



U.S. Army Research, Development and Engineering Command

2011 GSS APBI Briefing: *Hit and Kill Avoidance Organization*



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

TARDEC GSS Industry Day
Hit and Kill Avoidance
14 June 2011

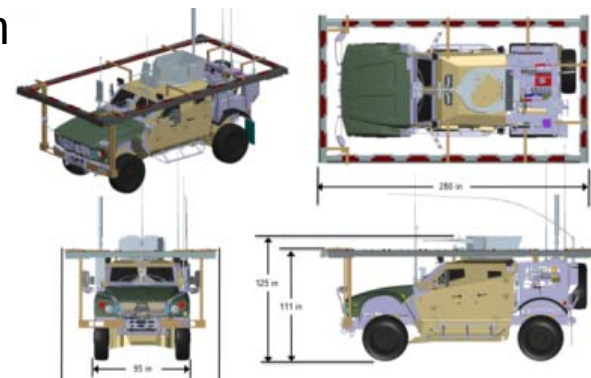
Mr. Jeff Jaster

Distribution A: Unlimited distribution. Approved for Public Release.

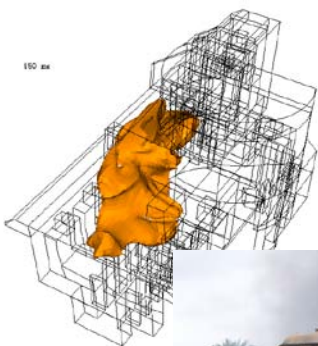
Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 14 JUN 2011		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE @100 GSS APBI Briefing: Hit and Kill Avoidance Organization			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Jeff Jaster			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000, USA			8. PERFORMING ORGANIZATION REPORT NUMBER 21970RC		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000, USA			10. SPONSOR/MONITOR'S ACRONYM(S) TACOM/TARDEC/RDECOM		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) 21970RC		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the TARDEC 2011 GSS APBI Industry Day 27 JUN 2011. Selfridge ANGB, Michigan, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 19	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Hit and Kill Avoidance Overview

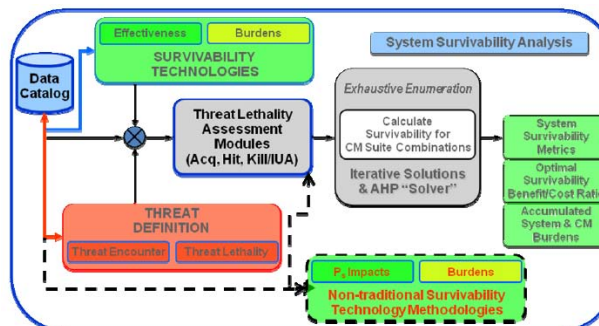
Hit Avoidance/Active Protection



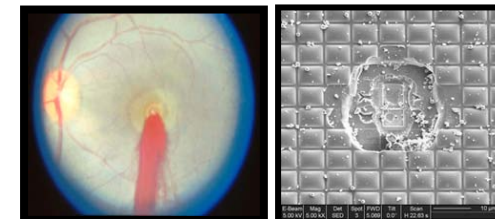
Fire Protection



System Optimization



Laser Protection



Program Name	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Hit Avoidance (HA) Technologies								
RPG Active Protection (RAP)								
Mature an APS for unitary RPG defeat. Demonstrate integrated ATGM defeat system. Development of passive system integration kits and technology advancements.								
Enhanced RPG Active Protection (ERAP)								
Utilizing open arch, mature APS components for 360° hemispherical tandem RPG/ATGM defeat. Includes passive systems dev and tech advan, next gen countermeasure.								
Kinetic Energy Active Protection System (KE APS) Effort								
Provide capability to defeat Tank-fired Kinetic Energy (KE) Long Rod Threats with guided interceptor.								
Vertical-launch Architecture LOnG Range (VALOR) APS								
Guided interceptor integration into vertical launch system architecture, that includes an alternate fuzing for ATGM defeat.								
Kill Avoidance Technologies								
Common AFES System Development								
Development of a set of standards, requirements and components to support a common AFES system for tactical and combat ground platforms.								
Advanced Fire Suppression Technologies								
Development, integration, test and research on fire protection technologies (e.g. agents, distribution, ammo protection, fuel tank enhancements, battery suppression, etc.).								
Vision Protection from Lasers (VPL)								
Fire control optics to incorporate wavelength-agile laser protection.								
Advanced Directed Energy Protection – Cameras & Eyes								
Establish laser damage thresholds for sensors.								
Short-Pulse & High Energy Laser Protection Research								
Test and document laser protection performance of various materials against the emerging technologies of both SPHP laser systems.								
Vehicle Optimization								
Threat Oriented Survivability Optimization (TOSOM)								
Software code to represent survivability technologies (signatures, hit avoidance, armor, blast, kill avoidance) for the assessment of specific technology and/or technology suites.								
Demonstrator For Novel Design (DFND)								
Effort leveraging motorsports unique tools, processes, and innovative technology ideas to enhance Force Protection, Vehicle Survivability, and Mobility.								



Active Protection Programs



Purpose:

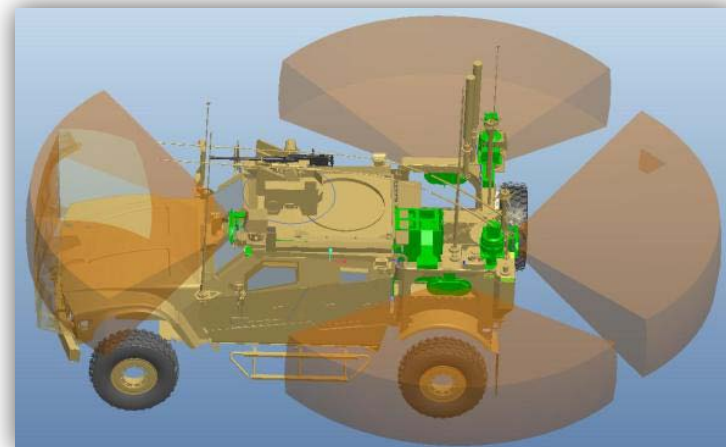
- **Technology development and maturation for RPG hard-kill defeat and ATGM soft-kill defeat.**
- **Iterative build-up of a Hit Avoidance Development and Integration Lab (HADIL) with capability and tool enhancements to support in-house test and validation of components.**

Requirements:

- **Efforts are planned and synchronized in order to meet customer requirements now and in the future.**
- **The RAP program will develop, build, and test toward requirements derived from TRADOC, PM Stryker, and PM MRAP.**

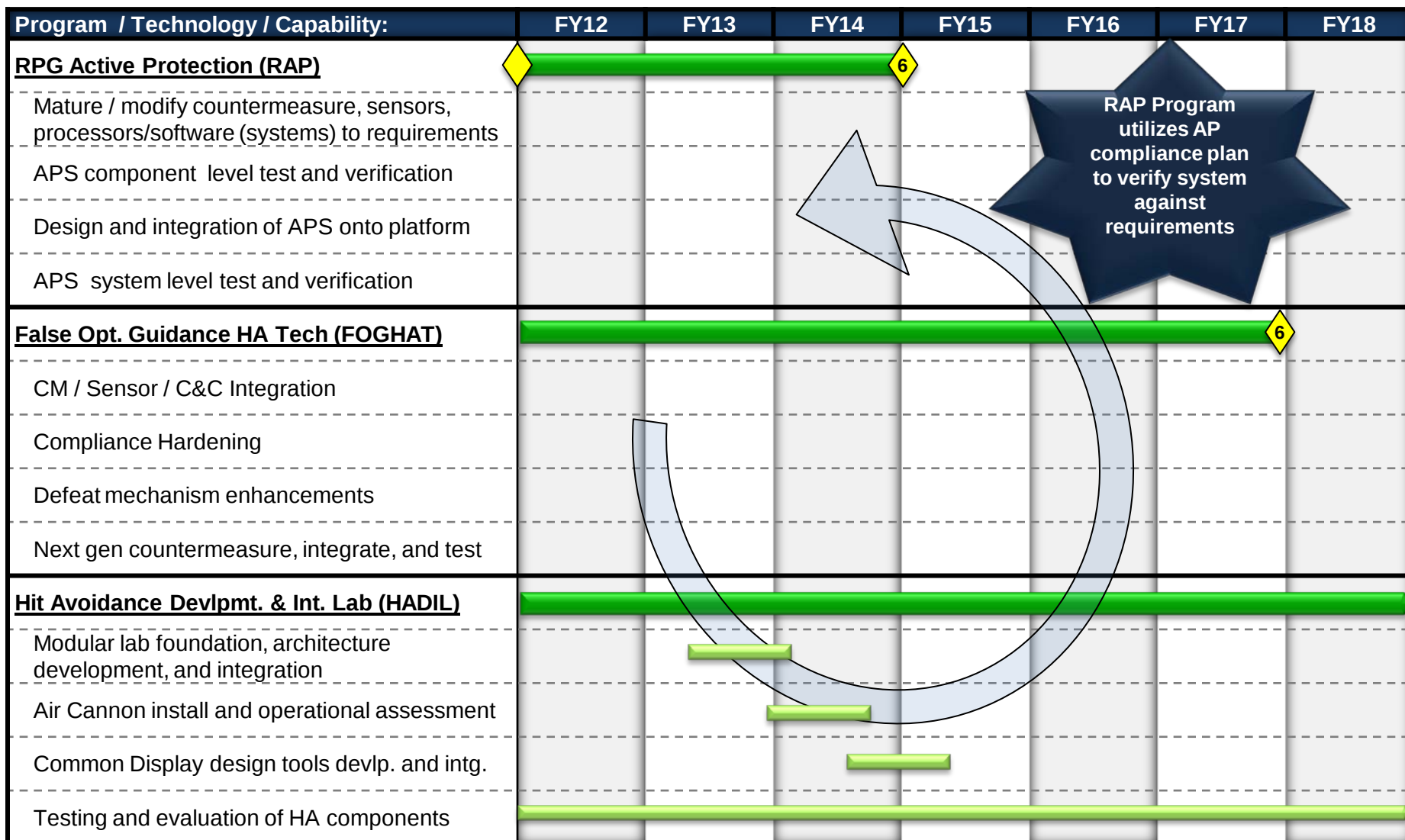
Products:

- **RAP Program: Hard-kill APS, using a plug-n-play open architecture approach for RPG threats**
- **FOGHAT: Low-cost, light-weight integrated ATGM softkill defeat system including threat detection sensor, fire-control processor and countermeasure.**
- **HADIL: Hardware in-the-loop test capability to verify TRL compliance**





Active Protection Program Schedule



◆ Technology Readiness Level (TRL)



AP Key Technical Components



RPG Active Protection (RAP) Program

Key Program Component: Leveraging existing APS to show compliance to PM requirements through a test and verification program.

Issue(s): PM requirements and existing APS capabilities delineate a technology gap; Need significant reduction in delta between capability and requirements

Plan to Approach: Partnership between Gov't and Contractor for system modification and development to TRADOC/PM developed requirements; Government test and verification

False Optical Guidance Hit Avoidance Technology (FOGHAT) Program

Key Program Component: Demo low-cost softkill ATGM defeat system including; countermeasure, warning sensor and fire-control. Future growth to include additional threats.

Issue(s): Identifying the required defeat mechanism for ATGMs

Plan to Approach: Coordinated effort between RDECOM and industry to mature and integrate existing tech to demo the capability to defeat an ATGM in an end-to-end scenario.

Hit Avoidance Development & Integration Lab (HADIL)

Technology development and evaluation. Capabilities will include M&S, HW in the loop testing / emulation, SW validation, physical test, vehicle integration, and integration SW validation.



AP Industry Partnership Outlook



RPG Active Protection (RAP) Program

- Will utilize the TARDEC Omnibus Contract
- RAP RFI with initial draft requirements was released in January 2011

False Optical Guidance Hit Avoidance Technology (FOGHAT) Program

- Integration of existing Multi-Function Countermeasure components (leveraged from U.S. Army Integrated Army APS Program) with sensor and fire-control
- Development of defeat mechanisms for ATGMs
- Next generation sensor, fire-control and countermeasure

Hit Avoidance Development and Integration Lab (HADIL)

- HLA/DIS compliant simulation, processor engagement load cases and man machine interface
- System evaluation and emulation with stressing cases
- Threat characterization
- Physical test data acquisition and analysis
- Potential CRADA partner to leverage IRAD activities.
- Physical System Integration with A-Kit Design

Program	POC
All	Steve Caito
RAP	Heather Kammer
FOGHAT	Jason Morse
HADIL	Will Norton



Common AFES Program Overview



Purpose:

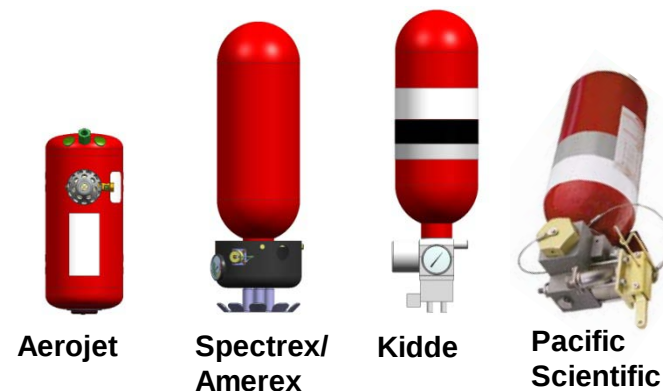
- Provide emerging platforms and legacy vehicle programs with improved damage mitigation techniques to protect against fire threats.

Requirements:

- Battlefield threats have exposed fire protection capability gaps in vehicles. Efforts align with platform survivability and crew protection Warfighter Outcomes and support PM needs for more capable fire protection. Common component efforts requested by PEO GCS & CS/CSS.

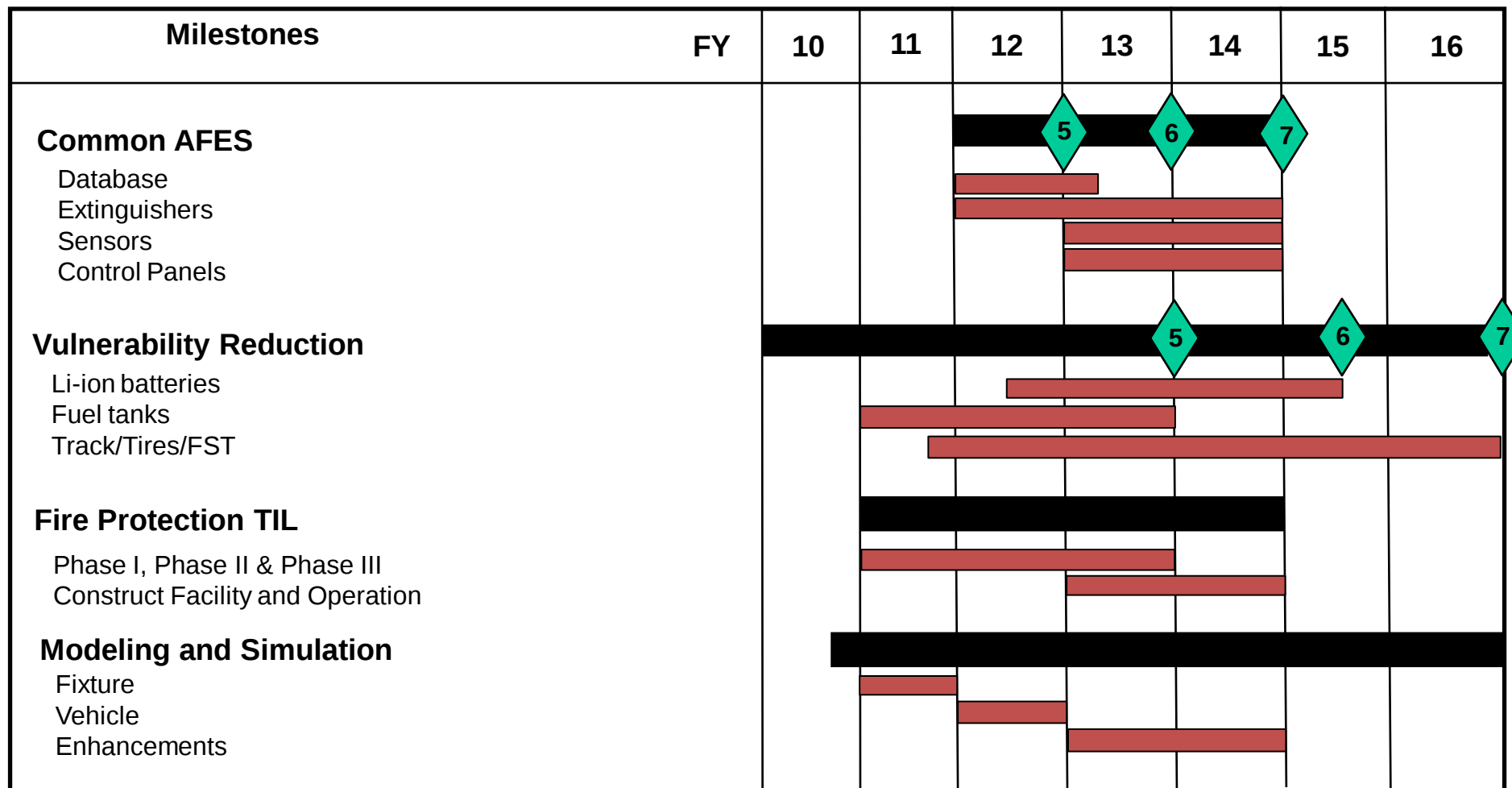
Products:

- Improved fire protection for vehicles and crews.
- Common AFES components.
- Next generation materials/technologies to protect track/tires/FST, fuel, and batteries.
- M&S tools for advanced threats/technologies.
- Laboratory to investigate fire protection technologies at component and system level.





Fire Protection Program Schedule



TRL 



Fire Protection Key Technical Components



Common AFES

Key Program Component: Develop common components for fire suppression systems to include extinguishers, sensors, and control panels.

Issue(s): Lack of standardized requirements and equipment. Systems are tailored to each platform within their SWAP constraints.

Plan to Approach: Implement common AFES components to reduce logistics and maintenance costs.

Vulnerability Reduction

Key Program Component: Develop techniques to address vulnerabilities in emerging technologies (i.e. Li-ion batteries, Fuel tanks, Track/Tires/Fire, Smoke, and Toxicity)

Issue(s): Peacetime & combat-initiated fires are a major source of crew casualties/vehicle damage.

Plan to Approach: Utilize next generation materials and technologies for vehicle protection.

Fire Protection TIL

Key Program Component: Capabilities to develop, integrate, and evaluate vehicle/occupant fire protection.

Issue(s): Need faster and thorough evaluation of new solutions that can be integrated on weapon systems.

Plan to Approach: The facility will support integration, engineering, test and evaluation of next generation materials and technologies.

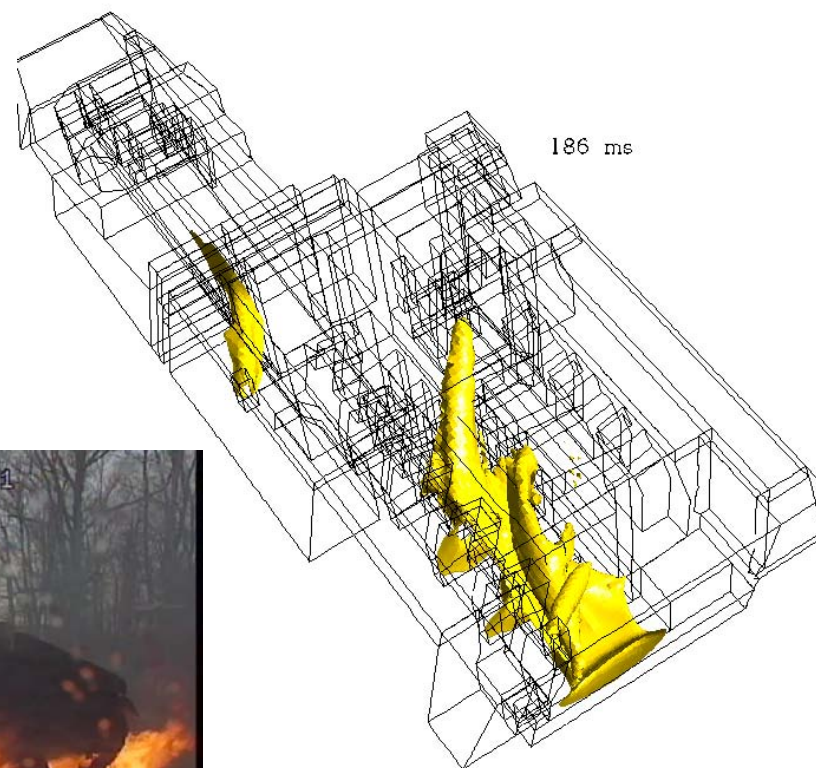
Modeling and Simulation

Key Program Component: M&S code to predict performance of emerging crew AFES.

Issue(s): Models, integration, and testing of existing and novel systems and components do not exist.

Plan to Approach: Create capability to predict fire extinguishing system perf and compare configurations.

Fire Protection POC's



Program	POC
Fire Protection Team	Steve McCormick
Fire Protection TIL	Eric Hahka



Vision Protection from Lasers Program Overview



Purpose:

- *Provide solutions protecting eyes and day-vision cameras from laser weapons*

Requirements:

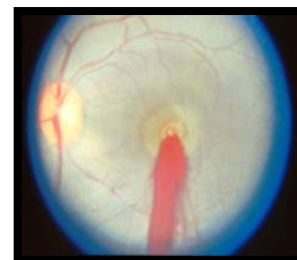
- *Develop materials that limit the amount of light energy allowed to the sensor*
- *Develop new optical system designs allowing the integration of advanced laser protection materials*

Products:

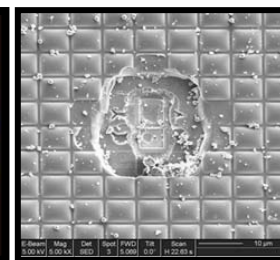
- *Designs, data and reports for applying laser protection technologies to platform optical sighting systems*
- *Designs and reports for applying laser protection technologies to unity magnification periscopes*
- *Sensor vulnerability & signature studies, designs to protect from lasers & mitigate signature*



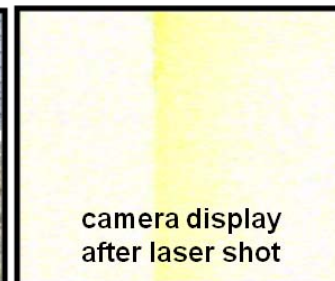
RETINAL
HEMORRHAGE



CAMERA
DAMAGE

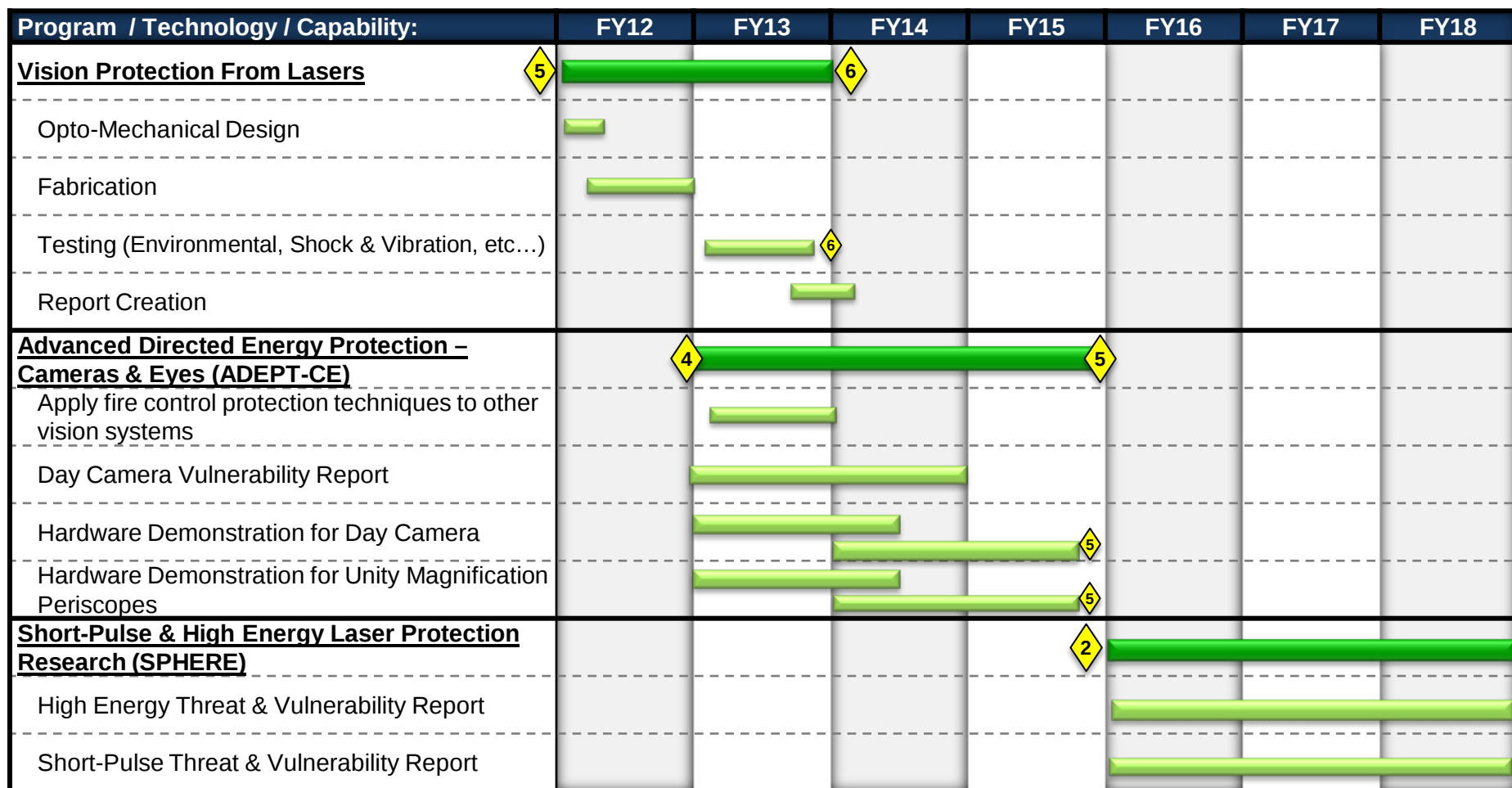


CAMERA
JAMMING





Laser Protection Program Schedule



◆ Technology Readiness Level (TRL)



Laser Protection Key Technical Components



Vision Protection From Lasers Program

Key Program Component: Simplified Optical Design.

Issue(s): Concepts for the integration of technologies are complex (many optical elements).

Plan to Approach: Working with optical designers and OEMs to simplify the designs while meeting protection and performance requirements.

Advanced Directed Energy Protection – Cameras & Eyes (ADEPT-CE) Program

Key Program Component: Continuous-Wave Band Blocking

Issue(s): Filters used to block certain wavelength(s) from entering an optical system. High speed insertion of filters is challenging.

Plan to Approach: Need compact integrated switching mechanisms. Collaborate for the development of fast switching technologies to replace filters and optical materials.

Short-Pulse & High Energy Laser Protection Research (SPHERE):

Key Program Component: Research short-pulse/high power laser energy on optical systems.

Issue(s): New technologies in laser fabrication may have new science to be researched.

Plan to Approach: Work with industry to perform basic research on the science around shorter pulse and higher energy lasers.

Laser Protection POC's

Future Research:

- *Shorter Pulses*
- *Higher Powers*



Program

POC

Laser Protection Research & Technology Integration Laboratory

Robert Goedert



TOSOM Program Overview



Purpose:

- Advanced and innovative capability to perform system level trades using a mathematical assessment of the benefits and burdens of both traditional and non-traditional survivability technologies.

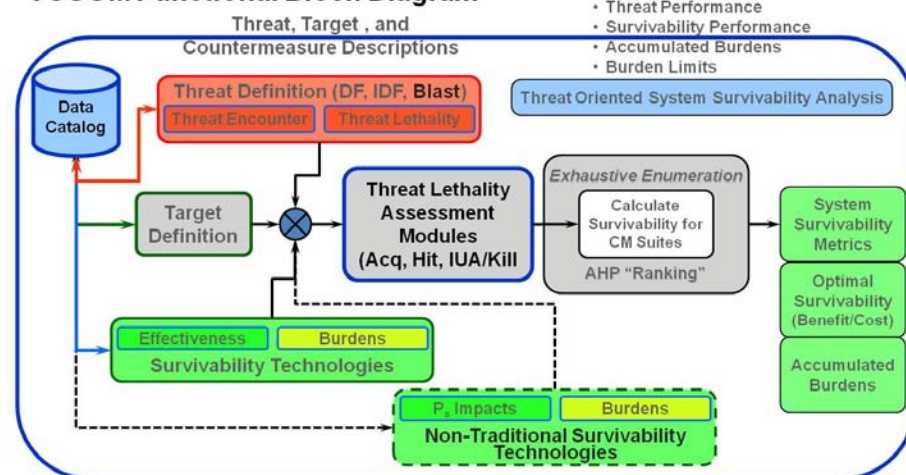
Requirements:

- Need for the ability to model optimal vehicle survivability while minimizing the overall burdens.
- Leverage existing and future survivability efforts such as Hit Avoidance SIL, Long Range Active Protection System Simulation (LRAPSS), GSS Crew Protection Systems Integration Lab, Fire Suppression Efforts and Blast Mitigation

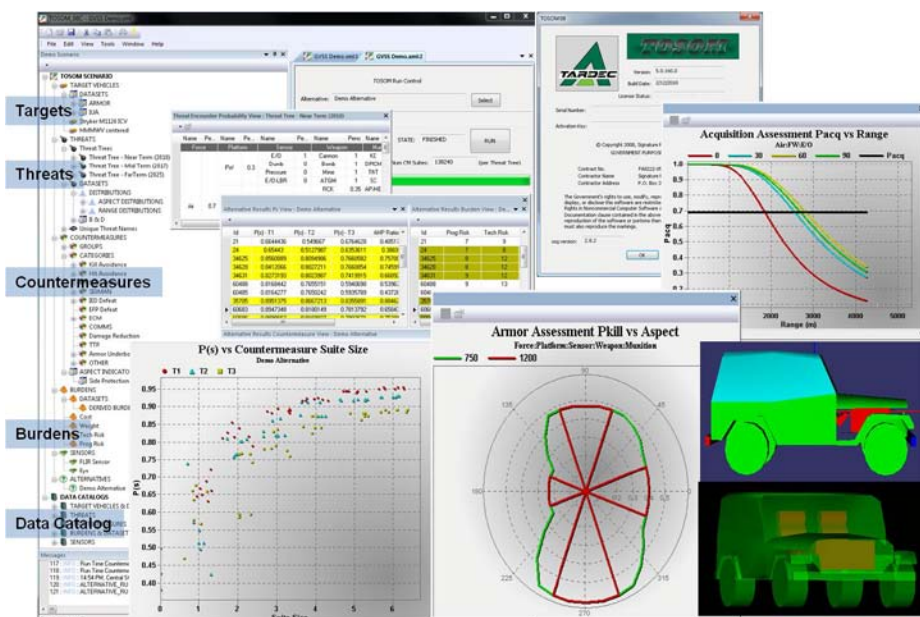
Products:

- Optimization Software
- Supporting “trade-offs” for survivability systems.
- Quantifiable survivability metrics
- Streamlining of concept definition phase
- Visibility into (Acquisition/Hit/Kill) assessment data

TOSOM Functional Block Diagram

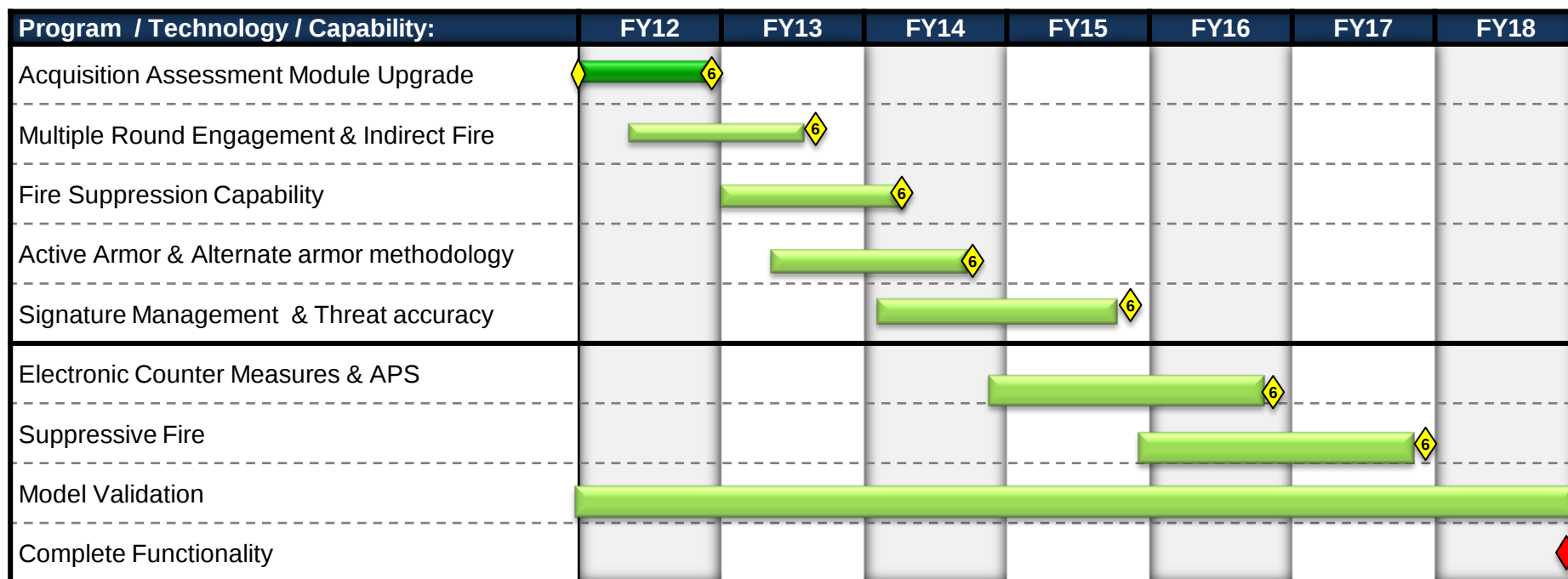


TOSOM Provides Analytical Insights Into Optimal System Survivability Solutions





TOSOM Program Schedule



Technology Readiness Level (TRL)



TOSOM Key Technical Capabilities



- Support “*trade-offs*” for survivability systems
- Provides “*Quantifiable*” survivability metrics
- Assessment tool for “*what if*” and “*how much*” questions
- Use and inclusion of “*Accredited*” data
- Ease of problem setup and metric “*Standardization*”
- Development of metrics for definition of “*Requirements*”, “*Evaluation*” and “*Validation*”
- *Derived burdens allows assessment of Performance vs Protection vs Cost/TRL/Risk*



System Optimization & Modeling Team



- SOM Team has the unique expertise/experience to perform analyses in the optimization of traditional and non-traditional survivability technologies.
- TOSOM is a decision support tool designed to conduct survivability suite tradeoff analyses. It is a methodology for:
 - Selecting feasible solutions from a number of possible outcomes
 - Estimating the variety and magnitude of combat risks to a system
 - Providing robust, responsive “what if” analyses
- TOSOM services can be contracted for DOD studies and projects.

Program	POC
System Optimization & Modeling - TOSOM	Thomson David
System Optimization & Modeling - TOSOM	Daniel Hicks