” Transformed Army