

SPECIAL REPORT AMR-AS-05-01

# 2005 “BLUE BOOK” SCIENCE AND TECHNOLOGY PROGRAM COMPENDIUM

Advanced Science and Technology Directorate  
Aviation and Missile Research, Development, and  
Engineering Center

April 2005

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# Report Documentation Page

*Form Approved  
OMB No. 0704-0188*

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1. REPORT DATE <b>00 APR 2005</b>	2. REPORT TYPE <b>N/A</b>	3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>2005 "Blue Book" Science And Technology Program Compendium</b>		5a. CONTRACT NUMBER	
		5b. GRANT NUMBER	
		5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)		5d. PROJECT NUMBER	
		5e. TASK NUMBER	
		5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Advanced Science and Technology Directorate Aviation and Missile Research, Development, and Engineering Center</b>		8. PERFORMING ORGANIZATION REPORT NUMBER	
		10. SPONSOR/MONITOR'S ACRONYM(S)	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
		12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>	
13. SUPPLEMENTARY NOTES <b>The original document contains color images.</b>			
14. ABSTRACT			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>UU</b>
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	
19a. NAME OF RESPONSIBLE PERSON			

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## INTRODUCTION

The primary purpose of the “Blue Book” is to provide an accessible and current source of information for use in briefing individuals within the Department of Defense on programs defined in the Aviation and Missile Army Science and Technology Management Information System (ASTMIS). The “Blue Book,” composed of a single chart on each of the programs, is a living document and will be updated as the Aviation and Missile ASTMIS program is revised.

Programs in ASTMIS are funded programs. Thus, the appropriate Program Element (PE) and project reference numbers are provided in the table of contents to show the relationship of funding to the programs. For ease of navigation through the document, the list of program titles in the table of contents is hyperlinked to the corresponding program briefing chart. Immediately following the briefing charts is a list of acronyms and abbreviations used in the charts.

This document has been prepared mainly for use by members of the combat development community. Additionally, those individuals who work as liaisons with the Training and Doctrine Command may find this document a useful source of information during visits.

Point of Contact for additional information regarding the “Blue Book” is Stephen L. Drzycimski, 256-313-1955, [Stephen.drzycimski@us.army.mil](mailto:Stephen.drzycimski@us.army.mil).

# Table of Contents

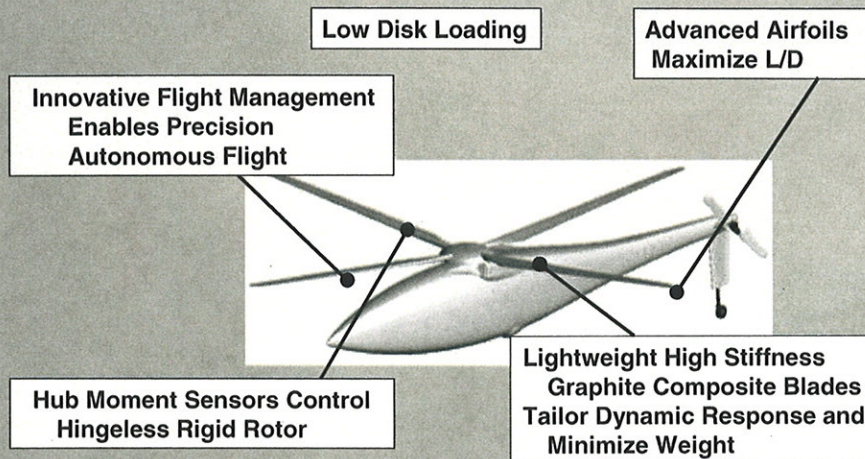
<u>Program Title:</u>	<u>PE:</u>	<u>Project:</u>	<u>Page:</u>
A-160 Hummingbird	63003	313	1
A214 SS-01 Missile Simulation Technology			2
Active/Passive Aircraft Survivability (APAS)	63003	313	3
Advanced Miniature Multi-Role Precision Guided Missile (AMMPGM) Technology	62303/63313	214/703	4
Close-In Active Protection System (CIAPS)	62303/63313	214/550	5
Compact Kinetic Energy Missile (CKEM)	63313	655	6
Cruise Missile Defense Via RF Altimeter Detection	62303	214	7
Deep Throttling Booster	62303	214	8
Enhanced Rotorcraft Drive System	63003	435	9
Extended Area Protection & Survivability (EAPS)	62303	214	10
Fire Control-Node Engagement Technology (FC-NET)	63313	704	11
GMLRS Cargo Round Technology	62303	214	12
Guidance Electronics Miniaturization and Structronics	62303	214	13
Hardened Combined Effects Penetrator Warheads	62303	214	14
Hypersonic Engine Demonstration/NAI	62303	G02	15
IR Seeker CCM for the Laser Threat	62303	214	16
Lightweight Active Rotor Concept (LARC)	62211	47A	17
Line of Sight Smaller Lighter Cheaper (LOS-SLC)	62303	214	18

## Table of Contents (Continued)

<u>Program Title:</u>	<u>PE:</u>	<u>Project:</u>	<u>Page:</u>
Manned-Unmanned Common Architecture Program (MCAP)	63003	436/313	19
Manned-Unmanned Rotorcraft Enhanced Survivability (MURES)	62211	47A	20
MEMS/IMU for Common Guidance	62303	214	21
Micro Controlled Arrays ( $\mu$ CAS)	62303	214	22
Missile Aerodynamics Technology Aero Design, Analysis & Test			23
Missile Propulsion IM Technology	62303	214	24
Networked UAV System Demonstration	63003	436	25
NLOS-LS Technology	63313	263	26
Novel Energetic Materials for the Objective Force	62303	214	27
Passive Variable Area Nozzle (VAN)	62303	214	28
Phased Arrays for Tactical Seekers (PATS)	62303	214	29
Precision Autonomous Landing Adaptive Control Experiment (PALACE)	62211	47A	30
Rotorcraft Drive Systems for the 21st Century (RDS-21)	63003	313	31
Sensor & Electronics P/D for FCS	62705	H94	32
Small Heavy Fuel Engine	62211/63003	47A/447	33
Survivable, Affordable, Repairable Airframe (SARAP)	62211/63003	47A/436/313	34
Uncooled Infrared Technology for Missile Seekers	62303	214	35
Unmanned Autonomous Collaborative Operation	62211/63003	47A/313	36

# A-160 Hummingbird

**Optimum Speed Rotor (Patented)**  
Adjusts RPM 50%-100% to Optimize Performance



## Purpose:

*Provide capability to have a VTOL UAV with Predator-like vehicle performance to provide C4ISR to the legacy and objective forces.*

## Product:

*Six sensor equipped air vehicles with three ground stations. Sensors will include EO/IR and SAR/GMTI packages.*

*Schedule and Cost*

Milestones	FY03	FY04	FY05	FY06	FY07
Phase 0 (AV 001-003) Flight Test	█				
Phase 1 Subsystem Ground Test (less engine & transmission)	█	█	█	█	█
Phase 1 AV Fabrication & Mods	█	█	█	█	█
Phase 1 GCS Fabrication	█	█			
Phase 1 (AV 004-009) Flight Test		█			
Program Reviews		▲	▲	▲	▲

## Payoff:

- **Dominant situational awareness on future battlefields**
- **Persistent stare and companion vehicle capabilities**
- **Class IVb UAV (FCS ORD)**
- **ER/MP candidate**

# A214 SS-01 Missile Simulation Technology



**Purpose:**

*Provide capability to produce detailed hardware-in-the-loop simulations with accurate and realistic target signatures and sensor scene backgrounds to support development, production, and fielding of future missiles.*

**Product:**

*Technology and tools (hardware and software) to permit accurate evaluation of missiles and operational concepts by means of hardware-in-the-loop simulations.*

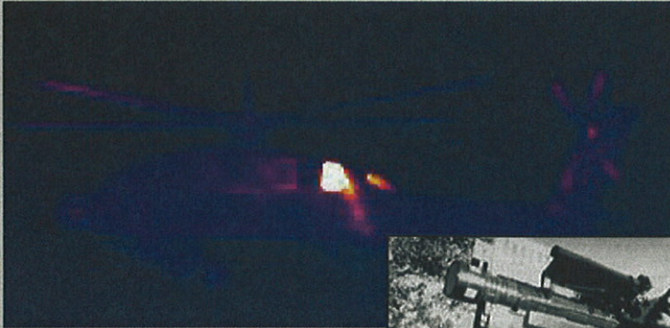
**Payoff:**

*Improved, cost-effective capabilities for development, production, and fielding of future missiles and operational concepts. Transition into use in simulation facilities immediately as the technology and tools become available.*

**SCHEDULE AND COST**

Milestones/Tasks	FY05	FY06	FY07
• PERLSHELL/LINUX Script for ASC Facility Control Programs	[Green bar spanning FY05 and FY06]		
• S- and C-Band RCS Prediction Methods and Codes	[Green bar spanning FY05, FY06, and FY07]		
• LADAR and IR Scene Generation Methodology	[Green bar spanning FY05, FY06, and FY07]		

# Active-Passive Aircraft Survivability (APAS)



## Integrated Survivability to Defeat MANPADS

MILESTONES	FY05	FY06	FY07	FY08	FY09	FY10
Develop Adaptive IR Suppressor System	█					
Integrate Passive IR	█					
Integrate Active CM & Threat Warning	█					
Flight Demo				█		

### Objective:

Develop and demonstrate a lightweight, low cost aircraft self-protection suite that is effective in defeating current Man Portable Air Defense System (MANPADS) threats.

### Description:

- Adaptive engine IR suppressor system
  - 75% reduction in exhaust IR signature
  - 3% increase in available engine power
- Super-lightweight thermal insulation
- Multi-spectral airframe coatings
- Lightweight, low cost omni-directional IR jammer (CERDEC)
- CMWS missile warning system
- Small arms & RPG threat warning (RDECOM)

### Approach:

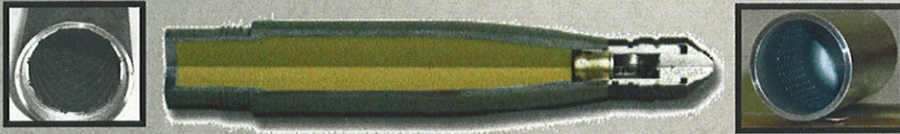
- Reduce aircraft signatures to delay threat acquisition and degrade engagement performance
- Utilize omni-directional jammer to reduce countermeasure latency
- Integrate small arms and RPG threat warning system
- Demonstrate 50% increase in probability of survival against MANPADS threats

### Payoff:

- Increased survivability of warfighter and aircraft
- Transitions to:
  - Intelligent Decision Aiding for Survivability (IDAS)
  - Apache Block III, FY08
  - A-160 Phase II FY08

# Advanced Miniature Multi-Role Precision Guided Missile (AMMPGM) Technology

## Enhanced Multi-Purpose Warhead



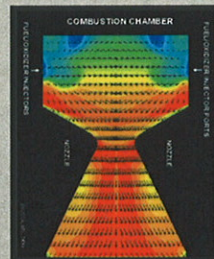
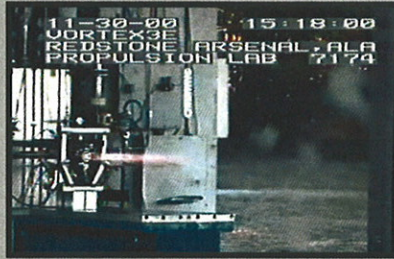
### Purpose:

Develop and demonstrate enhanced blast/frag warhead and extended range propulsion subsystems in support of APKWS Evolutionary Acquisition Strategy.

### Product:

- Mature, fully form factored and integrated enhanced blast/frag warhead and multi-function fuze
- Prototype controllable thrust propulsion subsystem capable of doubling the range in same form factor

## Small Diameter Controllable Thrust Propulsion



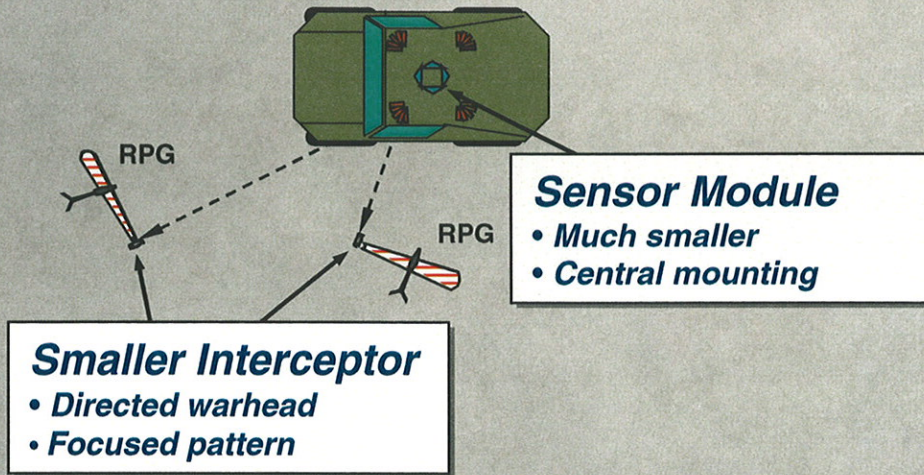
### Schedule & Cost

MILESTONES	ARL	AMRDEC	02	03	04	05	06	07	08
<b>Enhanced Blast/Frag Warhead/Fuze</b>									
• Preliminary Investigation/Test									
• Candidate Evaluation									
• Optimized Design/Test									
• Final Warhead Design/Test									
<b>Controllable Thrust Propulsion</b>									
• System Level Concept Design/Trades									
• Hardware Design/Fabrication									
• Component Test/Evaluation									
• Integrated System Level Test									
• CFD Design Tool Dev/Validation									

### Payoff:

- Increased lethality
- Increased standoff and survivability
- Enhanced blast/frag warhead/fuze transitions to APKWS P3I Program at end of FY05 (PEO Tactical Missile)
- Controllable thrust propulsion transitions to APKWS P3I Program at end of FY07

# Close-In Active Protection System (CIAPS)



## Purpose:

*Increase survivability by providing current and future ground systems with a capability to actively defeat RPG type threats.*

## Products:

- Phase 1 demonstrated prototype able to fit light armored vehicles
- Phase 2 demonstrated prototype able to fit tactical wheeled vehicles
- Validated simulations for tailoring to specific vehicle classes

## Schedule and Cost

Milestones	FY04	FY05	FY06
Demonstrate & Transition Phase I, LAV	█		
Concept Phase II, Tactical Wheeled Vehicle	█		
Design & Demonstrate Phase II Components		█	
Integrate Phase II Prototype on HMMWV		█	
Demonstrate & Transition Phase II for Tactical Wheeled Vehicles			█

## Payoff:

- Protect light vehicles from RPGs fired from ambush without warning
- Specific transitions plans (e.g. transitions to...PEO CSS in FY06 for SDD)

# Compact Kinetic Energy Missile

**Smaller, Lighter, Faster Hypervelocity Missile  
Providing Overwhelming Lethality Against Future Threat Targets**

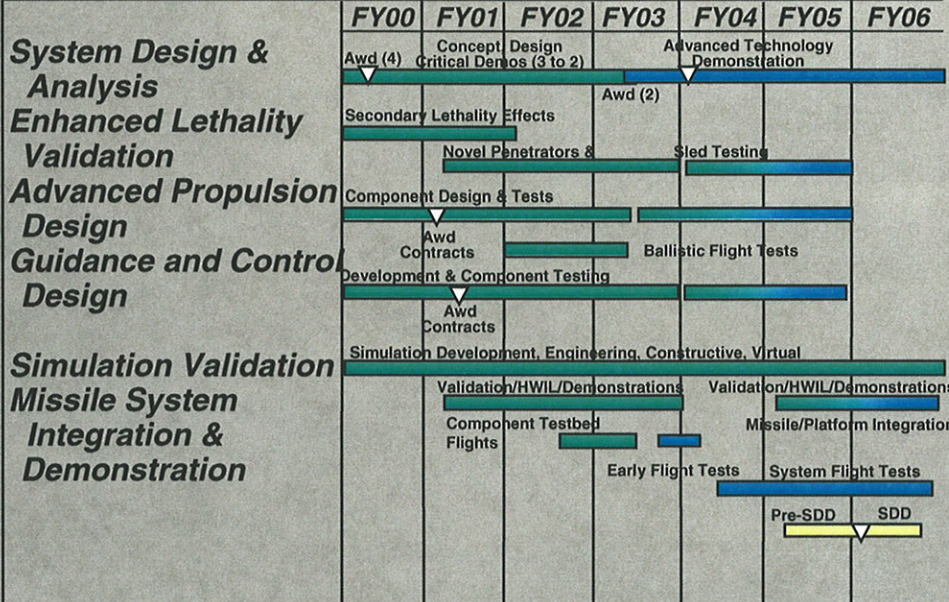
## PACING TECHNOLOGIES

- KE Penetrator/Missile Lethality
- High-g Guidance & Control
- High Performance, Non-Detonable Propulsion
- Missile/System Integration



## Schedule and Cost

### MILESTONES



## Purpose:

Demonstrate “overwhelming lethality” capability with a smaller, lighter, faster kinetic energy missile.

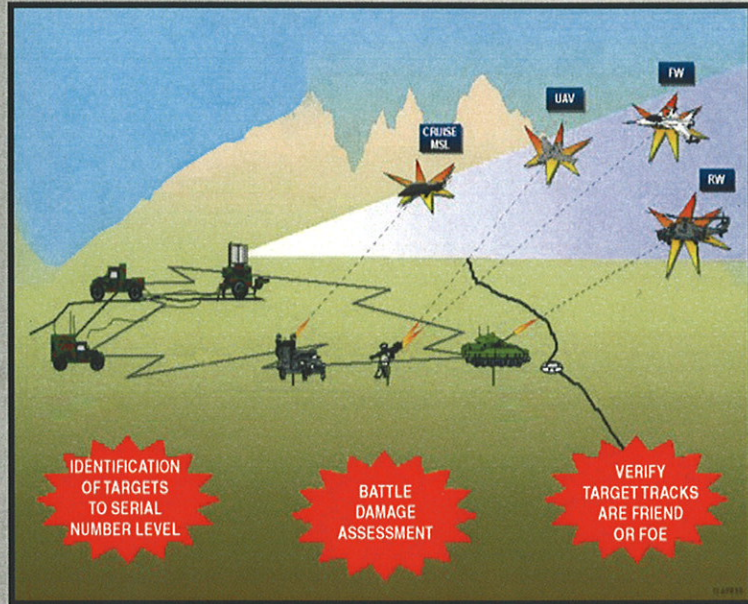
## Product:

- **Direct-Fire LOS Weapon System:**
  - “LOSAT-Like” Lethality at ~ Half the Size and Mass
  - High Pk Over Extended Ranges
    - “Overwhelming effects” (perforation, mass-momentum & energy transfer)

## Payoff:

- “Overwhelming Lethality”
- **Target Set: Advanced Armored Systems (APS, ERA) and Hard Point Targets, Bunkers, and Buildings**
- **Effective Over Extended Ranges**
- **Lightweight Quick Kill**
- **Large Quantity KE Stowed Kills – Rapidly Deployable**
- **Missile Fire on the Move Capability**
- **Platform Compatible with Stryker, FCS/OF, HMMWV**
- **ATD Transitions to CCWS PM**
- **Potential Capability in FCS Increment I**

# Cruise Missile Defense Via RF Altimeter Detection



**Schedule and Cost**

MILESTONES	FY04	FY05	FY06	FY07	FY08
Algorithm Development	█				
Integrate New RF and Signal Processing Components	█				
Demonstrate First Generation Prototype @ Red Flag 05		█			
Prototype Hardware Ready for Experimental Validation					
Detection and SEI Algorithm Improvements			█		

**Purpose:**

*Provide future forces with a highly mobile, highly accurate capability to detect, track, identify, engage, and destroy cruise missiles.*

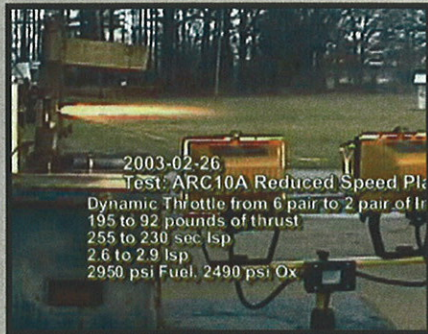
**Product:**

*Two passive RF detection systems capable of detecting, identifying, and tracking CM RF altimeters with sufficient angle and identification accuracy to support firing decisions.*

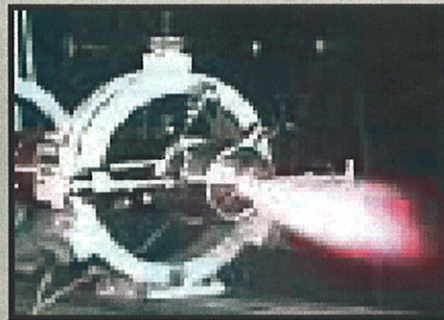
**Payoff:**

- Provide increased maneuver force protection through BVRE capability against CMs and other small targets for limited investment*
- SENTINEL PO in FY06 for SDD*

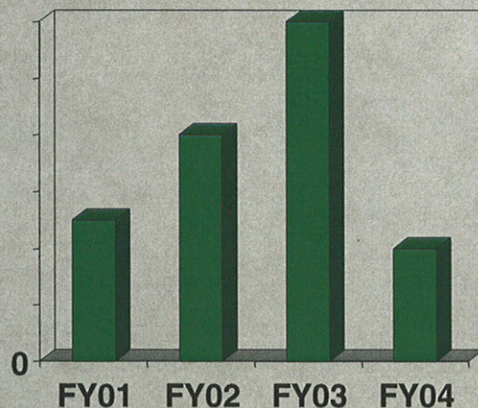
# Deep Throttling Booster



**Throttling Vortex**  
**12:1 Thrust Turndown**



**Throttling Solid**  
**15:1 Thrust Turndown**



## Purpose:

- Provide capability to increase range and flexibility of missile systems within the weight /volume constraints of existing and future Army launch platforms
- Improve insensitive munitions capability

## Product:

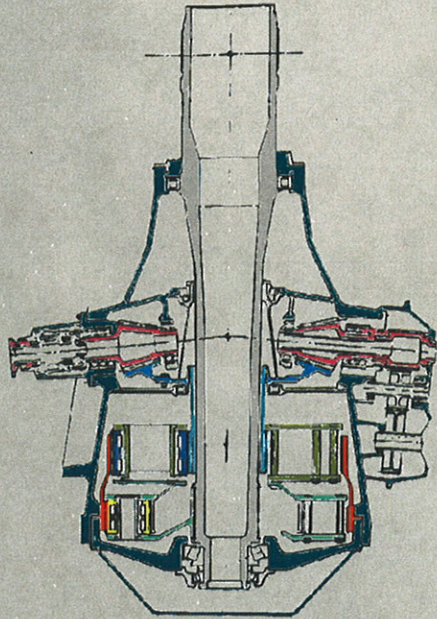
Throttleable gel vortex engine and a throttleable solid with an active variable area nozzle.

## Impact:

- Increased range and mission flexibility (60-80% increase in area coverage)
- Greater standoff enhancing survivability
- Shorter time of flight to intermediate ranges
- Enhanced end game performance
- Transitions to NLOS-LS technology STO supporting Spiral Development (FY04)

***Vision: Survivable, Controllable Thrust Propulsion  
for Future Army Missiles***

# Enhanced Rotorcraft Drive System



## Program Objectives:

*Develop and demonstrate advanced drive system technologies that will provide enhanced, reliable power transmission systems for Army rotorcraft at very low cost of ownership.*

- *Increase Power-to-Weight Ratio 40%*
- *Reduce Transmission Noise 15db*
- *Reduce Production & Maintenance Costs by 30%*

## Technical Challenges:

- *High-speed reduction in a single stage*
- *Reliability of lightweight, highly loaded precision components*

**Schedule and Cost**

Milestones	FY06	FY07	FY08	FY09	FY10
Design	█				
Fabrication		█			
Assembly			█		
Test / Evaluation				█	

## Payoffs:

- *Increased SHP/WT provides A/C with increased range and payload capability*
- *Reduced O&S costs and production costs increase aircraft affordability*
- *Supports manned and unmanned aircraft*

# Extended Area Protection & Survivability (EAPS)

**OBJECTIVE:** Extended Area Protection from Indirect and Top Attack Fires



**Schedule and Cost**

MILESTONES	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Threat Validation	█							
System Analysis	█							
Lethal Mechanism	█							
• Technical Trades	█							
• Demonstration	█							
Interceptor (Shooter)	█							
• Technical Trades	█							
• Critical Tech Demos			█					
Integrated System Demos				█				
System Simulation	█							

**Purpose:**

Demonstrate critical supporting technologies to enable stationary/mobile 360-degree hemispherical extended area protection from direct and indirect fires, including RAM, UAV, and CM threats.

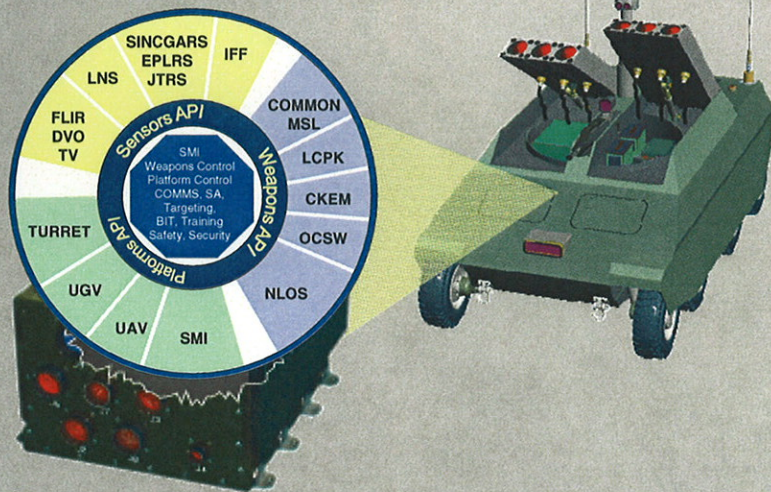
**Product:**

- Demonstration of form factored, low cost, lethal mechanisms to defeat RAM, UAV, and CM threats
- Demonstration of critical supporting shooter, sensor, and fire control technologies, including simulation models
- Demonstration through HWIL and simulation feasibility of integrated system solutions to provide robust area protection

**Payoff:**

- Provides extended area protection from direct and indirect fires, including RAM, UAV, and CM threats
- Reduced logistics and maintenance
- Distributed survivability across the force
- Transitions to EAPS ATD in FY08
- Continuous spiral transition to PM AMDCCS, Counter Mortar System (CMS)

# Fire Control Node Engagement Technology (FC-NET)



## Purpose:

Develop a common Fire Control (FC) system for the Army's Future Combat Systems (FCS) family of vehicles that seamlessly integrates FCS lethality platforms/nodes, sensor nodes, and decision nodes into a highly flexible, tailorable, and responsive networked SoS capable of optimized delivery of effects on target(s).

## Product:

Open application programming interface(s) common multi-weapon technical fire control architecture with real time weapon-target pairing and distributed fire control solutions.

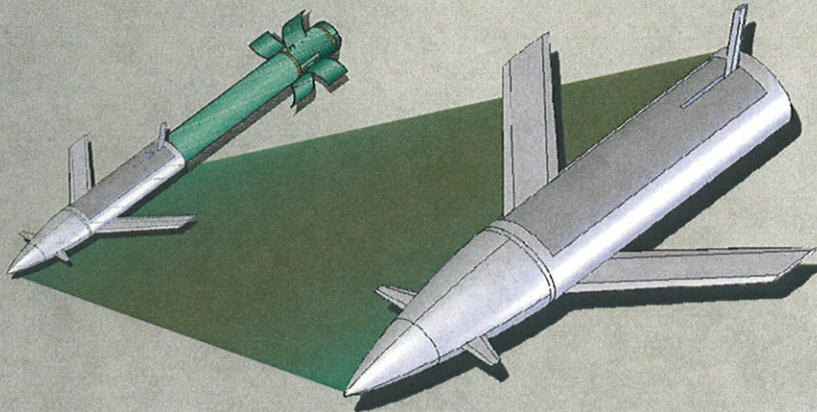
## Payoff:

- Warfighter TWP aid through common HTI application: cross service interoperability, single fire control for multi-missions (indirect/direct fire)
- Lower ownership cost, enhanced lethality and survivability, exploit situational awareness
- Major step towards networked fires and effects

*Schedule and Cost*

Milestones	FY02	FY03	FY04	FY05	FY06
Feasibility Demonstration	█				
Interface Demonstration		█			
Technical Demonstration			█		
Distributed Demonstration				█	

# GMLRS CARGO Round Technology



**Purpose:**

*Provide capability to carry and dispense multiple types of payloads with a common bus.*

**Product:**

- *Demonstrated novel airframe to carry, fly-out, maneuver and dispense multiple payloads*
- *End-to-end simulation with high fidelity cargo round fly-out and maneuvers*

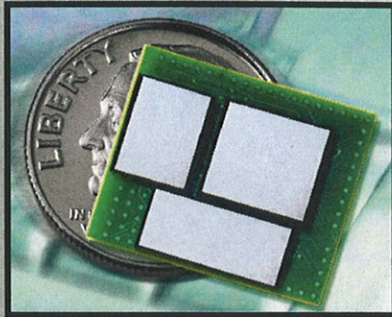
**Payoff:**

- *Extreme commander flexibility (multiple payloads, increased ranges, multiple payload dispense scenarios)*
- *Transitions to PEO Tactical Missiles for PFRMS GMLRS-Unitary through horizontal technology insertion (FY06 For CAD and SDD In FY06)*

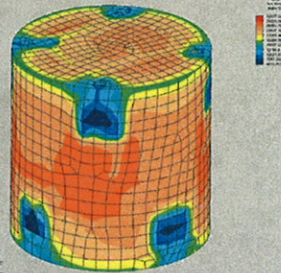
**Schedule and Cost**

MILESTONES	FY 04	FY05	FY06
•System Requirements	[Green bar spanning FY04, FY05, and FY06]		
•Warhead Design	[Green bar spanning FY04 and FY05]		
•Wing Mechanism	[Green bar spanning FY04 and FY05]		
•Payload	[Green bar spanning FY04 and FY05]		
•Separation System	[Green bar spanning FY04 and FY05]		
•Dispenser System	[Green bar spanning FY04 and FY05]		
•Wind Tunnel	[Green bar spanning FY04 and FY05]		
•Guidance and Control	[Green bar spanning FY04, FY05, and FY06]		
•Hardware-In-The-Loop	[Green bar spanning FY04, FY05, and FY06]		
•TM		[Green bar spanning FY05 and FY06]	
•Air Drop		[Green bar spanning FY05 and FY06]	
•Flight Tests			[Green bar spanning FY06]

# Guidance Electronics Miniaturization and Structronics (GEMS)



- FPGA, Microprocessor, EEPROM, DRAM
- Each subcomponent testable
- >400 internal chip-to-chip connections
- 12.4 mm x 14.5 mm package size
- 0.94 mm package height
- 600% smaller; 1000% lighter
- High reliability; high performance



Schedule and Cost

MILESTONES	FY05	FY06	FY07	FY08	FY09
Miniaturized Electronics					
Structronics					

## Purpose:

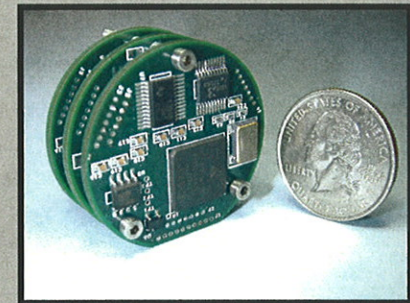
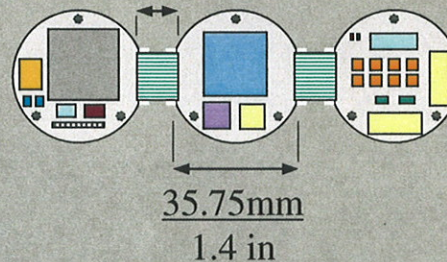
*Develop, test, and transition miniaturized electronics packaging technology into AMRDEC missile programs to decrease flight electronics weight, space, and power footprint.*

## Products:

*Miniaturized electronics suitable for small diameter missiles and munitions.*

## Payoff:

- *Increased Missile Lethality and Range*
- *Transition to SLC, NLOS-LS STO, EAPS, L-RAM*



# Hardened Combined Effects Penetrator Warheads



**Purpose:**

*Provide overmatch lethality using a single warhead that defeats armor, bunkers, personnel, and UAVs. Provides hardened capability to bash-through detonate within urban structures and clear rebar. This program supports LOS/NLOS/BLOS gun and missile systems.*

**Product:**

- Warhead subcomponent and munition integrated demonstrations
- TRL6 Near Tactical Warheads
- MRM, NLOS-LS, PGMM, Common Missile and APKWS warheads
- LOS/NLOS/BLOS warhead technology

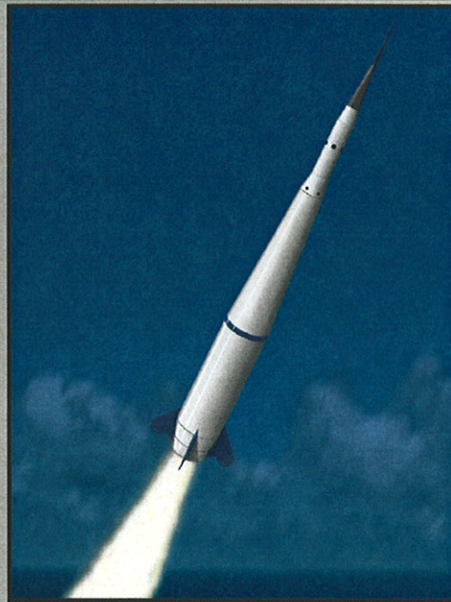
**Payoff:**

- Increased lethality over a broader range of targets, improved effectiveness against ERA & APS, increased stowed kills
- Specific transition plans: Ammo & Tactical Missiles for SDD; PM CM, PM-MAS, PM NLOS-LS, PM-CAS, PM-ARMS SDD developments (FY06, FY07, FY08)

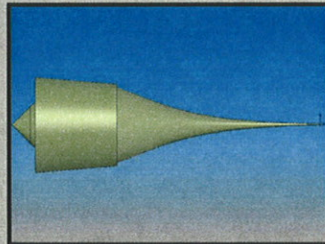
*Schedule and Cost*

MILESTONES	FY04	FY05	FY06	FY07	FY08
• Baseline Modeling/Testing	█				
• Define Bash-Thru Loads for Key Targets		█			
• Develop Appropriate "Hardening" Techniques		█			
• Incorporate Hardening, Enhanced Energetics and Frag into w/h Design		█			
• Model Designs/Eval Shortfalls			█		
• Optimize Designs/Build Prototypes			█		
• Integrated Demos Against Targets/Eval				█	
• Redesign & Scale				█	
• Final Integrated Demo					█

# Hypersonic Engine Demonstration/NAI



**Mach 12, H2  
Fueled  
Axisymmetric  
Scramjet  
Engine**



*Schedule and Cost*

MILESTONES	FY05	FY06	FY07	FY08	FY09
Component Trade Studies	█				
Pre-Component Design	█▲▲	█			
Pre-Engine Ground Test			█▲▲		
Detailed Engine Design			█	█	
Engine Fabrication				█	
Engine Ground Tests					█▲▲

**Purpose:**

*To develop hypersonic air breathing propulsion and related technologies to enhance capability in army fire support, air defense, and cruise missile defense missions.*

**Product:**

*Mach 12, H2 fueled scramjet engine ready for transition to weapons program.*

**Payoff:**

- *Active defense against CMs, ICBMs, IRBMs, and MRBMs with Weapons of Mass Destruction (WMD) and other time-critical targets with shorter times of flight (>2x reduction in response time) to provide increased lethality and extended range engagements (2x)*
- *Enhanced lethality & survivability (greater mutual support range, faster missile, more energy on target)*

**Transitions:**

- *Potential transition of H2 scramjet to ATACMS/HIMARS system improvement programs, Long Range CM/UAV intercept for AMD Increment 3*

# IR Seeker CCM for the Laser Threat



Schedule and Cost

MILESTONES	FY03	FY04	FY05	FY06	FY07
<b>Level II (Electronic/Algo)</b>					
HITL CM Assessment	█				
Simulation/Modeling	█				
Skr Lab, HITL & Field Tests					
<b>Level II (Optical)</b>					
Design & Development		█			
Component Devel & Fab	█ 1st Gen		█ 2nd Gen		
Compon Lab & Skr HITL Tests					
<b>Level III HITL CM Assessment</b>					
Simulation/Modeling		█			
Component Development			█		
Lab & HITL Tests					

**Purpose:**

Provide capability to harden future IR seekers (and multimode seekers) against dazing and damaging laser CM.

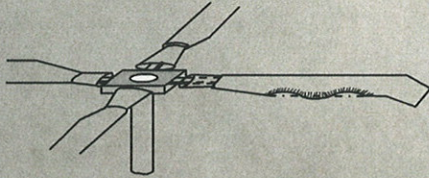
**Product:**

Technologies, simulations, test data, reports documenting CCM solutions.

**Payoff:**

- Missile systems with laser CM resistant seekers will maintain lethality in the anticipated IRCM environment of the future battlefield
- Technology available to
  - Common Missile SDD Phase II
  - NLOS-LS SDD Block II

# Lightweight Active Rotor Concept



## Advanced Rotor Technology

- **Lightweight rotor**
- **Active on-blade control**



## Schedule and Cost

Milestones	FY05	FY06	FY07	FY08
Computational Fluid Dynamics Simulation	█			
Bench Test Most Promising Advanced Rotor Technologies		█		
Integrate Technologies into Model Rotors			█	
Evaluate Primary Flight Control				█
Test Performance in Wind Tunnel				█

## Purpose:

**Demonstrate performance enhancements gained from advanced rotor technologies, including on-blade controls.**

## Products:

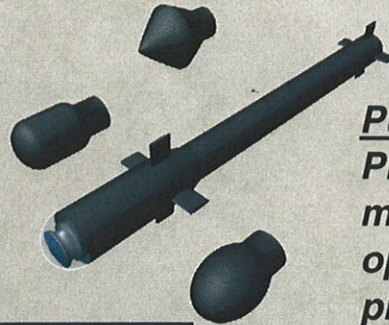
- **Lightweight active rotor design that eliminates the swashplate**
- **Active on-blade control system test data**
- **Improved analytical design tools**

## Payoff:

- **Provide the warfighter the capability to increase range (~40%) or payload (~30%) while reducing rotor O&S costs by ~30%**
- **Potential application to current fleet and Future Force (Joint Multi Role, Joint Heavy Lift)**

# Line of Sight Smaller, Lighter, Cheaper (LOS-SLC)

**Search, Detect, and Engage LOS Targets in a Specified Area**



**Purpose:**

Provide the capability to rapidly adjust missile payloads to match target profiles or operational needs for Soldier and UGV platforms.

**Product:**

- Low cost guidance
- Sensor miniaturization
- Enhanced warhead/fuze performance
- Motor fire from enclosure, IM

**Payoff:**

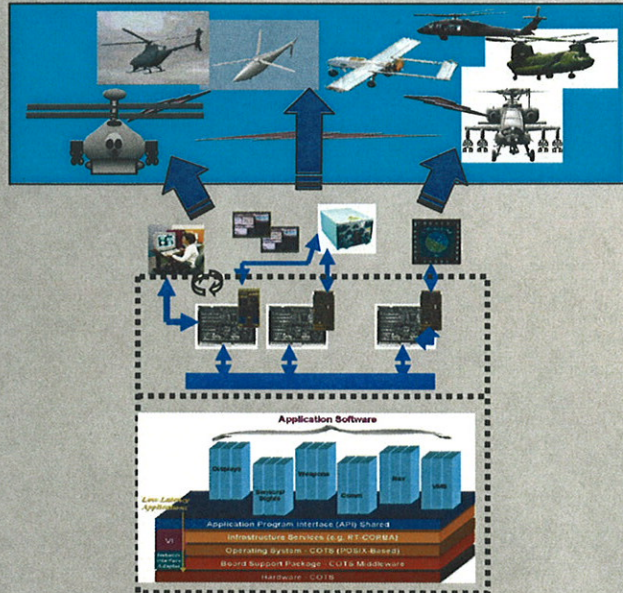
- Scalable effects, lethal and non-lethal
- Improved survivability and tactical flexibility
- LOS fires in mounted operations

**Technical Challenges:**

- Sensor miniaturization
- Guidance integration
- Warhead enhancements

MILESTONES	FY05	FY06	FY07	FY08	FY09	FY10
<b>Component/Subsystem Dev</b>	[Green bar spanning FY05 to FY07]					
• Virtual Prototypes	[Green bar]					
• Component Design	[Green bar]					
• Subsystem Fab/Tests		[Green bar]				
• Integrated Tests		[Green bar]				
<b>Prototype Development</b>		Award Contracts	[Blue bar]			
<b>Operational Demos</b>			[Blue bar]			

# Manned-Unmanned Common Architecture Program (MCAP)



**Open Systems Architecture**  
Schedule and Cost

Milestones	FY03	FY04	FY05
Requirements Analysis, Comparison, and Trade/off, Manned-Unmanned Coordination, Standards Selections	[Green bar spanning FY03, FY04, and FY05]		
Manned Systems/UAV Harmonization, HW/SW Architecture Design/Checkout	[Green bar spanning FY03 and FY04]		
HW/SW Architecture Detailed Design, Integration, and Functional Tests		[Green bar spanning FY04 and FY05]	
Flight Preparations & Demonstrations			[Green bar in FY05]

**Purpose:**

Enable Army Aviation to use modular COTS electronics and open systems interface standards for advanced mission processing.

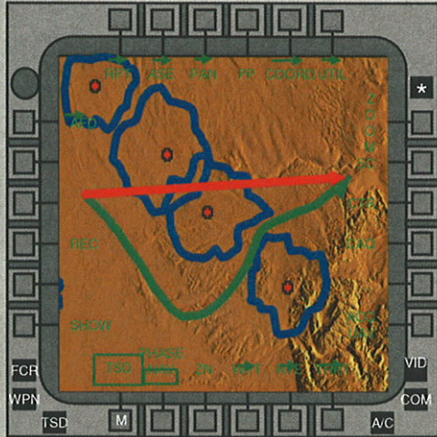
**Product:**

- **Prototype mission avionics computing system**
  - Bus – Fibre Channel, Ethernet, 1553B
  - Processors – PowerPC G4 minimum
  - Backplane – up to 5 GHZ (Fibre Channel/VME, cPCI, Ethernet)
  - Mezzanine Cards
  - Standard Form Factor – 6U / 3U
  - Portable Operating System (POSIX) & OpenGL Graphics

**Payoff:**

- Enhances future force battle command, mission performance, information flow, and avionics affordability
- Transitions to PEO AVN in FY06 for Apache Block III Upgrade and to UAVs

# Manned-Unmanned Rotorcraft Enhanced Survivability (MURES)



## Cooperative Manned-Unmanned Team Survivability

### Schedule and Cost

Milestones	FY04	FY05	FY06	FY07
Develop Agents and Susceptibility S/W	█			
Develop Threat Lethality Predictor	█	█		
Integrate Into Unmanned Platform and Demo		█	█	
Integrate Into Manned Platform and Demo		█	█	█

### Purpose:

- Develop a real-time Survivability Associate Re-Router tailored to small unit manned-unmanned team operations
- Eliminates the need to provide complete self-protection suite to each element of manned-unmanned team
- Threat countermeasures can be distributed among team and activated through integration into existing unmanned and manned mission management/decision-aiding systems, saving payload

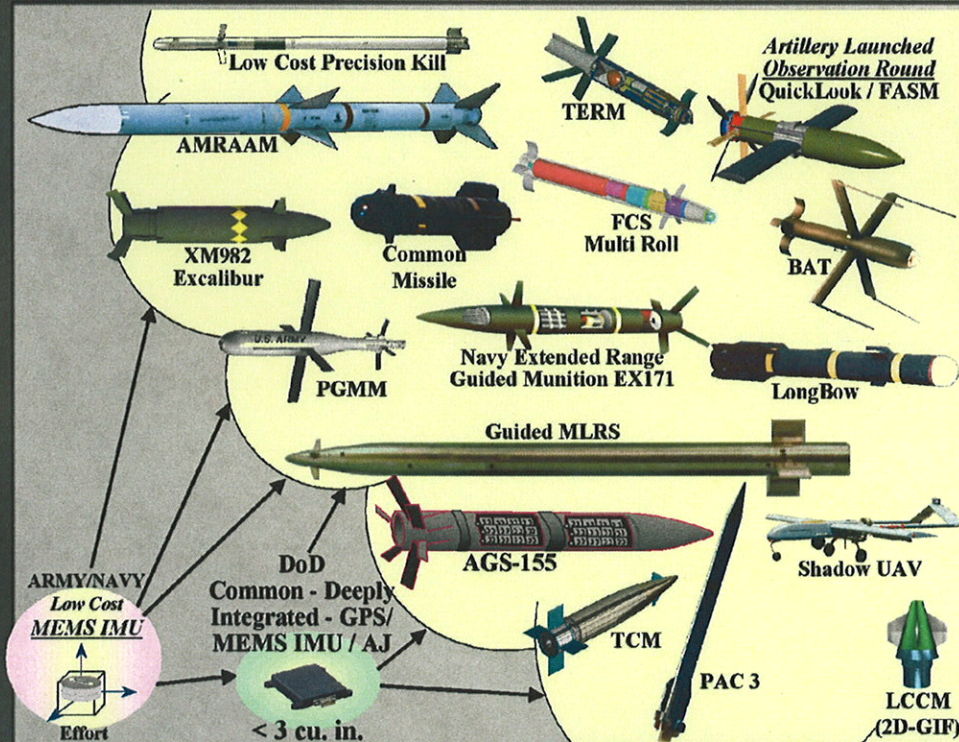
### Product:

Real-Time Survivability Associate Re-Router Software.

### Payoff:

- Increased survivability of warfighter and aircraft
- Transitions to:
  - UCAR FY06
- Potential:
  - Apache Block III, FY07
  - FCS Block II, FY09

# MEMS/IMU for Common Guidance



## Purpose:

The Army is pursuing technologies to meet transformation goals of a lighter, faster, more lethal, greatly reduced logistics footprint. Munitions and missiles are a major contributor to the logistics footprint and essential to increased lethality.

## Product:

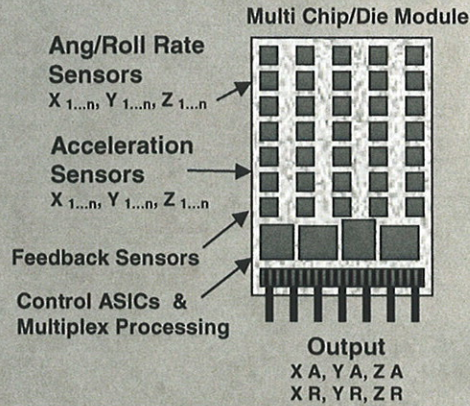
- Minimum of two manufacturers capable of producing affordable MEMS inertial & GPS devices for military needs
- Prototype MEMS IMUs & GPS/ISA for XM982, PGMM, ERGM, TCM, AGS, FCS, APKWS, CM & FCS multi-roll evaluation

## Payoff:

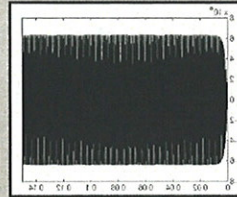
- MEMS IMUs and DI-GNU for 90% of DoD tactical systems

ACTIVITY	FY	01	02	03	04	05	06	07
Consolidate IMU Requirements		█	█					
Devel Com Guidance ICD/Spec		█	█					
Process Enhancements		█	█	█	█	█	█	
Electronics Integration		█	█	█	█	█	█	
Evaluate and Refine Enhanced Processes and Equipment				█	█	█	█	
Fab IMU Prototypes/Conduct MEMS IMU & DI-GPS/ISA Demos		█	█	█	█	█	█	
IMU Qual & Test Bed Integ.			█	█	█	█	█	
DI GPS/ISA Development OPT 1			█	█	█	█	█	
DI GPS/ISA Qual & Test Integ.				█	█	█	█	

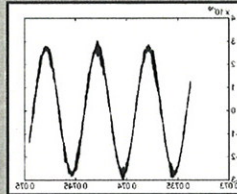
# Micro Controlled Arrays ( $\mu$ CAS)



## Model Simulation



MEMS ARS output in high-vibration environment



MEMS ARS output in high-vibration environment with accelerometer feedback

## Schedule and Cost

Milestones	FY03	FY04	FY05
Concept Modeling	█		
Expand Temp Range for RRAPDS	█		
Integrate Accel FB with ARS		█	
Accelerometer Bank/Array		█	
Integrate Arrays & Test			█

## Purpose:

Provide capability to FCS via CKEM and RRAPDS for increased performance at lower cost. Shift the microsystems paradigm to a system-of-systems concept, incorporating multiple economy-of-scales micro devices to achieve military performance levels.

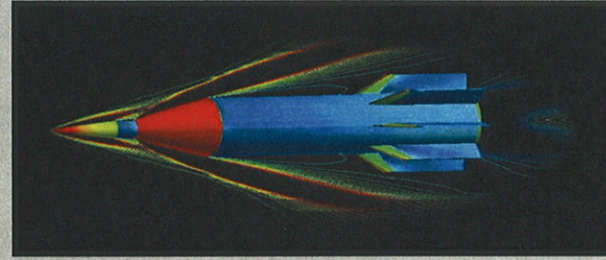
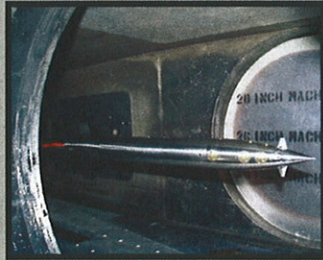
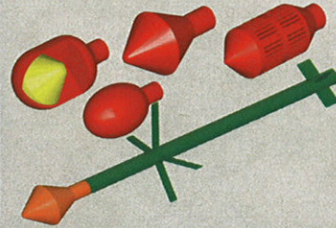
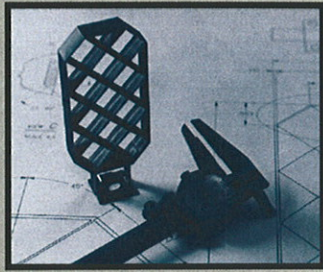
## Product:

- A methodology for developing array architecture
- A beyond mil-spec MEMS temperature sensor array
- A vibration-stabilized MEMS ARS array
- An expanded-range accelerometer array
- An integrated inertial array incorporating the above

## Payoff:

- Low cost sensor systems with improved performance and new capabilities for extreme environments sensing
- Transitions:
  - Temp array to RRAPDS, end FY03
  - Stabilized gyro to APKWS & CKEM, end FY04
  - Accel array to CKEM, end FY05

# Missile Aerodynamics Technology Aero Design, Analysis & Test



## Purpose:

*Enabling technology investigations to enhance the Army's understanding of aerodynamic phenomenon associated with future missile geometry trends and to provide more aerodynamically efficient airframes and control methods.*

## Product:

- *Validated WAF Induced Force Characterization Methodology*
- *Experimental Data to Characterize Numerous Compact Aerodynamic Control Methodologies*
- *Experimental Data to Characterize Non-Cylindrical Missile Bodies*

## Payoff:

- *Longer Range, Precision Hit/Kill, Lighter, Smaller, and Faster Missiles, Enhanced Maneuverability*
- *Transitions to AMRDEC 6.3 Tech Demos*

*Schedule and Cost*

MILESTONES	FY05	FY06	FY07	FY08	FY09	FY10
<i>Non-Cylindrical Body</i>	█					
<i>WAF Induced Force Modeling</i>	█					
<i>Aero Control for Small Missiles</i>	█					
<i>Aero Considerations for CIAPS</i>	█					

# Missile Propulsion IM Technology



**Current Minimum  
Smoke Propellant**



**IM Candidate Propellant**

- Passed BI/FI
- Failed Fielding Requirements

**Purpose:**

**Demonstrate IM technology to significantly increase warfighter survivability**

- For minimum smoke motors, APKWS, JCM, NLOS-LS
- For high performance, large motors, GMLRS, MEADS, SLAMRAAM

**Product:**

- IM technologies (propellants, integrated venting and/or barriers) that increase survivability, reduce hazards classification, and improve logistics while meeting performance requirements
- Reduction in level of reaction to required IM tests (SD, SCJ, FCO, SCO, FI, BI)

**Payoff:**

- Improve probability of crew/platform survivability
- Increased safety in transportation and storage
- Available technology to transition to 6.3 munition STOs, ATDs, and acquisition programs
- Spiral insertion of IM technologies for PEO TM & PEO ASMD

**Schedule and Cost**

Milestones	FY04	FY05	FY06	FY07	FY08	FY0
Propellant Development		█				
Prototype Mitigation		█				
Propellant/Venting Demo						
Shock (Barrier) Mitigation			█			
Final Mitigation Demo					█	

# Networked UAV System Demonstration



## Objective:

*This effort will advance decision aiding, UAV intelligence, common architecture standards, and human interfaces to demonstrate the operational synergy, efficiency, and effectiveness that results from intelligent teaming of smart, networked UAVs. It will mature behaviors/TTPs/Conops through simulation and validate through flight demonstrations.*

## Approach:

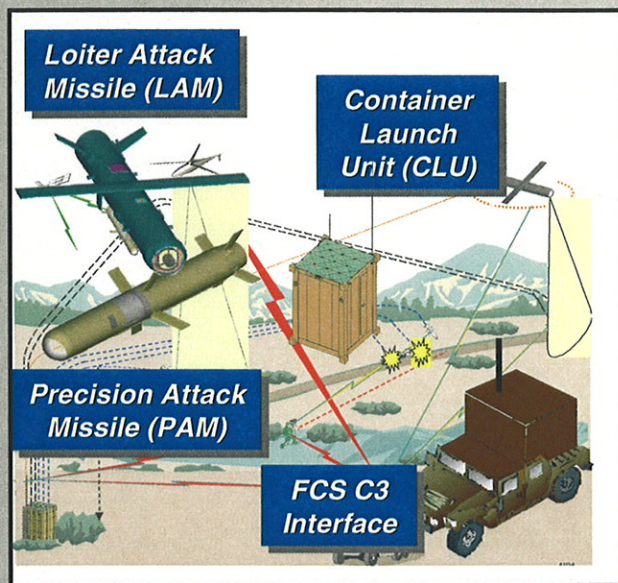
- *Build on RPA, HSKT/AMUST-D, UACO, MCAP, & SPAR work and AFRL/DARPA/academia*
- *Advance/infuse decision aiding on manned platform for UAV control use of ground & distributed assets*
- *Increase UAV autonomy*
- *Offer UAV autonomy extensions for MCAP, JAUS, FCS SoSCOE and NATO 4586*
- *Experiment with behaviors, TTPs, and Conops in simulation*
- *Validate in flight*

**Schedule and Cost**

Milestones	FY06	FY07	FY08	FY09	FY10
Studies, Preparation	█				
DA on Manned Helo		█	█	█	
UAV Autonomy		█	█	█	
Simulation		█	█	█	
UAV/ACFT Integration				█	█
Flight Demos					█

# Non Line of Sight - Launch System (NLOS-LS) Technology

*Responsive, Precision Attack of High-Payoff Targets*



**Purpose:**

*Develop/mature improved components and subsystem technologies for the NLOS-LS missile system.*

**Product:**

- *Improved Seekers for Better Resolution*
- *IM Controllable Propulsion Maturation*
- *Warhead Subsystem Integration and Testing*
- *Validated Simulation Models and Performance Studies*

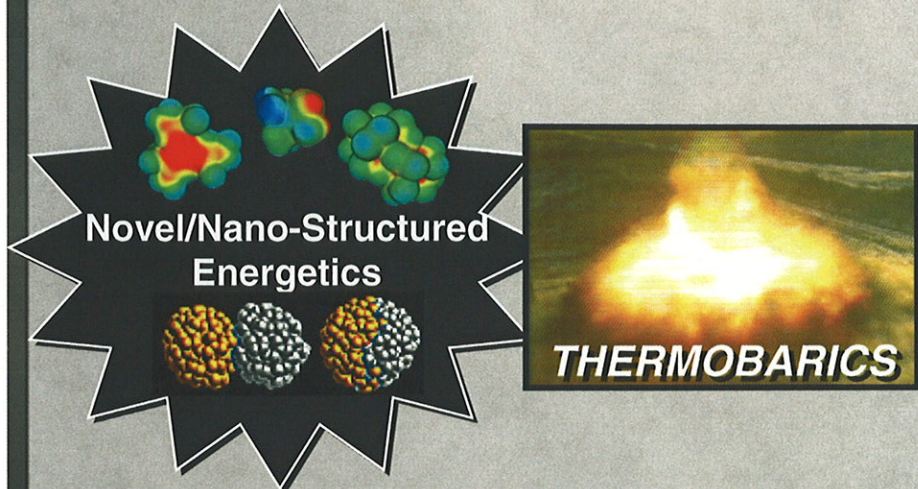
**Payoff:**

- *Affordable NLOS-LS Missile with Improved Performance*
- *Advanced Imagery to Enhance Target Detections and Battle Damage Assessment*
- *Extended Range/Increased Loitering Time*
- *Increased Lethality Against Expanded Target Sets and Environments*

**Schedule and Cost**

Milestones	FY04	FY05	FY06	FY07
<b>Subsystem Design/Dev/Test:</b>				
PAM Seeker				
LAM Seeker				
Propulsion Maturation				
Tandem Warhead Integration				
<b>Objective System Studies</b>				
<b>Design/Development of Critical Tech</b>				

# Novel Energetic Materials for the Objective Force



**Purpose:**

**Mature advanced energetic materials to provide:**

- 40% increase in deliverable energy from advanced gun propellant systems
- 20-50% increase in warhead effectiveness (munitions, active protection)
- 40% decrease in munitions vulnerability

**Product:**

- **Demonstration of advanced energetic materials with ability to tune energy release for precision munition & counter-munition applications (e.g., propellants, explosives, thermobarics, multi-purpose warhead, APS)**

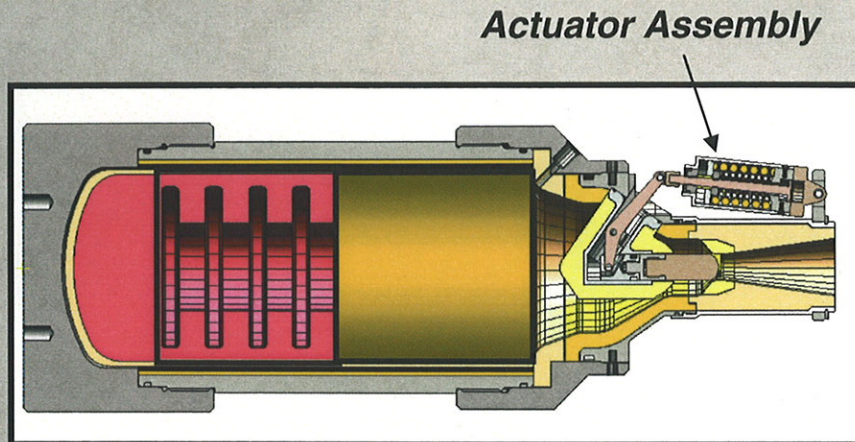
**Impact:**

- **Mission-enabling lethality at range and crew survivability under ambush for the full range of Objective Force weapons systems and emerging/unforeseen classes of new weapons**
- **Transitions to ARDEC/AMRDEC for FCS Increment 2 upgrades**

**Schedule and Cost**

Tasks	FY03	FY04	FY05	FY06	FY07
• Identify candidate novel/nano-energetics (molecular simulations, synthetic chemistry)	[Green bar from FY03 to FY04]				
• Downselect most promising concepts		[Red diamond]	[Green diamond]		
• Laboratory evaluation of energetic concepts		[Green bar from FY04 to FY06]			
• Define energetic materials for weapons systems applications (propellant/explosive formulation TBX)				[Green diamond]	
• Experimentally assess systems/configurations that exploit energy management	[Green bar from FY03 to FY06]				
• Extend/validate modeling tools for energy managed systems	[Green bar from FY03 to FY06]				
• Demonstrate potential improvement of energy managed system (propulsion/warhead)			[Green diamond]		
• Downselect a system for demonstration of novel energetic material (propulsion/warhead)				[Green diamond]	
• Design, fabricate, demonstrate energy managed system for improved performance				[Green bar from FY06 to FY07]	

# Passive Variable Area Nozzle (VAN)



Typical Tactical Missile Rocket Motor

## Purpose:

Develop low cost controllable propulsion system for tactical missiles.

## Product:

- *Passive VAN Concept Design Using Low Cost Materials*
- *Smaller, Lower Cost Actuators Suitable for Precision Attack Missile (PAM), Joint Common Missile (JCM), and Other Tactical Missiles*

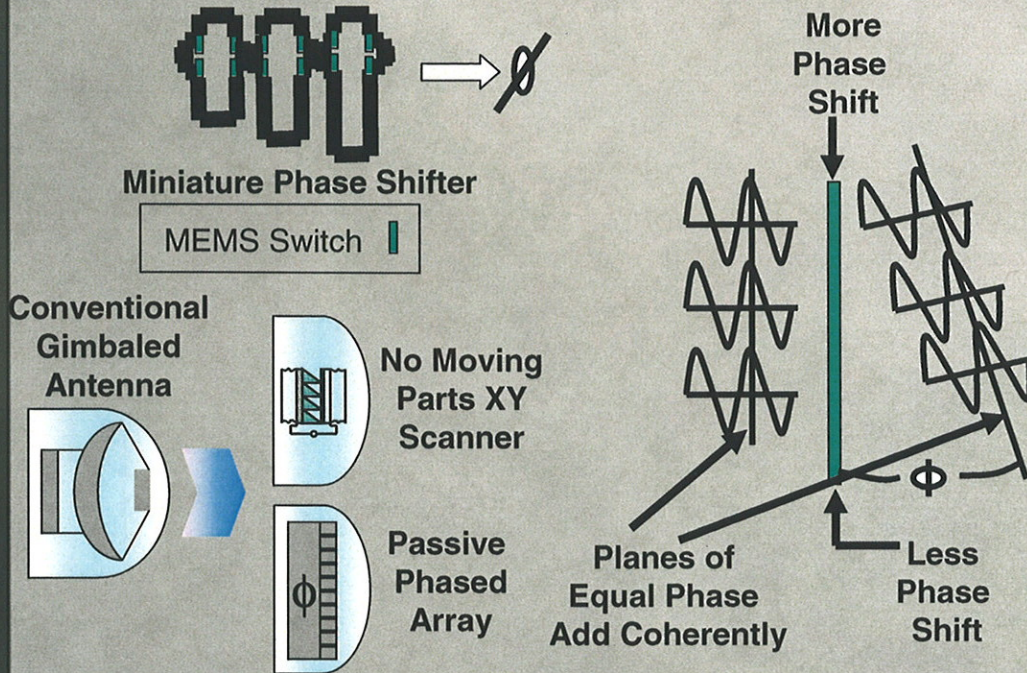
## Schedule and Cost

Milestones	FY04	FY05	FY06	FY07
System Level Concept Studies	█			
Downselect Two VAN Concepts		█		
Design/Fabricate Component Hardware		█		
Demonstration Components		█	█	
Integrated System Static Tests				█

## Payoff:

- *10-15% Increased Range and Greater Mission Flexibility*
- *Variable Thrust Provides Choice of Extended Standoff Range or Shorter Time-of-Flight*
- *Improved Insensitive Munitions Characteristics*
- *Potential Cost Avoidance of \$2k/Missile Over Active Variable Nozzle Designs*

# Phased Arrays for Tactical Seekers



**Schedule and Cost**

Milestones	FY04	FY05	FY06	FY07	FY08
Fab/Test RF PACs in Lab	█				
Fab/Test Optic PACs in Lab	█	█			
Demo Phase Shifters in Lab			█		
Fab/Demo Sub-Array (RF DL & LADAR Seeker) Using Phase Shifters				█	
Demo Sub-Array (RF Seeker)					█

**Purpose:**

Develop MEMS-based or alternative low-cost phased arrays to provide rapid beam steering for sensors, RF seekers and data links, and optical/LADAR seekers in support of Future Combat System.

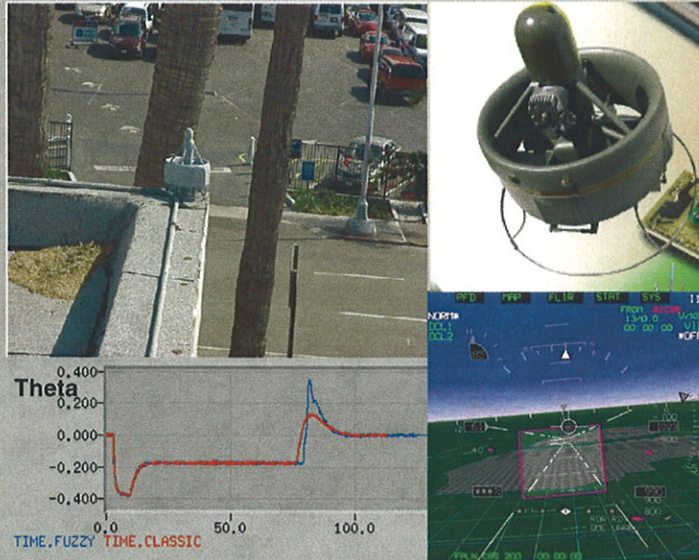
**Product:**

- Low-Cost Phased Array Components and Designs
- RF Sub-Arrays
- Optical Sub-Arrays
- Integrated Sub-Arrays/Phased Arrays

**Payoff:**

- Improved Lethality and Reliability Without Cost Increase
- Increased Target Search Speed
- Increased Range of High Bandwidth Data Links
- Transition Components, Designs, & Test Data to NLOS-LS BLK-II Follow-on in FY07 & Joint Common Missile P3I/BLKUpgrade in FY08

# Precision Autonomous Landing Adaptive Control Experiment (PALACE)



Schedule and Cost

Milestones	FY03	FY04	FY05
Define Control Law Architecture	█		
Implement in Real-Time Simulation, Including Prototyping GCU Display	█	█	
Simulation Evaluation, Control Law Sensor Optimization		█	
Complete Associated Flight Vehicle Mods		█	
Test Matrix In-Flight, Publish Results			█

## Purpose:

Autonomous precision UAV VTOL to unprepared sites in variable winds for perch and stare surveillance, precision UAV supply delivery, recovery, and FARP operations.

## Product:

Performance criteria, methods and flight proven adaptive control techniques for precision helicopter landing at arbitrary sites. Includes full nonlinear vehicle dynamics, control laws, sensor, and actuator models.

## Payoff:

- Reduces UAV reliance on prepared landing sites
- Reduces manpower
- Reduces VTOL crashes
- Allows precision UAV critical supply delivery.
- Allows perch and stare surveillance capabilities
- Provides capability for UAV FARP Ops without returning to home
- Transitions to DARPA Obstacle Avoidance MAV. 6.3 follow on work via A-160. Portions applicable UCAR, UCL & AMRDEC 6.3 UAV vehicle mgt system demos

# Rotorcraft Drive Systems for the 21<sup>st</sup> Century (RDS – 21)



Schedule and Cost

Milestones	FY01	FY02	FY03	FY04	FY05
Preliminary Design	█				
Detailed Design		█			
Fabrication		█			
Component Testing			█		
Demo Testing					█

## Purpose:

- Demonstrate a major advancement in rotorcraft drive system performance and affordability applicable to future manned and unmanned aircraft of the Future Force.

+35% SHP/WT

-12 dB Noise (Cabin Center)

-20% O&S Costs

-20% Production Cost

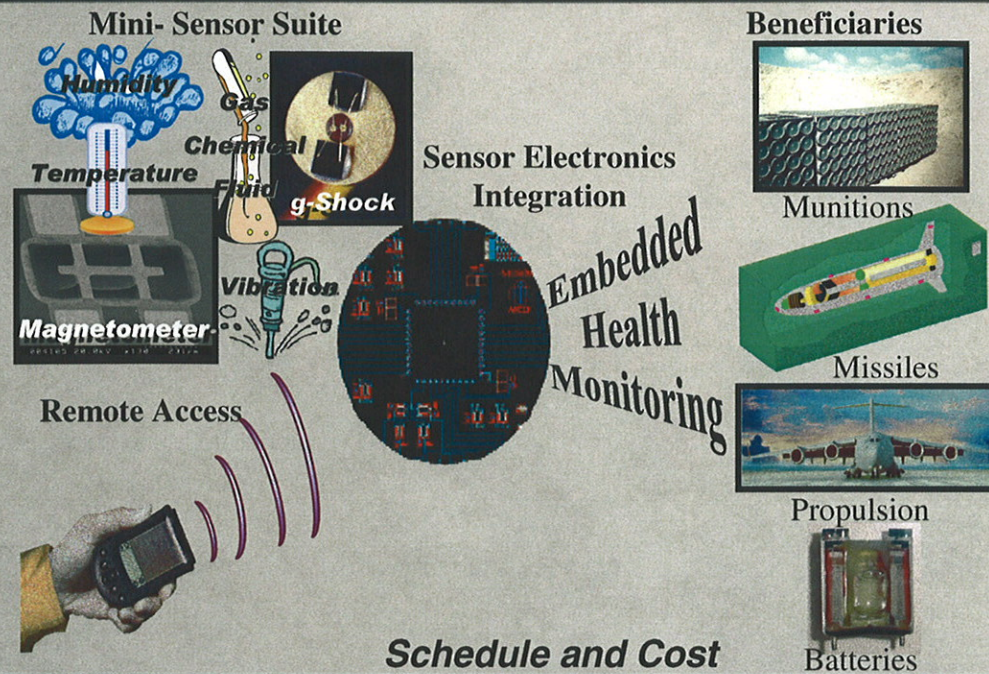
## Product:

- Low weight, high performance drive system with reduced cost of ownership
- Validated advanced design tools and modeling techniques
- Results documented in final report

## Payoff:

- Increased SHP/WT provides A/C with increased range and payload capability
- Reduced O&S and production costs increase aircraft affordability (achieved through reduced maintenance costs)
- Transitions to AH-64 Block III for FY06 SDD
- Designs transitioned to UCAR A/C demonstrators

# Sensor & Electronics P/D for FCS



## Purpose:

- Develop embedded diagnostics sensors and on-board prognostics capabilities to monitor system health
- Develop remote access to diagnostics and prognostic estimations for commanders and logisticians

## Product:

Compact sensor platform having the capability to provide prognostics and diagnostics of systems where g-shock, temperature, humidity, vibration and gas/chemical/fluid sensing are needed for system health monitoring.

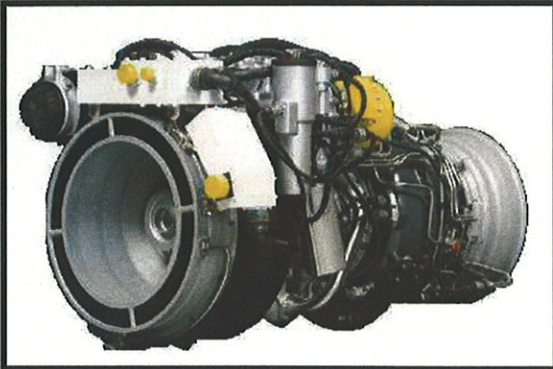
## Payoff:

- Enhanced awareness of system condition
- Increased readiness and reliability of Future Combat Systems
- Smaller logistics foot print with condition-based maintenance
- Increase confidence of mission completion
- Transition to NLOS-LS Spiral 2, PGMM, MERM, Excalibur

**Schedule and Cost**

MILESTONES	FY04	FY05	FY06	FY07	FY08
RRAPDS Improvements (Gen-II)	[Bar spanning FY04 to FY06]				
g-Shock Sensor	[Bar in FY04]				
Vibration Sensors	[Bar spanning FY04 to FY07]				
Communications	[Bar spanning FY04 to FY08]				
Gas/Chemical/Fluid Sensor	[Bar spanning FY04 to FY06]				
P/D Validation-Threshold Failures		[Bar spanning FY05 to FY08]			
Multi-Function Sensor Integration			[Bar spanning FY07 to FY08]		

# Small Heavy Fuel Engine



**Purpose:**

*Develop small heavy fuel engine to enable required range and payload for future UAVs.*

**Product:**

- *Provides reliable heavy fuel propulsion capability for A-160, Fire Scout, and other UAVs*
- *Scalable technology and design tools to support Future Force engine development efforts*

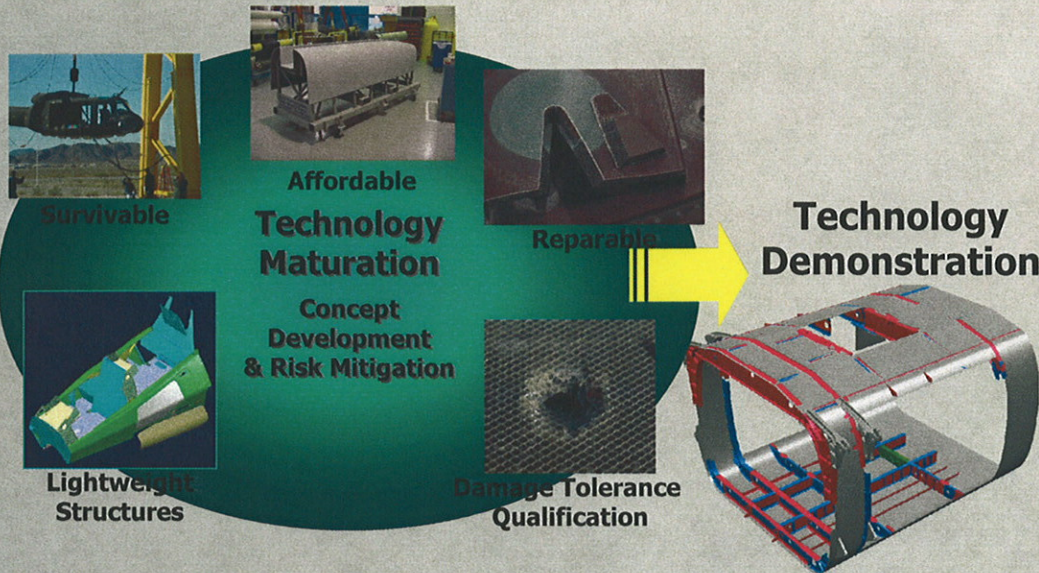
**Schedule and Cost**

Milestones	FY04	FY05	FY06	FY07
SHFE Design	█	█	█	
SHFE Fabrication		█	█	
SHFE Component Test		█		█
SHFE Test			█	█

**Payoff:**

- *Provides future UAVs with SHFE capability that enables affordable range and payload capability*
- *Reduced logistic footprint*
- *35% reduction in production and maintenance cost*

# Survivable, Affordable, Reparable Airframe Program (SARAP)



## Purpose:

Demonstrate a major advancement in airframe affordability, weight, survivability, and supportability for manned and unmanned objective force rotorcraft.

## Product:

- Validated virtual prototype capability (TRL6) for structures
  - 100% model-based definition
  - Full-scale demo/validation article
- Crashworthy and ballistic tolerant airframe concepts (TRL7)
- Durable, inspectable, reparable concepts (TRL7)

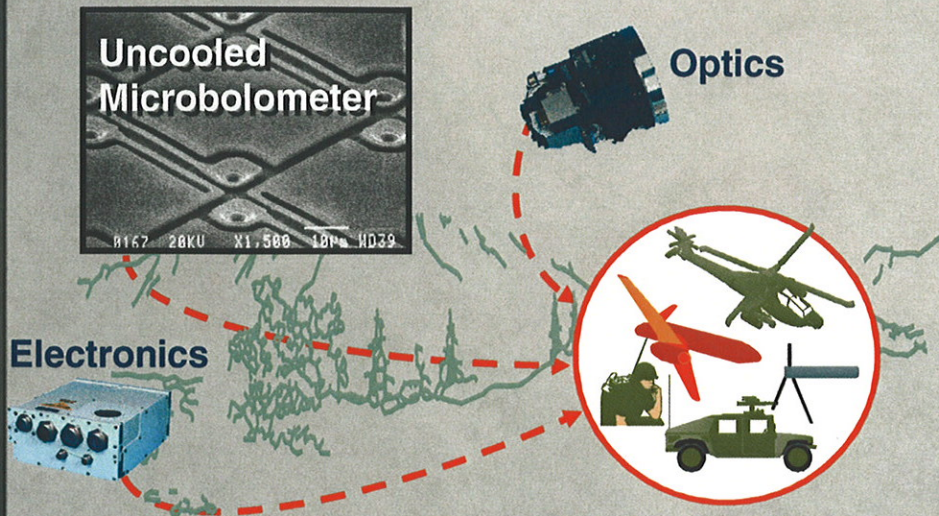
## Payoff:

- 28% improvement in payload or 54% increase in range
- Improved survivability, availability, and performance
- Reduce life-cycle costs
  - Block III UH-60/FUR
  - A-160

*Schedule and Cost*

Milestones	FY02	FY03	FY04	FY05	FY06
Durability & Dam Tol Design Criteria	█				
Adaptive Landing Gear	█				
Adaptive Vibration Control	█				
Virtual Prototype		█			
Crash/Ballistic Test		█			
Reparability Demonstration		█			
Full Scale Static Test					

# Uncooled Infrared Technology for Missile Seekers



**Purpose:**  
 Provide NLOS-LS with the maximum capability to achieve overall system effectiveness through the application of uncooled IR technology by demonstrating uncooled IR concepts for lock-on-after-launch and lock-on-before launch missile seekers, providing maximum performance at an affordable cost.

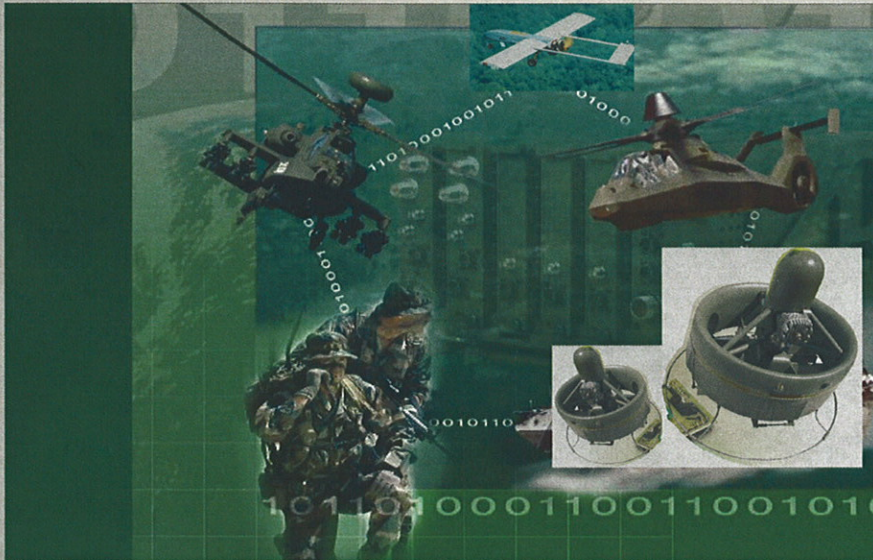
- Product:**
- Quantitative analysis of detectors
  - Laboratory and field characterization
  - Optimized optical packages
  - Sensor specifications
  - Enhanced NLOS-LS PAM Seeker (640x480 EPAM Seeker)

**Schedule and Cost**

Milestones	FY02	FY03	FY04	FY05	FY06	FY07
Lab Test Bed	[Green bar]					
Field Test Bed		[Green bar]				
Electronics/Optics		[Green bar]				
G&C Techniques			[Green bar]			
Enhanced NetFires	[Green bar]					

- Payoff:**
- Warfighting operational benefits
    - Lower cost systems, increased reliability
    - Instantly responsive, reusable systems
  - Transitions plans for NLOS-LS SDD
    - Uncooled IR Models in Jun 04
    - EPAM Seeker to NLOS-LS in May 06
    - Advanced uncooled IR in FY 07

# Unmanned Autonomous Collaborative Operation



**Schedule and Cost**

Milestones	FY04	FY05	FY06	FY07
ACO Behavior Defn, Tech Assess		█		
Reqmts Analysis/Prelim Design		█		
System Architecture & Software Design		█		
Software Development		█		
Hardware Integration		█		
Simulation/HWIL Lab Evals			█	
Flights/Demos (incl. C2ORE)		█	█	█
Transition of Behaviors			█	

## Purpose:

*Provide capability for UAVs to act in concert with manned vehicles and work as a team to accomplish mission-level objectives with minimal human intervention or control.*

## Product:

- *Software for UAV Collaboration and Autonomy*
- *Requirements for Software, Sensors, Processors, and Data Links*
- *UAV Cooperative Engagement Capability*

## Payoff:

- *Integrated Manned-Unmanned & Unmanned-Unmanned Vehicle Team Operations*
- *More Attention to Critical Mission Elements*
- *Increased Soldier/System Lethality*
- *Transitions to UCAR, FCS Spiral Development, Further 6.3 S&T Programs*

## ACRONYMS AND ABBREVIATIONS LIST

A2C2S	Army Airborne Command and Control System
A/C	Aircraft
ABCS	Army Battle Command Systems
ACF	Autonomous Collaborative Flight
ACFT	Aircraft
ACTD	Advanced Concepts Technology Demonstration
AF	Air Force
AFRL	Air Force Research Laboratory
AFSOC	Air Force Special Operations Command
AGS	Armored Gun System
AJ	Antijam
AMD	Air and Missile Defense
AMMPGM	Advanced Miniature Multi-Role Precision Guided Missile
AMRAAM	Advanced Medium Range Air-To-Air Missile
AMRDEC	Aviation and Missile Research, Development, and Engineering Center
AMUST-D	Airborne Manned-Unmanned Systems Technology Demonstration
APEX	Advanced Prototyping, Engineering, and eXperimentation
APKWS	Advanced Precision Kill Weapon System
APAS	Active-Passive Aircraft Survivability
APS	Active Protective System
ARDEC	Armament Research, Development, and Engineering Center
ARH	Anti-Radiation Homing
ARL	Army Research Laboratory
ARM	Antiradiation Missile
ARS	Angular Rate Sensor
ASC	Advanced Simulation Center
ASIC	Application-Specific Integrated Circuits
ASTMIS	Army Science and Technology Management Information System
ATA	Air-to-Air
ATACMS	Army Tactical Missile System
ATD	Advanced Technology Demonstration
AV	Air Vehicle
AVGAS	Aviation Gasoline
AVN	Aviation
BAT	Brilliant Anti-Tank
BDA	Battle Damage Assessment
BI	Bullet Impact
BLK	Block
BLOS	Beyond Line-of-Sight
BVRE	Beyond Visual Range Engagements

## ACRONYMS AND ABBREVIATIONS LIST (Continued)

C2	Command and Control
C3	Command, Control, and Communications
C4ISR	Command, Control, Communications, and Computer Intelligence Surveillance and Reconnaissance
CAD	Computer Aided Design
CAS	Controlled Arrays
CCM	Counter-Countermeasures
CDR	Critical Design Review
CECOM	Communications-Electronics Command
CERDEC	Communications-Electronics Research, Development, and Engineering Center
CFD	Computational Fluid Dynamics
CIAPS	Close-In Active Protection System
CLU	Command Launch Unit
CKEM	Compact Kinetic Energy Missile
CM	Common Missile, Countermeasure, Cruise Missile
CMS	Counter Mortar System
CMWS	Common Missile Warning System
CONOPS	Concept of Operations
COTS	Commercial Off the Shelf
COSSI	Commercial Operating and Support Savings Initiative
CSS	Contract Support Sets
DARPA	Defense Advanced Research Projects Agency
DBBL	Dismounted Battlespace Battle Laboratory
DI	Deeply Integrated
DIS	Distributed Interactive Simulation
DL	Data Link
DOF	Degree of Freedom
DRAM	Dynamic Random Access Memory
DRFM	Digital Radio Frequency Modulator
EAPS	Extended Area Protection and Survivability
EEPROM	Electrically Erasable Programmable Read Only Memory
EO	Electro-Optical
EPAM	Enhanced Precision Attack Missile
EPLRS	Enhanced Position Location Reporting System
ER	Extended Range
ERGM	Extended Range Guided Munitions

## ACRONYMS AND ABBREVIATIONS LIST (Continued)

FARP	Forward Arming and Refueling Point
FASM	Field Artillery Smart Munitions
FB	Feedback
FC	Fire Control
FC-NET	Fire Control – Node Engagement Technology
FCO	Fast Cook-Off
FCR	Fire Control Radar
FCS	Future Combat System
FF	Future Force
FI	Fragment Impact
FLIR	Forward Looking Infrared
FOC	Force Operating Capability
FPA	Focal Plane Array
FPGA	Field Programmable Gate Arrays
FUR	Future Utility Rotorcraft
G&C	Guidance and Control
GCS	Ground Combat System, Ground Control Station
GCU	Guidance and Control Unit
GEMS	Guidance Electronics Miniaturization and Structronics
GIF	Guidance Integration Facility
GMTI	Ground Moving Target Indicator
GMLRS	Guided Multiple Launch Rocket System
GNU	Guidance and Navigation Unit
GPS	Global Positioning System
HIMARS	High Mobility Artillery Rocket System
HITL	Hardware-In-The-Loop
HMMWV	High Mobility, Multipurpose Wheeled Vehicle
HP	Horsepower
HSKT	Hunter Stand-Off Killer Team
HTI	Horizontal Technology Integration
HUMS	Health and Usage Monitoring System
HW	Hardware
HWIL	Hardware In-The-Loop
ICBM	Intercontinental Ballistic Missile
ICD	Interface Control Document
IDA	Intelligence Decision Aiding for Survivability
IFF	Identification, Friend or Foe
IIR	Imaging Infrared
IM	Insensitive Munitions
IMU	Internal Measurement Unit
IR	Infrared

## ACRONYMS AND ABBREVIATIONS LIST (Continued)

IRBM	Intermediate Range Ballistic Missile
IRCM	Infrared Countermeasures
ISA	Inertial Sensor Assembly
JAHUMS	Joint Advanced Health and Usage Monitoring System
JAUS	Joint Architecture for Unmanned Systems
JCM	Joint Common Missile
JPO	Joint Project Office
JSOW	Joint Standoff Weapon
JTA-A	Joint Technical Architecture—Army
JTAGG	Joint Turbine Advanced Gas Generator
JTF	Joint Task Force
JTRS	Joint Tactical Radio System
KE	Kinetic Energy
KEM	Kinetic Energy Missile
Km	Kilometer
LADAR	Laser Radar
LAM	Loitering Attack Missile
LAV	Light Armored Vehicle
LCAR	Low Cost Active Rotor
LCCM	Low Cost Cruise Missile
LCPK	Low Cost Precision Kill
LNS	Land Navigation System
LOS	Line-Of-Sight
LOSAT	Line-Of-Sight Antitank
LOS-SLC	Line-Of-Sight Smaller Lighter Cheaper
L-RAM	Long-Range Aviation Missile
MANPADS	Man Portable Air Defense System
MAS	Maneuver Ammunition Systems
MAV	Manned Aerial Vehicle; Micro Air Vehicle
MCAP	Manned-Unmanned Common Architecture Program
MEADS	Medium Extended Air Defense System
MEMS	Micro Electro-Mechanical System
MERM	Multi-Purpose Extended Range Munition
MIL	Man-in-the-Loop
MLRS	Multiple Launch Rocket System
MOSP	Multi-Optronics Stabilized Payload
MOUT	Military Operations in Urban Terrain
MP	Multi-Purpose
MRBM	Medium Range Ballistic Missile
MRM	Medium-Range Missile

## ACRONYMS AND ABBREVIATIONS LIST (Continued)

MSB	Milestone B
MUM	Manned-Unmanned
MURES	Manned-Unmanned Rotorcraft Enhanced Survivability
NAI	National Aerospace Initiative
NATO	North Atlantic Treaty Organization
NLOS	Non Line-of-Sight
NLOS-LS	Non Line-of-Sight Launch System
NRTC	National Rotorcraft Technology Center
NUGAS	Networked Unmanned Ground and Air System
O&S	Operating and Support
OCSW	Objective Crew Served Weapon
OFW	Objective Force Warrior
ORD	Operational Requirements Document
PAC	Patriot Advanced Capability
PALACE	Precision Autonomous Landing Adaptive Control Experiment
PAM	Precision Attack Missile
PATS	Phased Arrays for Tactical Seekers
P/D	Prognostics/Diagnostics
PE	Program Element
PEO	Program Executive Officer
PK	Probability of Kill
PGMM	Precision Guided Mortar Munitions
PKAT	Precision Kill Autonomous Targeting ask Bill Nourse
PM	Project/Program Manager
PO	Project/Program Office
RAM	Reliability, Availability, Maintainability
RCS	Radar Cross-Section
RDECOM	Research, Development, and Engineering Command
RDS	Rotorcraft Drive system
RF	Radio Frequency
RPA	Rotorcraft Pilot's Associate
RPG	Rocket Propelled Grenade
RPM	Revolutions Per Minute
RRAPDS	Remote Readiness Asset Prognostic/Diagnostic System
S&T	Science and Technology
SAL	Semi-Active Laser
SAR	Synthetic Aperture Radar
SARAP	Survivable, Affordable, Repairable Airframe Program
SBIR	Small Business Innovation Research

## ACRONYMS AND ABBREVIATIONS LIST (Continued)

SCJ	Shaped-Charge Jet
SCO	Slow Cook-Off
SD	Sympathetic Detonation
SDD	System Development and Demonstration
SEAD	Suppression of Enemy Air Defenses
SEI	Specific Emitter Identification
SFC	Specific Fuel Consumption
SHFE	Small Heavy Fuel Engine
SHP	Shaft Horsepower
SINGARS	Single Channel Ground and Air Radio System
SLC	Smaller, Lighter, Cheaper
SLAMRAAM	Surface-Launched Advanced Medium-Range Anti-Aircraft Missile
SMI	Soldier-Machine Interface
SOS	System of Systems
SOSCOE	System of Systems Common Operating Environment
SPAR	Survivability Planner Associate Rerouter
STO	Science and Technology Objective
SW	Software
TBX	Thermobaric Explosives
TCM	Tri-Service Common Missile
TD	Technology Demonstration
TERM	Tank Extended Range Munitions
TM	Technical Manual
TOC	Tactical Operations Center
TRL	Technology Readiness Level
TTP	Techniques, Tactics, and Procedures
TWP	Target Weapon Pairing
UA	Unit of Action
UACO	UAV Autonomous Collaborative Operation
UAV	Unmanned Aerial Vehicle
UAWS	Unmanned Aerial Vehicle System
UCAR	Unmanned Combat Armed Rotorcraft
UCL	Unmanned Cargo Lifter
UGV	Unmanned Ground Vehicle
UGVS	Unmanned Ground Vehicle System
UFR	Unfunded Requirement

## **ACRONYMS AND ABBREVIATIONS LIST (Concluded)**

VAATE	Versatile Affordable Advanced Turbine Engine
VAN	Variable Area Nozzle
VTOL	Vertical Take-Off and Landing
WAF	Wraparound Fins
WISP	Wideband Infrared Scene Projector
WMD	Weapons of Mass Destruction
WT	Weight

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