"Focus the Future Faster"

# PEO LAND SYSTEMS

## Advanced Technology Investment Plan (ATIP)

## 2013 - Volume IV

**PROGRAM EXECUTIVE OFFICER**
**LAND SYSTEMS**
**ADVANCED TECHNOLOGY**
**INVESTMENT PLAN UPDATE**
**2013**

## Executive Summary

The 2013 edition of the Program Executive Officer Land Systems (PEO LS) Advanced Technology Investment Plan (ATIP) reflects a re-alignment and consolidation of both programs and Technology Focus Areas within PEO LS. In order to maximize efficiencies, PEO LS has aligned programs within the same domain/portfolio. Our vehicle programs are now aligned into Light, Medium & Heavy, and Amphibious portfolios.

The Air Command & Control and Sensor Netting portfolio now includes the Common Aviation Command and Control System, Theater Battle Management Core Systems, Marine Air Command and Control System and the Composite Tracking Network system. The Air Defense portfolio includes the Ground/Air Task Oriented Radar and the Ground Based Air Defense System.

The enclosed ATIP identifies and prioritizes each Program's Top Technical Issues with the goal of informing, influencing, and aligning Science & Technology (S&T) investment to resolve program technical issues and support transition of critical capabilities to the Warfighter. These technical issues have been vetted through the appropriate S&T Representative, Lead Engineer, Deputy Program Manager, and Program Manager to ensure an accurate representation of their highest priority technology needs.

Having recently marked the five-year point of operations as the Marine Corps' first PEO, our goal remains clear – to 'focus the future faster' for the Warfighter through engagement, collaboration, and communication across the S&T Enterprise. This 2013 edition of the PEO LS ATIP demonstrates our continued focus on concept-aligned, capability-based technology transitions into Programs of Record in order to provide the most affordable, and reliable capabilities to the Warfighter.


William E. Taylor
Senior Executive Service
Program Executive Officer Land Systems

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## Bottom Line Up Front

The enclosed Advanced Technology Investment Plan (ATIP) identifies and prioritizes the Program's Top Technical Issues within Program Executive Officer Land Systems (PEO LS), with the goal of informing, influencing, and aligning Science & Technology (S&T) investment to resolve program technical issues and support transition of critical capabilities to the Warfighter. Each technical issue has been thoroughly vetted through the appropriate S&T Representative, Lead Engineer, Deputy Program Manager, and Program Manager (PM) to ensure an accurate representation of each program's highest priority technology needs.

Today's budgetary realities are helping to drive ongoing program realignment within the PEO. The Advanced Combat Vehicle, the Marine Personnel Carrier, and the Advanced Assault Vehicle have been consolidated within the PEO under a PM, Advanced Amphibious Assault. Programs have been realigned over this past year with the movement of the Marine Corps' fleet of light, medium, and heavy tactical wheeled vehicles from under Marine Corps Systems Command to the PEO LS structure. Also, trailer programs have been realigned with their associated prime movers. PM Towed Artillery Systems, PM Ground Based Air Defense – Ground Air/Task Oriented Radar, and PM Air Command and Control and Sensor Netting have been similarly realigned.

This 2013 edition of the ATIP reflects the realignment of the PEO portfolio as well as S&T focus areas, to include Power & Energy, Survivability & Mobility, Open Plug & Play Communications Architecture, and Modeling & Simulation.

As always, we welcome any comments or suggestions to improve the utility of this investment plan. Please forward any suggestions or comments to me, Mr. Mike Halloran, PEO LS Director, S&T at Michael.D.Halloran@USMC.mil.

Michael D. Halloran
Director, Science & Technology
Program Executive Officer Land Systems

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# 1.0 INTRODUCTION

***"Focus the Future Faster"***

Today's fiscally austere environment and the shift to refocus on amphibious operations presents significant challenges to the Marine Corps as it strives to replace or modernize its legacy equipment. The 2013 Advanced Technology Investment Plan (ATIP) was developed as a tool to help the Program Executive Officer Land Systems (PEO LS) inform, influence, and align the Science and Technology (S&T) enterprise and support key stakeholders in their efforts to transition affordable, reliable technologies with increased capabilities to the Warfighter. The primary purpose of the 2013 ATIP is:

- Identify and Prioritize Top Technical Issues within PEO LS Programs
- Inform, Influence, and Align S&T Investments
- Resolve Capability Gaps & Technology Issues
- Support Technology Insertion and Transition into Programs of Record (POR) and eventually to the Warfighter

The ATIP is also developed to assist industry and government in their efforts to be better informed concerning the S&T needs of the major Acquisition Category (ACAT) I & II programs within PEO LS. There are many needs that are common across all PEO programs: the need to be more reliable; the need for more efficient power; the need for enhanced survivability while maintaining and/or increasing mobility; and the need to have an independent and reliable Modeling & Simulation (M&S) capability. These needs are being addressed through numerous S&T initiatives managed by Office of Naval Research (ONR), the Tank and Automotive Research, Development and Engineering Center (TARDEC), and the Defense Advanced Research Projects Agency (DARPA), and within the program offices themselves. The goal of this 2013 ATIP is to better define the critical technology needs and the efforts each organization is contributing to address them.

This fourth edition of the ATIP incorporates the new programs added to the PEO last year and addresses the top technical issues of each program within PEO LS in an effort to transition gap closing technologies to the Warfighter. Identifying the technical challenges is an essential first step, but the real key to getting affordable, state-of-the-art capability to the Warfighter is focused engagement with the stakeholders of the Marine Corps S&T Enterprise. This group is also referred to as the "3 Circles." The "3 Circles" represent a set of collaborative relationships between the *Combat Developer*, the Combat Development and Integration (CD&I) and the Marine Corps Warfighting Laboratory (MCWL); the *S&T Developer*, ONR Expeditionary Maneuver Warfare and Combating Terrorism Department (ONR Code 30); and the *Material Developer*, which are the Marine Corps Systems Command and PEO LS. In order to maximize S&T funds and to facilitate transition, PEO LS has actively expanded this community of stakeholders to include additional key stakeholders and partners such as TARDEC, DARPA, academia and industry as depicted in Figure 1 on the following page.

**Mr. William E. Taylor, the Program Executive Officer for Land Systems Marine Corps, converses with Marines during his tour of the facility at Camp Pendleton, Calif., Feb. 7. His visit coincided with the beginning of Phase I of the Common Aviation Command and Control Systems at MASS-3.**

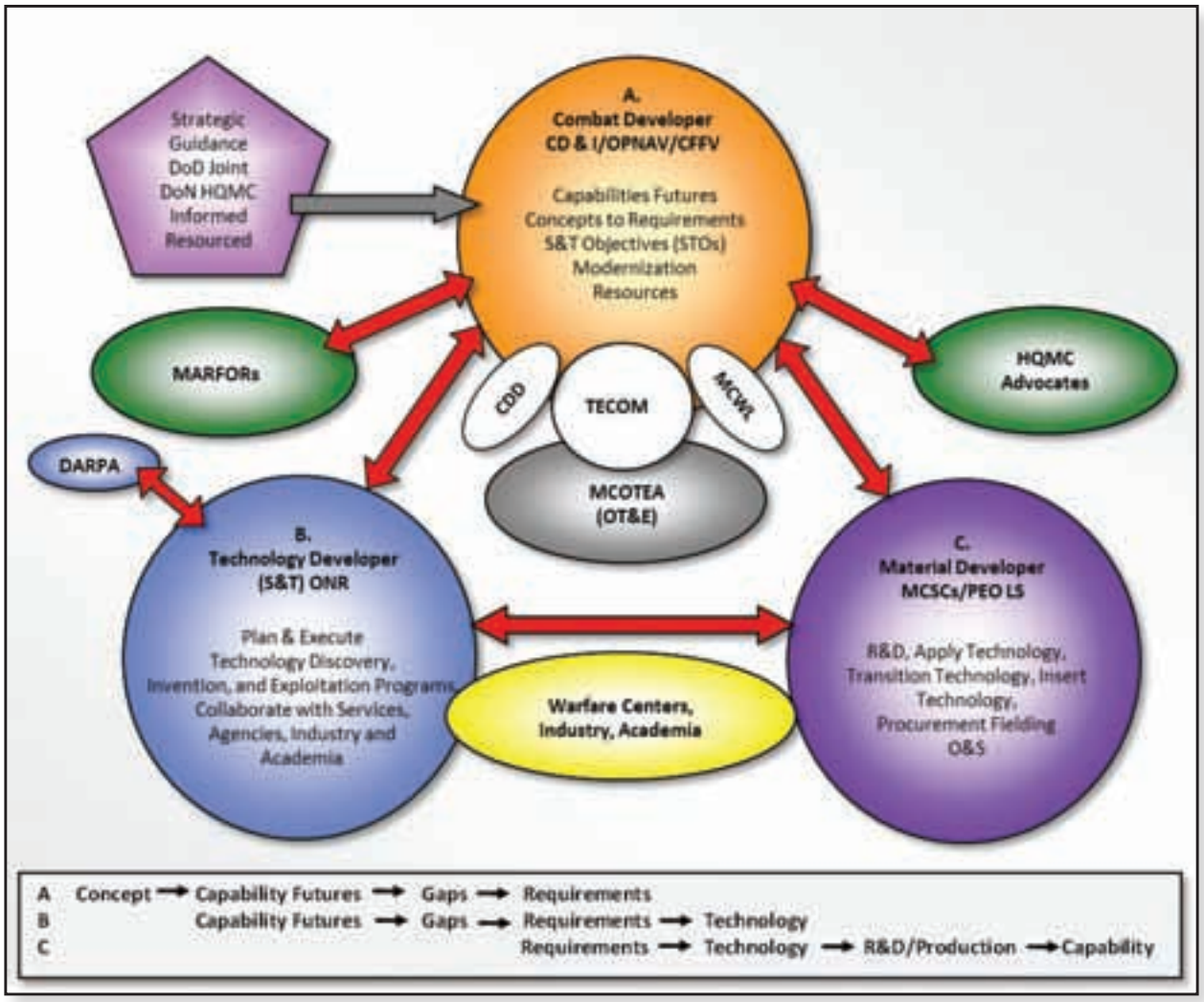


**Figure 1. Marine Corps S&T Enterprise "3 Circles"**

## Joint Center for Ground Vehicles

An excellent example of the expanded "3 Circle" community at work is the Joint Center for Ground Vehicles (JCGV). A Memorandum of Understanding was signed between the Army and Marine Corps in August of 2010 establishing the Joint Center. PEO LS has been working with the Army in a joint construct (see organizational chart on the following page). The JCGV was formed from existing organizations and infrastructure (Figure 2) to address current and future technical and resource challenges surrounding ground vehicles. The JCGV is focused on ground tactical vehicles and is seeking efficiencies across programs. Its key goals are to increase efficiency, reduce costs, and synchronize technology development – ultimately improving the effectiveness of the ground vehicle system development and acquisition across both the Army and the Marine Corps.

A few of the key pillars of the Joint Center are:

- No additional layers of oversight
- Builds from existing structures
- Centralized collaborative governance
- Synchronized technology development
- Open communications
- Deliberate focus on cost cutting issues
- Existing authorities remain unchanged

The JCGV has afforded the Marine Corps the opportunity to leverage Army investments that are relevant to the needs of the PEO LS Program Managers and the Marine Corps.

## "Concept to Capability" Process

The PEO Land System's S&T "Concept to Capability" Process is a repeatable process with ongoing review and focused feedback. This process has proven essential when interacting with the JCGV and S&T Stakeholders. The process actions begin with an in-depth understanding and alignment to the overarching concepts identified in *Marine Corps Vision and Strategy 2025* and capstone concepts for the future. It is critical to employ these guiding documents and concepts to inform and align the capability requirements, guide technical development, and provide best value investing. An understanding of the Warfighters' Concepts and the core capabilities required to enable those concepts is the next step in the process. Also critical is an understanding of the top level strategic and operational service issues (listed below) that rely on material solutions for resolution.

- Rehoning the Expeditionary Edge – Reducing the Sustainment Footprint
- Fuel Saving Across the Marine Air Ground Task Force (MAGTF)
- Lightening the MAGTF Load
- Reducing the MAGTF Footprint

Once the operational concepts and capabilities are understood, an analysis is performed to identify

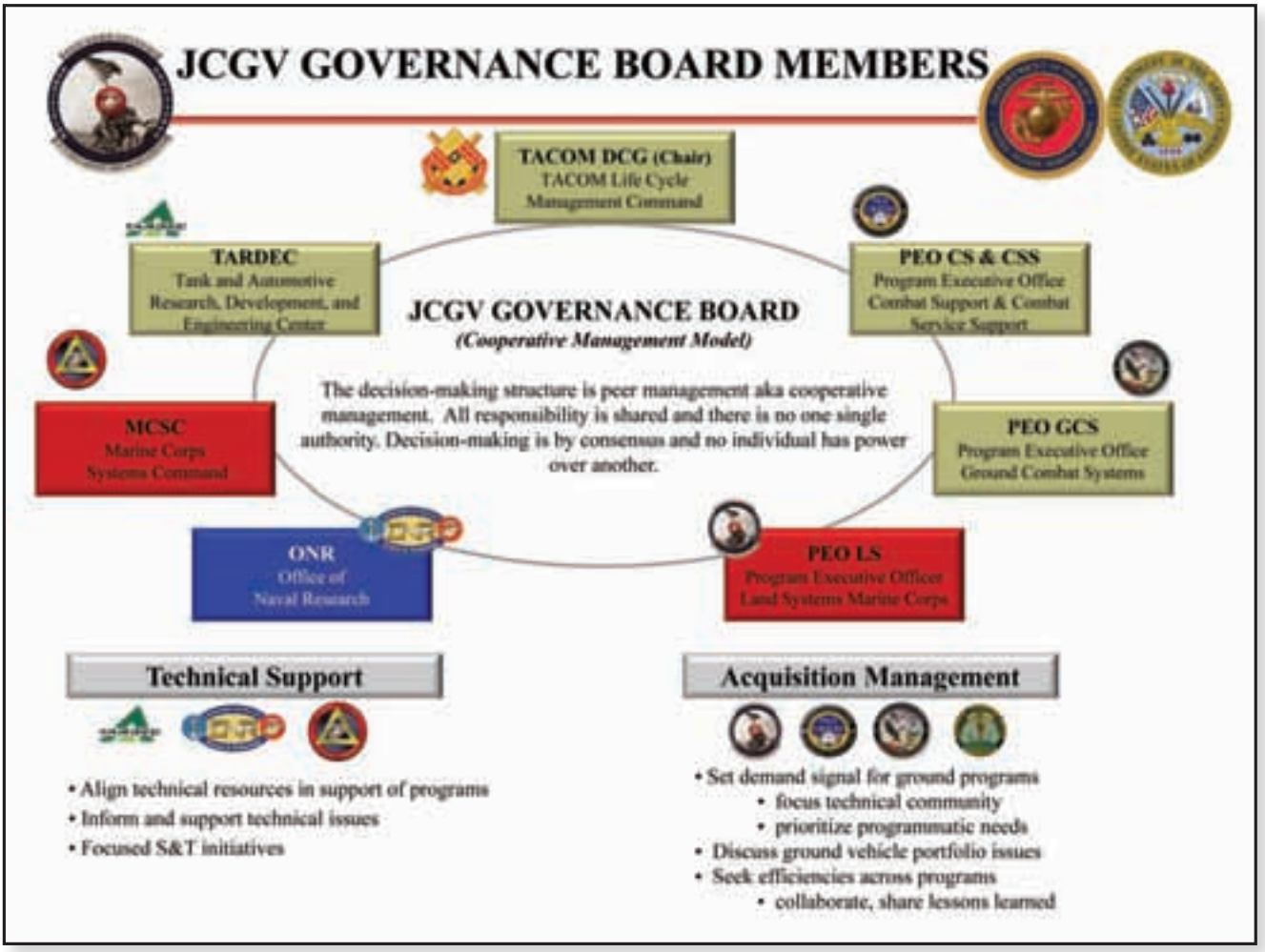


**Figure 2. Joint Center for Ground Vehicles Governance Board Members**

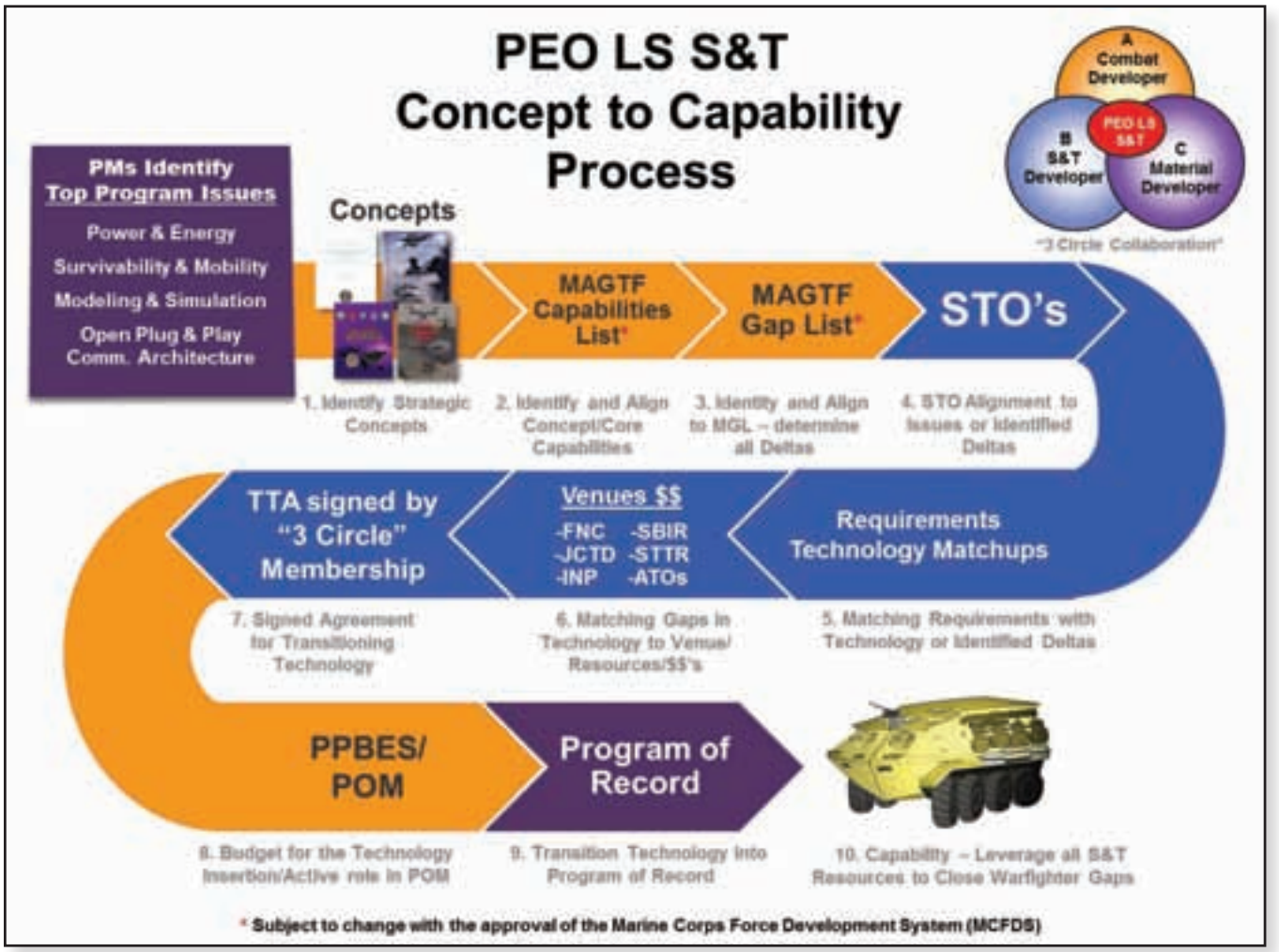


**Figure 3. PEO LS ATIP "Concept to Capability" Process**

the MAGTF capabilities and technology gaps. These capabilities and gaps are codified in the MAGTF Capability List (MCL) and MAGTF Gap List (MGL), as well as in the Solutions Planning Directive (SPD) and the MAGTF Requirements List (MRL).

A review is conducted to align all applicable Science and Technology Objectives (STOs) to the technology issues/capability gaps. This alignment of STOs with high priority gaps ensures traceability of PEO LS S&T investments and enables stronger support within the Program Objective Memorandum (POM) process.

Once the alignment is complete, a thorough review of current S&T initiatives is conducted to highlight those initiatives that have potential to resolve the identified technology issue/capability gap. If it is determined a "delta" exists and no current S&T initiative is in place to address/resolve the gap, then potential S&T venues are evaluated and a "new" S&T initiative is submitted via the appropriate forum – matching gaps in technology to the appropriate venue able to best align resources to resolve the program technical issue and schedule.

Upon approval of the new S&T initiative, the Project Manager, as well as all "3 Circle" members, capture the shared commitment within the framework of a formalized Technology Transition Agreement (TTA). After the TTA is signed by the appropriate level of "3 Circle" leadership, the S&T Representative continues to work closely with

the Project Manager to ensure funding support is available (in the POM) to integrate and transition the technology to the appropriate POR and close the associated Warfighter gap.

By working through the "Concept to Capability" process (Figure 3) potential S&T opportunities and solutions are identified, enabling PEO LS S&T Representatives to better inform requirements, provide "best value" S&T investing and transition gap closing technologies to a POR.

The best way to leverage this funding is though consistent, informed engagement across all "3 Circle" partners.

## PEO LS Organization

Figure 4 reflects the current PEO LS organization.

## Electronic Copies of ATIP

The PEO LS ATIP is published annually and is available electronically on the Defense Innovation Marketplace website:

http://www.defenseinnovationmarketplace.mil/USMCInformation.html

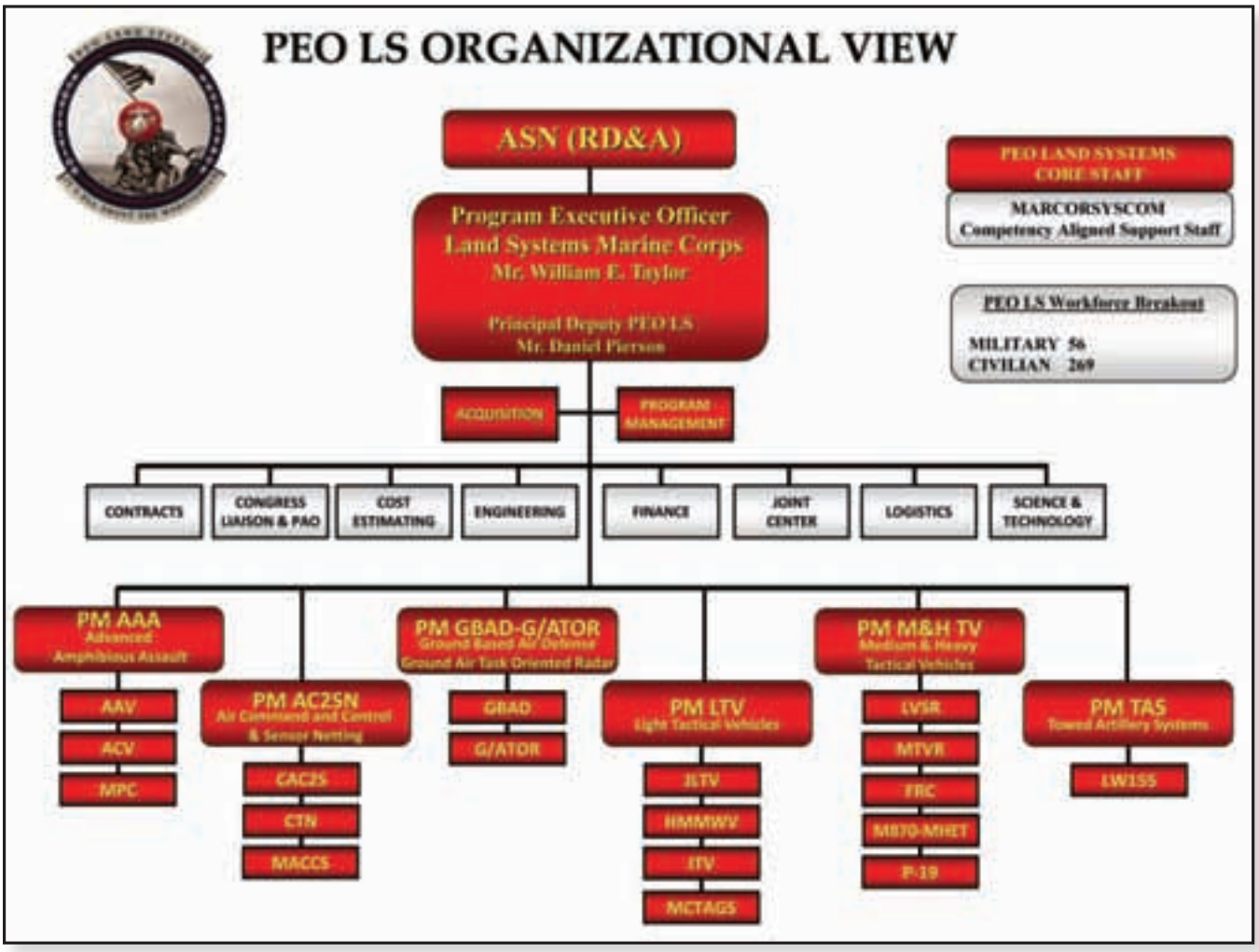


**Figure 4. PEO LS S&T Organization**

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# 2.0 FUTURES

***"We will likely not call the future exactly right, but we must think through the nature of continuity and change in strategic trends to discern their military implications to avoid being completely wrong. These implications serve to influence the concepts that drive our services' adaptations to the environments within which they will operate, adaptations that are essential if our leaders are to have the fewest regrets when future crises strike."***

-Gen James N. Mattis USMC, Joint Operating Environment 2010

Our responsibility is clear, focus the future faster by transitioning affordable, reliable and capable technologies into our PEO LS programs of record. We must consider a wide variety of threats, strategic trends and opportunities to ensure an informed understanding of the technological art of the possible. We must also remain aligned to our overarching concepts within a realistic context of the global landscape in which that capability will be employed. As an acquisition command operating in fiscally constrained times, we must also look at views of the future that span relevant, well focused sources and perspectives.

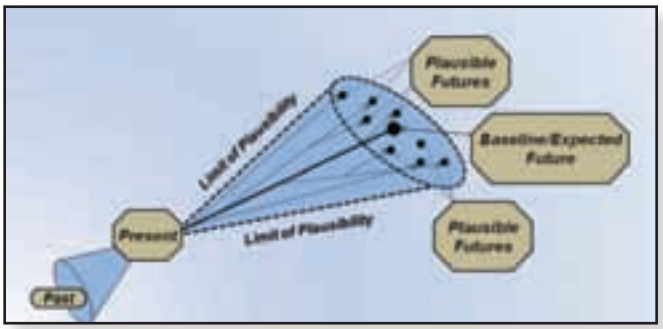
For PEO LS, this required activity centers squarely on the U.S. defense establishment. The strategic methodology utilized in the "Concept to Capability" process informs our advanced technology investment plan and provides context to our understanding of the "expected" future state of the world. This investment plan also references and responds to Department of Defense, Joint, and Service guidance relative to what the future is expected to hold. It also considers other likely, plausible futures as espoused by experts from industry, academia, and the international community.

These "expected futures" are derived from baseline forecasts that extrapolate existing trends into the out years. To gain a better understanding of the expected landscape, we have a responsibility to look at those unanticipated futures and chronological trends to anticipate potential threats and opportunities that could lead to strategic or tactical surprise.

Organizations and industry participants who are focused on supporting current and future PEO LS material needs and capability solutions will also benefit from an understanding of these trends and forecasts.

Trends and forecasts used to support our examination of the most likely future security environments are outlined in a number of key U.S. defense-related publications: *DoD Sustaining U.S. Global Integrated Digital Technology Backbone Leadership: Priorities for 21st Century Defense (2012), Capstone Concept for Joint Operations: Joint Force 2020 (CCJO) (2012), Joint Operational Access Concept (JOAC) (2012), Chairman of the Joint Chiefs of Staff Mission Command White Paper (CJCS 2012), Naval Operations Concept 2010 (NOC 2010), Marine Corps Operating Concepts 2010 (MOC 2010), Marine Corps Vision & Strategy 2025 (MCV&S 2025) (2008), and the 35th Commandant of the Marine Corps Commandant's Planning Guidance 2010 (CPG 2010).*

## Futures 101: Strategic Foresight




**Source: LtCol Daniel S. Wisniewski, USMC – Strategic Vision Group, STRATEGIC FORESIGHT, 8 Feb 2011**

The future holds a variety of predictable and unpredictable threats, challenges and opportunities. The trends and forecasts outlined in these seminal documents that are relevant to PEO LS include:

- An era of Fiscal Austerity and Government Debt
- Technological Diffusion – Weapons of Mass Destruction proliferation
- Increased urbanization, particularly in the littorals
- The traditional view of three primary domains (air, land, and sea) within the "global commons" in context, with the addition of space and cyberspace as new domains
- The demand for critical resources is likely to continue to exceed supply, even with advanced conservation and efficiency measures coupled with alternative sources
- Transnational Crime – Regional Instability – Violent Extremism

***"The current challenge is to determine how to balance finite logistic capacity against wide ranging operational imperatives."***

- Marine Corps Operating Concepts Third Edition, June 2010

The PEO LS S&T Directorate monitors Marine Corps efforts in the areas of futures and concepts and understands the potential impacts and influences across the PEO LS portfolio. To that end, this plan identifies and prioritizes the PEO LS top technical issues and technology needs in order to inform, influence and align S&T investment in support of transitioning critical capabilities to the warfighter.

These trends and forecasts portend a dynamic future security environment characterized by fiscal austerity, instability, complexity, competition and uncertainty. In an effort to better inform, influence and align future technology transition options to resolve top priority technical challenges, PEO LS evaluates potential technology trends to identify cost-effective solutions that improve warfighter capabilities to meet the future threats and associated challenges.

PEO LS's "Concept to Capability" approach provides a valid, repeatable process for addressing the uncertain future, within the context of the evolving Marine Corps Force Development System. Future risks are minimized by selecting well researched areas of focused investment based on technical issues that share common warfighting connections to multiple programs within the PEO. Focusing S&T funding on these key areas enables the Marine Corps to maximize its Return on Investment (ROI) and to be better prepared as it moves into the future.

Our current PEO LS key focus areas include: 1) Power & Energy, 2) Survivability & Mobility, 3) Modeling & Simulation, and 4) Open Plug & Play Communications Architecture. These focus areas serve as the primary means for identifying critical technology enablers and resolving critical capability challenges. These critical areas—along with their associated subsets of fuel efficiency, intelligent power and thermal management, autonomy, corrosion resistance, crew visibility, fuel containment and fire suppression, safety and weight reduction—provide a relevant focal point to credibly inform our future investments.

Dynamic challenges are associated with future U.S. Marine Corps and Naval Expeditionary Concepts and provide the context for shaping and enabling the "balanced" Marine Corps of Tomorrow. Our S&T investment strategy must account for these challenges while lightening the MAGTF, optimizing energy efficiencies, and operationalizing the sea base.

## PEO LS Focus the Future Faster - "Concept to Capability" Vision

Achieving a lighter and more lethal Naval expeditionary force within the fiscal constraints of


current budgetary realities will require innovation, dedication and focused professionals who are intent on mission accomplishment. As current maritime forces are constrained by limits to scale in organization of forces and platforms, future maritime assets will find an even greater challenge to effectively resource the Naval expeditionary force and operationalize the Sea Base. This is a key focus within the PEO LS "legacy to modernized" investment strategy. As the Marine Corps positions itself for the future, our investment focus must be on reducing the weight and cube of the MAGTF and maximizing efficiencies across all domains, with particular attention placed on energy and logistics. The intent is to provide technologies that are affordable, reliable and capable and that are focused on supporting the Marine Corps' amphibious doctrine.

## PEO LS Futures Focus - Holistic Modularity and Modular Vehicle Platform Concepts

Future fiscal constraints will almost certainly impact the development of new programs of record to lighten the MAGTF and operationalizing the Sea Base. Therefore, it is critical that the Marine Corps maximize capability with proven legacy systems and platforms and "modernize" those capabilities with purposeful capability packages and systems applications.

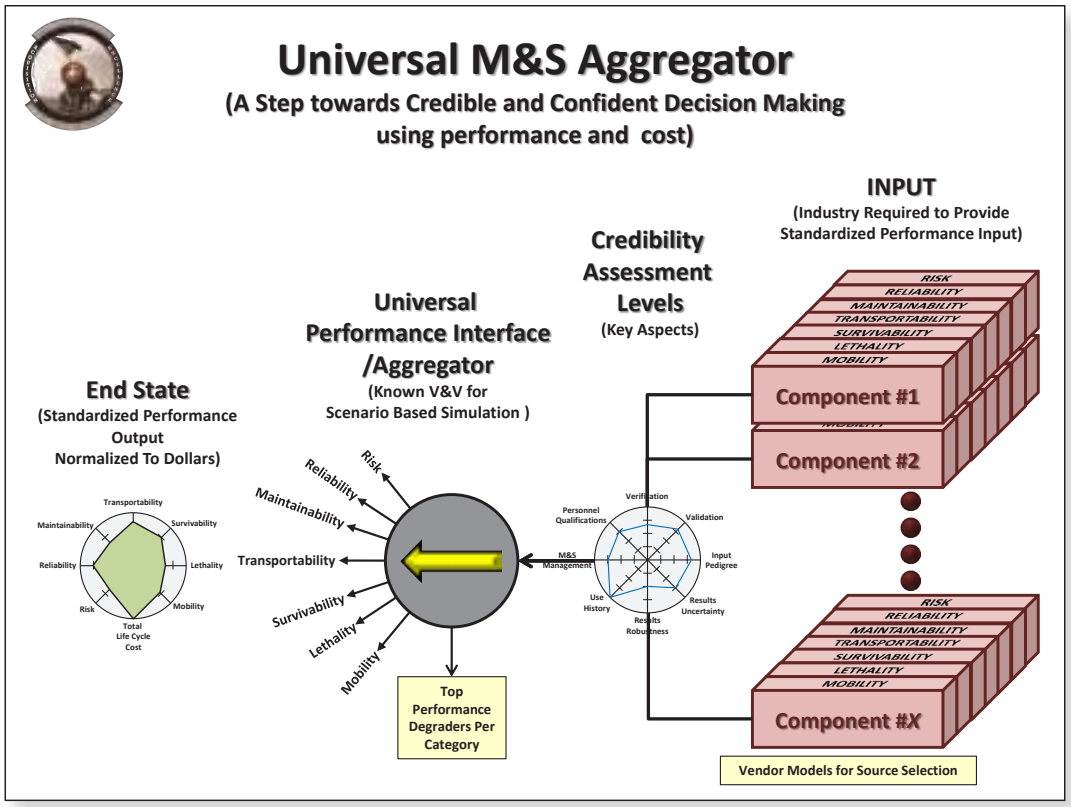
A key approach to developing a lighter, more fiscally responsible capability is Holistic Modularity, a design philosophy that incorporates a multi-disciplinary design approach, optimized for requirements. In order to effectively operate from the Sea Base in remote areas of the Asia Pacific

theater, Marines must embrace a "Lighten the Load" mentality for all associated acquisition programs. While the design, development and implementation of this holistic modularity presents significant 2nd and 3rd order effect technical challenges, it will ultimately provide an enabling framework to lighten and modernize the future Marine Corps.

One such example of holistic modularity is the Modular Vehicle Platform (MVP) concept, employing the legacy Medium Tactical Vehicle Replacement (MTVR), which is a proven warfighting asset programmed for employment through 2035.

The MVP concept illustrates how modularity can modernize legacy platforms with tremendous operational impact and significant benefit to our warfighters.

- MVP leverages the flexibility of MTVR with Onboard Vehicle Power (OBVP) and offers the commander multiple options for mission sets, to include: Mobile Modular Command and Control (M2C2), Mobile Trauma Bay, Gunslinger Force Protection, Mine Neutralization, Expeditionary Power/ H2O purification, Counter Rocket Artillery and Mortar, Universal Lift and Loaders, and Ground Based Air Defense (GBAD) on the Move.
- Provides the Sea-based Commander with mission package flexibility once embarked.
- Reduces the number of vehicles required in theater.
- Reduces the MAGTF maintenance burden.




- Reduces the MAGTF footprint afloat and ashore.
- Provides an integrated Digital Backbone with Modular interfaces and architectures networked together to enable seamless interchange and operation of "plug and play" mission modules.
- Future Autonomy - Select MVPs equipped with autonomous capability sets and employing a leader/follower Concept of Operations will further reduce MAGTF footprints as well as manning and associated force protection requirements.

## PEO LS Futures Focus – Development of a Universal Modeling & Simulation M&S Aggregator – the next generation of computing power

M&S remains a critical enabler in our ability to maximize future PEO LS investments and material contributions to the Warfighter. Equally essential is the requirement that future M&S capabilities employ an accurate, verified, and validated "Universal Modeling and Simulation Aggregation" tool.

The development of a universal modeling and simulation aggregation tool will allow quick and accurate assessments concerning Performance, Cost, and Schedule (PCS) of the full inventory of Marine Corps vehicles, and it is a key to our future material capability development process. A universal intelligent based tool will effectively interface and aggregate component data provided by industry, assess the aggregated data through scenario based simulation, and provide normalized PCS output, allowing Marine Corps leadership to assess a system's total cost and overall value with a high level of confidence.

## PEO LS Futures Focus – Science and Technology Investment to Support Condition Based Maintenance (CBM)

As the Marine Corps reduces, standardizes, and modernizes its equipment and vehicle fleet to

address future missions, it must accomplish this in a fiscally conservative manner that allows for multiple-platform equipment upgrades that do not compromise combat effectiveness. Additionally, current capability provided by legacy platforms must be sustained in order to ensure that the future Marine Corps maintains its combat edge. Conditioned Based Maintenance provides such a capability and affords the Marine Corps the opportunity to:

- Use modular sensor-based technology integrated into existing platforms to greatly improve the readiness and combat effectiveness of units operating in the Area of Operations.
- Employ sensor technology that can indicate when a system (e.g., transmission, engine, electrical components) is not performing at desired parameters or when critical maintenance is required.
- Predict required maintenance for major end items, which will increase the turn-around rate for assets in the maintenance cycle, reduce parts storage, and increase the requisition process rate, since fewer items are kept in the pipeline and parts orders are made in advance.
- Deploy cyber protected sensor-based technology integrated into pre-existing platforms and monitor on a secure and live network, which will enable the Marine Corps to take full advantage of a CBM System.

## PEO LS Futures Focus - Adaptation of Autonomy and Robotic Capabilities

Autonomous and robotic capability sets are quickly establishing a strong foundation in every aspect of the Department of Defense (DoD). Semi-autonomous systems are being employed in every segment of society (commercially and militarily), with research into fully-autonomous (cognitive) systems the target of development efforts as forecasted in the Autonomy Maturity Horizon graphic below. Currently, the majority of autonomous and robotic systems employed by the Marine Corps are used in Unmanned Ground Vehicle (UGV) applications, such as Counter-Improvised Explosive Device detection, breaching operations, and defensive systems.


**Autonomy Maturity Horizon 2009-2034**

Increased use of robotics in dangerous UGV applications can ultimately increase the Corps' mission performance and combat effectiveness as increasing numbers of personnel are removed from hazardous tasks and assignments. The range of operations for autonomous robotic systems is vast and includes logistics, physical security, and urban warfare and virtually crosses all Warfighting domains.

Future sea-basing concepts seek to employ autonomy and robotics in sustainment and firefighting operations, both above and below decks. By being smaller, stronger, and faster, robotic Material Handling Equipment and connector-to-connector autonomous assets can be more easily deployed to operational areas without increasing airlift or sealift requirements. Autonomy and robotics provide a way forward to improve agility at the tactical edge with better throughput, smaller logistics overhead and more efficient energy management.

A key S&T autonomy capability under development in support of sustaining distributed operations via autonomous delivery systems is the ONR Autonomous Aerial Cargo & Utility System (AACUS). An Innovative Naval Prototype (INP), the technology targeted within this INP includes open architecture, tremendously enhanced processing speeds, and technology that is platform agnostic. The system focus will provide a substantial leap in levels of cognitive/full autonomy and targeted reductions in size, weight, and power. All parameters align closely to key issues and identified focus areas within PEO LS programs.

## PEO LS Futures Focus - Lighten the Load of the MAGTF

***"The current and future operating environment requires an expeditionary mindset geared toward increased efficiency and reduced consumption, which will make our forces lighter and faster. We will aggressively pursue innovative solutions to reduce energy demand in our platforms and systems, to increase our self-sufficiency in our sustainment, and reduce our expeditionary foot print on the battlefield. Transforming the way we use energy is essential to rebalance our Corps and prepare it for the future…."***

-Commandant of the Marine Corps, Power, Strategy & Vision 2025

The advantages of properly aligned S&T investments in regards to "lightening the load" are numerous and provide the future Marine Corps with potential game changing effects:

- Implementation of robotics and autonomy to remove Warfighters from potentially hazardous situations.
- OBVP that eliminates the requirement to tow a trailer carrying a generator.
- Fuel and power-efficient vehicle fuels that are modular and scalable.
    - Modular vehicle platforms will enable the deployment and employment of standardized equipment, specifically structured to operate in a variety of mission parameters. They will further reduce inventories of vehicle types and associated spare parts, reduce the MAGTF logistics footprint, and reduce the force's maintenance burden and weights associated with manning and equipping the force.

The Corps' desire to become an energy efficient and self-sufficient expeditionary force of the future has inspired both the vision and mission statements of the Marine Corps' expeditionary energy strategy.

**Vision:** "To be the premier self-sufficient expeditionary force, instilled with a warrior ethos that equates the efficient use of vital resources with increased combat effectiveness."

**Mission:** "By 2025 we will deploy full spectrum Marine Expeditionary Forces that can

maneuver from the sea and sustain its Control, Communications, Computers, and Intelligence (C4I) and life support systems in place; the only liquid fuel needed will be for mobility systems, which will be more energy efficient than systems are today."PEO LS continues to maintain a current Power & Energy Key S&T Focus Area. The use of renewable energy and more efficient fuels will have a dramatic impact on the lift required to support units while reducing overall operational costs of the future Marine Corps.

## PEO LS Futures Road Ahead

PEO LS continues to "focus the future faster" by evaluating both current and future threats/capability gaps with respect to potential S&T investments and potential material solutions that will improve Warfighter capabilities. The ability to equip, protect and sustain the warfighter is more than a catch phrase – it is a passion that remains constant for PEO LS.

Working within the constraints of a fiscally austere environment, it is imperative that the Marine Corps fully embrace S&T as a means to not only mitigate program risk but also as a means to modernize and sustain legacy equipment. By leveraging all available resources to inform, influence, and align S&T investments, PEO LS is committed to providing affordable and reliable capability transitions into our programs of record as we continue to "focus the future faster" in support of the Warfighter.

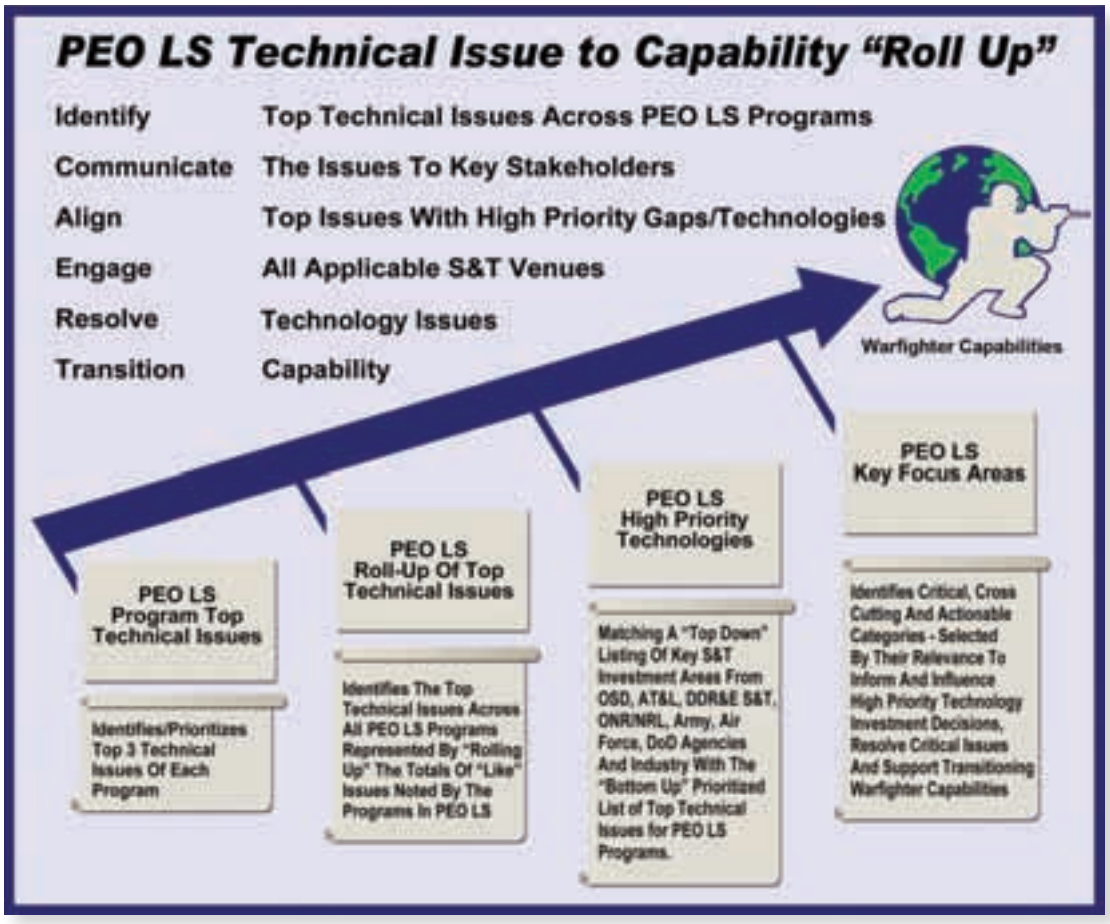
# 3.0 PEO LS TOP TECHNICAL ISSUES

***"I need the S&T community to help us think differently about how we make -- how we can make our distributive forces more capable and more expeditionary for the future. As we optimize and modernize, we need to focus on lightening the load, shedding the weight and size from our combat systems."***

-General Amos at the 2012 Naval Science & Technology Partnership Conference 23 October 2012

The PEO LS S&T Directorate has taken a consistent, deliberate and focused approach toward assisting the Program Managers in answering the top technical challenges of their programs. Each Top Technical Issue has been vetted through the Program's S&T Representative, Lead Engineer, Deputy Program Manager and the Program Manager for concurrence and prioritization. The approach below assists S&T Representatives from all PEO LS Programs, allowing them to work through the top technical challenges of their programs and identify capability gaps where S&T could potentially lead to requirement solutions.

This collaborative approach has proven extremely valuable, not only in identifying individual program technical issues, but also by identifying technology issues common among other PEO LS Programs. By understanding these common technical challenges, PEO LS can better align and leverage resources across the S&T Enterprise.



## Top Technical Issues

The Top Technical Issues of each individual PEO LS Program are identified in Figure 5.

**PEO LS Program Top Technical Issues**

| Program | Technical Issues |
|---|---|
| Assault Amphibious Vehicle (AAV) | Survivability<br>Weight/Buoyancy Management<br>Sustainment/In-Service Engineering |
| Amphibious Combat Vehicle (ACV) | Increase Survivability<br>Increased Weight Margin<br>Crew Visibility |
| Marine Personnel Carrier (MPC) | Survivability<br>Weight<br>On-Board & Exportable Power |
| Common Aviation Command & Control System (CAC2S) | Direct Air Cooling<br>Self-Healing Networks<br>Contextual Search Engines |
| Ground Based Air Defense (GBAD) | Stinger Night Sight Replacement, D-UNS<br>Frangible .50 and 7.62mm Rounds |
| Ground/Air Task-Oriented Radar (G/ATOR) | Lowering Manufacturing Costs<br>Transit/Receive (T/R) Module Efficiency<br>Gallium Nitride Reliability |
| Joint Light Tactical Vehicle (JLTV) | Weight/Armor<br>Reliability, Availability, Maintainability,<br>Modeling & Simulation<br>Corrosion Resistance |
| High Mobility Multipurpose Wheeled Vehicle (HMMWV) | Performance<br>Survivability<br>Reliability/Durability |
| Internally Transportable Vehicle (ITV) | Stability/Braking<br>Reliability/Durability<br>Corrosion |
| Medium Tactical Vehicle Replacement (MTVR) | Fuel Economy<br>Increased Survivability<br>Safety |
| Logistics Vehicle System Replacement (LVSR) | Fuel Economy<br>Increased Survivability<br>Safety |
| Lightweight 155mm Howitzer (LW 155) | Modular Artillery Charge (MACS) Compatibility With The M777A2 Howitzer<br>Power Upgrades<br>Thermal Warming Device Reliability |

**Figure 5. PEO LS Program Top Technical Issues**

# 4.0 PEO LS S&T FOCUS AREAS

This edition of the ATIP contains four Focus Areas, vice the eight outlined in previous editions. The main changes are outlined in the Survivability & Mobility and Power & Energy Focus Areas, which are now broken down into sub-categories. Within the Focus Area of Survivability & Mobility the following are being addressed for the first time as sub-elements: Autonomy, Corrosion, Safety, and Crew Visibility.

The S&T Focus Areas are meant to highlight mission essential, cross-cutting, and actionable areas of focused S&T investment and engagement. These Focus Areas were developed and vetted in coordination with PEO LS Program Managers, Deputy Program Managers, Lead Engineers, and PEO LS S&T Representatives. These operationally relevant technology focuses will help inform and influence high priority S&T technology investment decisions, resolve technical issues, and support the transition of warfighter capability.

## S&T Focus Areas

**4.1 Power & Energy:** Technologies that expand the overall capability of the MAGTF by increasing the availability/capability of battlefield power while decreasing the logistics footprint.

**4.1.1 Fuel Efficiency:** Technologies that can enhance vehicle performance and capability while reducing fuel consumption on the battlefield. Gains in this area may also have significant impact on the logistics footprint of the MAGTF.

**4.1.2 Intelligent Power & Thermal Management:** The development of integrated systems that manage power utilization on vehicle platforms in order to improve fuel efficiency, and that manage heat properties in the cab and other areas on the platform in order to maintain equipment and crew comfort. An effective power/thermal management system will improve electrical system efficiency and improve heat rejection.

**4.2 Survivability & Mobility:** Technologies that improve mobility and increase the survivability of both the Marine and the vehicle. These technologies include advance lightweight armor concepts, active protection systems, energy absorbing structures, floating floors, shock mitigating seats, and upgraded drive and suspension systems.

**4.2.1 Fuel Containment/Fire Suppression:** Technologies that safely extinguish internal and external vehicle fires without adversely affecting the crew; preferably a system of systems approach that provides fire suppression and/or containment for the vehicle cab, crew, tires, fuel tank, and engine compartment.

**4.2.2 Safety:** Technologies are needed that increase vehicle stability and mitigate vehicle rollover while maintaining the ability of the vehicle to achieve its off-road and on-road mission profile.

**4.2.3 Crew Visibility:** Clear and unobstructed crew visibility is essential for Situational Awareness (SA). This area addresses technologies that can provide the ability to identify, process, and comprehend critical elements of information regarding the mission.

**4.2.4 Corrosion:** Marine Corps vehicles are stored and maintained for long durations in prepositioned stock ashore and at sea, in outdoor motor pools, and in other areas exposed to salt air, rain, snow, heat, cold, and other corrosive elements. Damage from corrosion can cause significant maintenance requirements, decreases in readiness and potential degradation of operational and structural capabilities. Therefore, corrosion resistance technologies will reduce Total Ownership Costs and provide a significant increase in equipment readiness.

**4.2.5 Autonomy:** Technologies that provide full autonomous capabilities and separate the Warfighter from potentially hazardous missions while providing increased efficiency and economy of force.

**4.2.6 Weight Reduction:** The development of modular, scalable lightweight armor packages tailored to the mission in order to provide greater flexibility to the Warfighter. The Marine Corps does not want to compromise survivability, and must balance protection levels and mobility in order to provide the best solution.

**4.3 Modeling and Simulation:** Tools to facilitate a Systems Engineering approach to platform design by evaluating potential design/technology trade-offs for tactical wheeled vehicles. These trade-offs will address performance, payload, crew protection, life cycle costs, survivability, and Reliability, Availability, and Maintainability.

**4.4 Open Plug and Play Communications Architecture:** The development of an affordable, scalable and operationally flexible Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) architecture for use on new and legacy platforms.

# 4.1 POWER & ENERGY

***"By 2025 we will deploy Marine Expeditionary Forces that can maneuver from the sea and sustain C4I and life support systems in place; the only liquid fuel needed will be for mobility systems, which will be more energy efficient than systems are today."***

-USMC Expeditionary Energy Strategy and Implementation Plan

The power and energy demand on today's battlefield is a daunting one. Couple this with the challenges of "Lightening the Load of the MAGTF" and returning to our "roots" as an amphibious force, Program Managers find themselves with a formidable search for capability solutions for current and future power and energy demands.

PEO LS continues to engage with ONR, Marine Corps Systems Command (MCSC), U.S. Army Research Development and Engineering Command (RDECOM), and with other agencies and technology partners to address the Marine Corps' current and future power and energy challenges. Working in concert with the USMC Expeditionary Energy Office (E2O), as well as various Industry partners, PEO LS Program Managers and S&T Representatives continue to find innovative, game changing solutions to the critical requirement for power and energy across the PEO portfolio.

## 4.1.1 FUEL EFFICIENCY

**The Challenge:** The challenge for Fuel Efficiency is outlined in the USMC Expeditionary Energy Strategy and Implementation Plan: increase energy efficiency of weapons systems, platforms, vehicles, and equipment. Understanding the impacts of this challenge, the PEO LS S&T Directorate continues to leverage strategic partnerships in an effort to bring energy efficient capabilities to the USMC Ground Combat Tactical Vehicle fleet.

**Potential Solutions:**

**ONR Efforts**

**Fuel Efficient MTVR - Future Naval Capability (FNC):** The objective of the Fuel Efficient MTVR is to develop, optimize, integrate, and demonstrate at least 15% fuel efficiency improvement over the existing MTVR across a set of driving cycles representative of likely operational conditions, while maintaining MTVR affordability, mobility, transportability and survivability capabilities. The technology assessment phase will aggressively pursue applicable fuel efficiency enabling technologies, with the goal of maximizing MTVR fuel efficiency. Follow-on trade studies will identify fuel efficiency achievable given acquisition costs and ROI constraints.

Other ONR efforts include:

- Future Fuel Alternatives
- Intelligent Small Unit Power (Micro Grids)
- Energy Storage Module to Reduce Fuel Consumption
- Energy Efficient Electronic Devices


**Fuel Efficient MTVR**

- Power Management for Military Radios
- Vehicle Integrated Power and Propulsion

## TARDEC Efforts

PEO LS is actively engaged with TARDEC across its diverse landscape of vehicle programs. In addressing Power, Energy, and Fuel Efficiency PEO LS S&T Representatives monitor the efforts of TARDEC's Ground Vehicle Power and Mobility (GVPM) Division, whose mission is to *"Research, develop, and deliver advanced ground systems power and mobility technology solutions to enable the current and future force to decisively move shoot survive communicate and sustain."*

GVPM efforts are highlighted in Figure 6.

Additional TARDEC efforts being monitored by PEO LS include:

- Energy Storage Research and Development
- Alternative Fuels and Petroleum, Oil and Lubricants
- Thermal Management Systems Development
- Combat Vehicle Auxiliary Power Unit
- Efficient Powertrain Integration

## Small Business Innovation Research (SBIR) Efforts

**Engine Efficiency Enhancements SBIR Phase II (YAN Engines):** The Engine Efficiency Enhancement project is a SBIR Phase II effort. It includes developing non-trivial retrofit engine technologies that can be adapted to the existing vast base of DoD diesel and gas driven platforms to significantly increase fuel efficiency. The enhancements do not require a complete new engine, but rather upgrades/retrofits to existing engines in an effort to reduce costs.


**Figure 6. GVPM Technology Focus**

## USMC E2O Efforts

In 2009, the Commandant of the Marine Corps created the USMC E2O to "analyze, develop, and direct the Marine Corps' energy strategy in order to optimize expeditionary capabilities across all warfighting functions." In 2012, the Commandant further identified Expeditionary Energy as one of the six pillars of modernization in the Marine Corps -- "areas critical to maintaining operational capabilities and readiness," -- in his annual posture statement to Congress. Modernizing the Marine Corps' capabilities in expeditionary energy is critical to maintaining operational readiness of the Force, for today's fight and tomorrow's conflicts.

**Experimental Forward Operating Base (ExFOB):** The United States Marine Corps' ExFOB brings together stakeholders from across the Marine Corps requirements, acquisition, and technology development communities. In March of 2012, the ExFOB Charter was published by Marine Corps Combat Development Command, formalizing the ExFOB Executive Integrated Product Team (IPT) mission to "Conduct a semi-annual field demonstration to identify, evaluate, and accelerate material solutions to fulfill identified capability gaps and increase energy efficiency."

To date, ExFOB has:

- Reviewed 280+ technologies and evaluated 75+ systems
- Purchased and deployed 11 different technologies to Afghanistan
- Transitioned 4 technologies to POR
- Led the requirements development of battlefield hybrid power
- Collaborated with industry to develop high-efficiency flexible solar and small unit water purification systems
- Integrated and evaluated fuel-saving auxiliary power units for combat logistics vehicles


**ExFOB Charter Members**

**MTVR Auxiliary Power Unit (APU):** The PEO LS S&T Directorate closely follows and coordinates efforts with the E2O and ExFOB. Of particular interest to the PEO LS portfolio is the MTVR APU Technology Demonstrator sponsored by Program Management Medium & Heavy Tactical Vehicles (PM M&HTV) Office. Demonstrated during ExFOB 2012, the MTVR APU demonstrated a 39% increase in static fuel efficiency, receiving positive feedback from Marine Expeditionary Force observers. Phase II of the effort will result in an optimized design for Developmental Testing/ User evaluation, to include the stand-up of five MTVRs with optimized APUs for fuel efficiency and exportable power. Upon completion four vehicles will be sent to fleet users for evaluation.

**MTVR-APU Technology Demonstrator at ExFOB 2012**

## USMC Ground Vehicle Fuel Efficiency Scalability Study (formally APU Scalability Study) Effort

The Marine Corps employs a wide variety of ground vehicles in the performance of its mission. Many of these vehicles contain systems and equipment that require electrical power to operate at times when the vehicle is not in motion. In such instances, the vehicle engine is often required to operate for the sole purpose of providing electrical power to the ancillary systems supported by the vehicle. This includes the Communications Systems and Heating Ventilation and Air Conditioning Systems. The $411K APU Scalability Study is a six-month, high-level study that will help determine the ROI of installing APUs on Marine Corps tactical vehicles. The study will include an evaluation of which USMC vehicles could benefit from an APU as well as a determination of the minimum APU size requirements for each vehicle. This effort will analyze specific ground vehicle energy usage scenarios and conduct trade-off analyses to establish the most cost-effective auxiliary means of providing electrical power at specified points within the mission profile. The following vehicle variants will be evaluated:

- Logistics Vehicle System Replacement (LVSR)
- Expanded Capability Vehicle (ECV)
- Mine-Resistant Ambush Protected (MRAP) All –Terrain Vehicle
- Joint Light Tactical Vehicle (JLTV)

## 4.1.2 INTELLIGENT POWER & THERMAL MANAGEMENT:

***"Operational energy equates exactly to operational capability"***

-General John Allen, Commander, International Security Assistance Force/United States Forces-Afghanistan

**The Challenge:** The management, storage, and efficient use of vehicle power requires development of a suite of power control programs that can: 1) effectively prioritize and manage between C4, Intelligence, Surveillance, and Reconnaissance (ISR), Hotel Services, and HVAC systems in an adaptive operational environment; 2) extend vehicle operations; and 3) result in more efficient electric generation and consumption. By managing the thermal loads and supplies of vehicles, power consumption can be reduced and vehicle output can be made more efficient.

**Potential Solutions:**

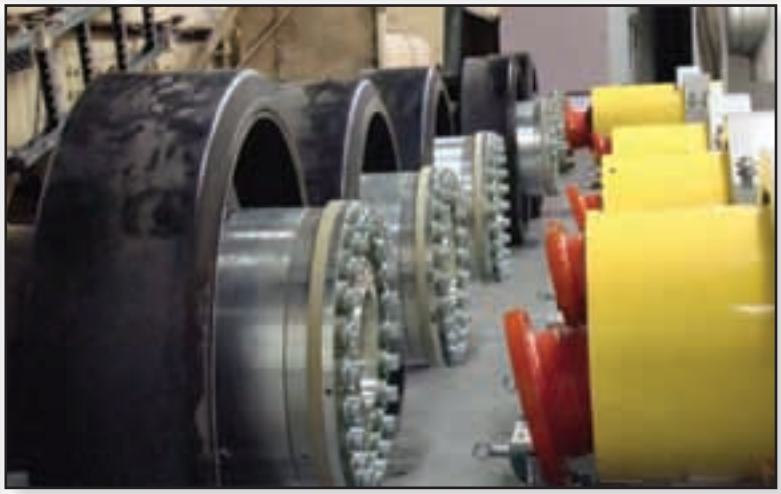
## ONR Efforts

**MTVR OBVP:** The MTVR OBVP program was a joint venture with ONR and PM Expeditionary Power System to develop a vehicle-integrated, exportable power source to reduce ground forces' reliance on legacy trailer-mounted generators. The original design, shown on the following page, was able to meet the threshold requirements and has participated in limited field testing.

**GBAD On-the-Move (OTM):** The GBAD OTM enabling capability will demonstrate a close-in, low altitude surface-to-air laser fire in defense of MAGTF assets defending forward combat areas, maneuvering forces, vital assets installations, and/or units engaged in special/independent operations. The proposed high energy, radar cued laser will prove to be a significant energy draw for any deployed vehicle and technologies will need to intelligently manage power generation and consumption while engaging targets and maintaining vehicle operation. This FNC requires 100kW of total power from an onboard vehicle power system and batteries that can enable engagement with multiple targets in a limited time.

**Advanced Battery Technology:** The advanced battery technology program is a joint effort with ONR and TARDEC to maximize both the power and energy density of ground vehicle batteries in



**Top Left and Right:** Original design of the MTVR OBVP **Bottom Left:** Ground/Air Task Oriented Radar. Photo from Northrop Grumman
**Bottom Right:** TARDEC Power and Energy Vehicle Environmental Laboratory. Photo from TARDEC.

order to extend silent watch and silent mobility capabilities as well as to support larger pulse power requirements. The goal is to increase the energy density by four times over current lead acid batteries in the fleet by maturing safe and reliable Lithium-ion alternatives in the same form factor with approximately one third the weight and reduced life cycle costs.

**Advanced Power Component Integration for Ground-Based, Active Electronically Scanned Array Radar DC/DC Converters – (Gallium Nitride (GaN) DC/DC converter):** The purpose of this Rapid Innovation Funds (RIF) Initiative is to enhance the power density and power efficiency of the air-cooled Ground/Air Task Oriented Radar (G/ATOR) Micro Power Supply (μPS) by incorporating advanced GaN on silicon μPSs. The large number of μPSs (approx. 718 w/ spares) in use in each G/ATOR will provide increased power efficiency.

## TARDEC Efforts

**Efficient Powertrain Technologies:** The Efficient Powertrain Technologies program will: 1) develop/demonstrate a powertrain integrated onboard electric power generation system capable of generating at high voltage 150 kW continuous at all vehicle speeds, with at least 80kW at a tactical idle speed (equal to or below 1800 rpm); and 2) develop a next-generation transmission based on a planetary gear design with mechanical shifting

sequences (referred to as a binary logic technology) that improves energy productivity and lowers system parasitic losses.

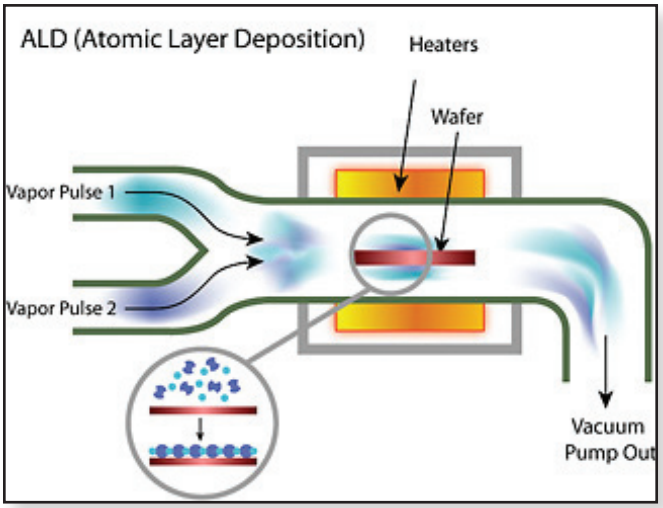
TARDEC has a number of initiatives aimed at more effectively generating and consuming power onboard the Army's fleet of vehicles. PEO LS leverages this investment and continues to follow these programs:

**Waste Heat Recovery:** Recover up to 5% of wasted vehicle energy from exhaust subsystems. Recovered energy will be returned to the Warfighter as increased available onboard electrical power.

**TARDEC Intelligent Micro Grid:** Produce electrical quality power needed to operate critical electronics-based military loads. Utilize renewable energy sources to cut cost, improve logistics, and reduce dependence on fossil fuels.

## SBIR Effort

**Atomic Layer Deposition Technology for GaN Microwave Monolithic Integrated Circuits:** This effort targets the development of commercially viable silicon-nitride (SiN) Atomic Layer Deposition process for GaN Monolithic Microwave Integrated Circuits applications. In particular, this project's objective is to provide a higher quality substitution for SiN passivation layers, currently grown by Plasma Enhanced



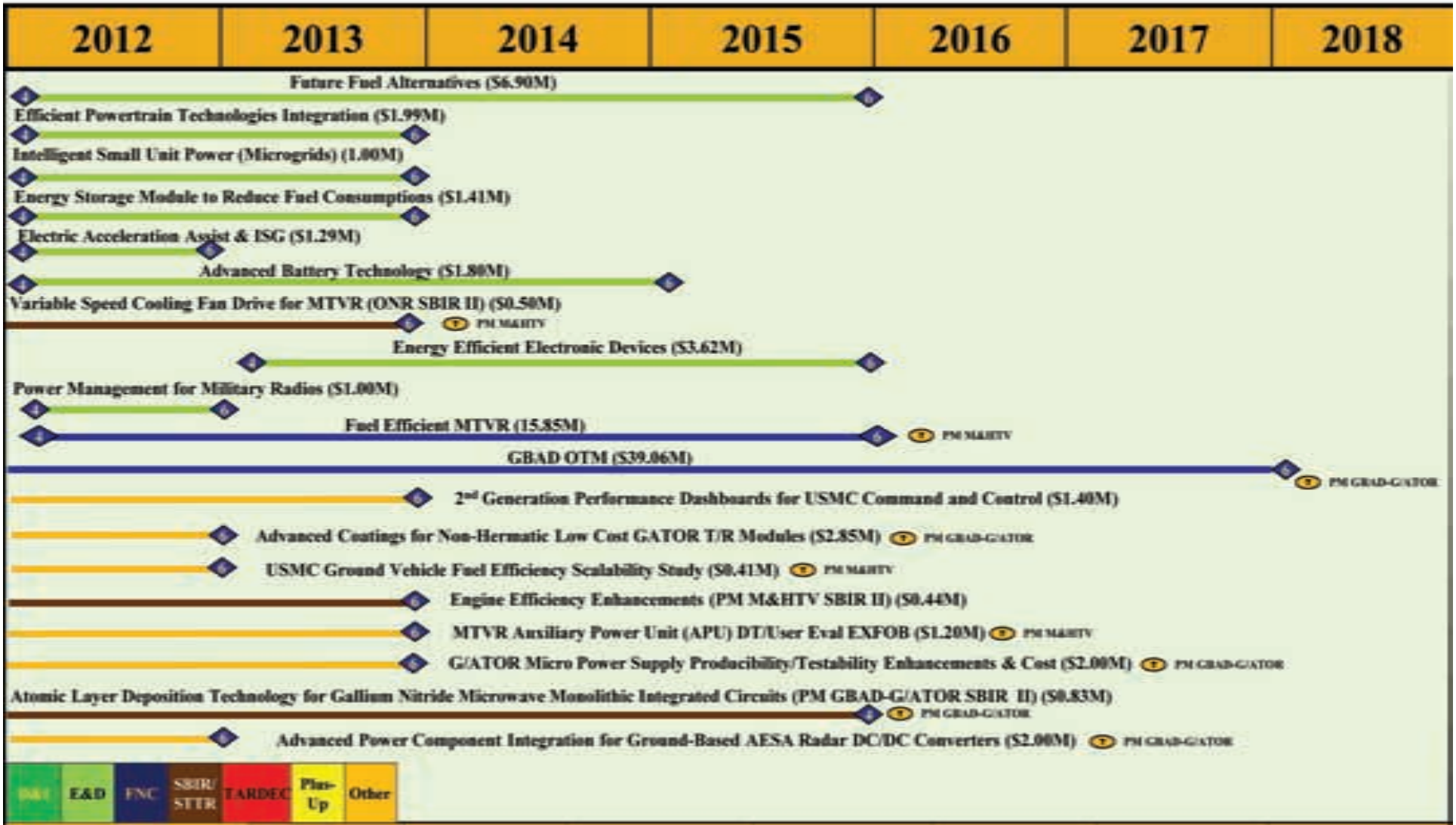

**Atomic Layer Deposition**

## Program Manager (PM) Expeditionary Power Systems Effort

**High Mobility Multipurpose Wheeled Vehicle (HMMWV) OBVP:** The HMMWV OBVP is a kit to the M-1152A2 Armor Ready HMMWV. It provides enhanced stationary export power (30 kW) and increased on-the-move electric power (10 kW). The system weighs less than 400 lbs (same as pintle weight of towed generator) and comes with a new transmission that has a permanent magnet generator installed within the transmission housing. The system was designed under an ONR contract and with a signed Statement of Need from CD&I. An Initial Operational Capability of 90 kits has been ordered for FY13 for the USMC. In addition the Navy and Army have expressed an interest in the capability.

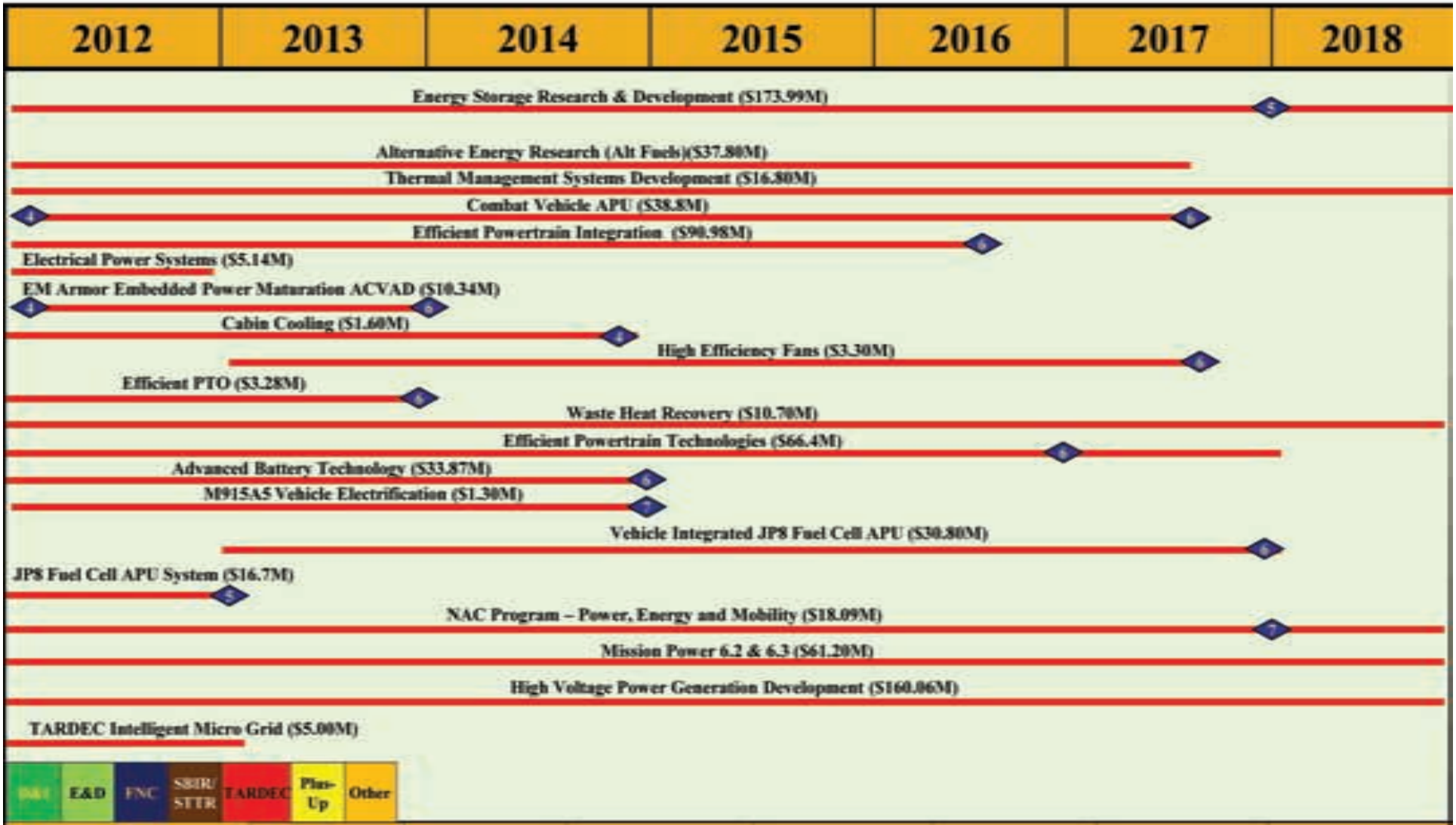
The Power & Energy Focus Area Charts on the following pages highlight critical efforts monitored and supported by the PEO LS S&T Director.

# Power & Energy




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 12.30 | 21.86 | 19.24 | 14.70 | 6.00 | 5.81 | |

# Power & Energy




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 99.39 | 105.22 | 93.49 | 104.88 | 106.09 | 96.79 | 77.57 |

# 4.2 SURVIVABILITY & MOBILITY

***"We need S&T to increase our Marine survivability, our maintainability, their reliability and last but not least affordability."***

-General James F. Amos, Commandant USMC, Naval Science & Technology Partnership Conference October 23, 2012

The Survivability and Mobility focus area consists of technologies that increase survivability of both the Marine and the vehicle. The two are addressed as a combined S&T Focus Area because what affects one often directly affects the other.

As an expeditionary force that is concentrating its efforts on re-honing their amphibious skills, the Marine Corps must ensure their tactical vehicle fleet is light, fast, easily transportable and survivable. The Marine Corps is modernizing the fleet with the JLTV procurement and development of the Amphibious Combat Vehicle (ACV) and Marine Personnel Carrier (MPC), but the current vehicle fleet will be in the inventory for many years to come. Modernizing and maintaining legacy vehicles while trying to increase their capability is a challenge, especially in an environment where affordability is as important as capability. One way of reducing development costs is through the use of simulation-based design tools that allow performance, survivability and reliability trade-off studies.

**The Challenge:** Providing increased protection to the Warfighter while maintaining or increasing mobility requires rigorous engineering that incorporates the latest technology applied in a "systems engineering approach". There are topic areas within the "Survivability & Mobility" focus area that warrant specific attention, but which fall under the domain of either survivability or mobility as sub-topics.

*Survivability* consists of:
- 3.2.1 Fuel Containment/Fire Suppression
- 3.2.2 Safety

*Mobility* consists of:
- 3.2.3 Crew Visibility
- 3.2.4 Corrosion
- 3.2.5 Autonomy
- 3.2.6 Weight Reduction

## SURVIVABILITY

PEO LS is working to enhance Warfighter and vehicle survivability by collaborating with MCSC, MCWL, Deputy Commandant Combat Development & Integration, ONR, RDECOM, TARDEC and other agencies. The objective is to develop affordable, state-of-the-art survivability technologies such as lightweight armor, blast absorbing seating and Rocket Propelled Grenade (RPG) countermeasures.

**A MRAP undergoes testing at Aberdeen Test Center, Md.**

### Potential Solutions:

### ONR Efforts

**Electronic Protection System (FNC):** Designed to passively protect ground vehicles from RPG threats.

**Advanced Camouflage:** This effort is intended to utilize field test data and state-of-the-art M&S tools to simulate the performance of a full-scale vehicle of Government Furnished Equipment design utilizing Gen III panel technology. The advanced technologies will allow design and integration on to a ground platform and provide a measurable reduction in the probability of detection across multiple bands in a given background.

**Energy Absorbing Structures for Blast Mitigation**: This project includes the development and testing of energy absorbing structures (e.g., crush tubes, cellular structures, hydraulic/ pneumatic absorbers) mounted between the blast hull and the crew compartment of a tactical vehicle (5 – 15 Ton), which will mitigate crew injuries (< 10% AIS level 2) following an underbody mine/ IED attack.

Additional ONR S&T projects that are of interest to PEO LS include:

- Air to Ground Missile (ATGM)/RPG Neutralization
- Carbon Nanotube Processing and Fiber Alignment
- Expeditionary High Energy Laser Study
- High Strain Rate Analysis of Ceramic/ Composite Armor Systems
- Materials for Survivability
- Multi-Modal Pre-Shot Sniper Detection
- Ultra High Strength Ballistic Resistant Materials
- Underbelly Blast Modeling & Simulation (see M&S section)

## RDECOM & TARDEC Efforts

**US Army, Occupant Centric Platform (OCP):** Traditionally vehicles have been designed simply to transport Soldiers and Marines rather than being designed around the specific needs of the occupants. When the protection levels of platforms are increased, the platform becomes heavier and interior volumes are affected, with reduced mobility, maneuverability, and freedom of movement for the occupants. Increasing protection levels of the platforms impacts interior volumes, reducing mobility, maneuverability, and freedom of movement for occupants and leads to heavier platforms. Overall, the program's purpose is to provide a means to develop, design, demonstrate, and document an occupant-centric Army Ground Vehicle design philosophy, with the goal of improving vehicle survivability and force protection by mitigating Soldier injury due to underbody Improvised Explosive Device (IED) and mine blasts and subsequent vehicle rollover and vehicle crash events.

The OCP Technology Enabled Capability Demonstration is in the process of developing an occupant-centric approach that designs or reengineers vehicles around the operators and crews as the first consideration in the vehicle design equation. The last ten years of conflict in Southwest Asia shows that this initiative is not only desirable but essential. Near term objectives (FY17) are to establish baselines; develop occupant protection standards; mature interior and exterior occupant protection technologies; and increase lab testing capability and improve confidence in M&S predictions. A longer term goal is to reduce overall platform weight by 25% and reduce casualties and wounded in action by 50% across each mission role, with scalable protection levels that will defeat a wide range of threats, enhance mobility, and maintain freedom of action during full spectrum operations.

**Integrated Defense Aid Suites:** The objective is to provide hit avoidance (hard-kill and soft-kill) in a vehicle-integrated system that utilizes a common architecture for RPG and ATGM defeat and that increase the survivability of combat vehicles.

**Kinetic Energy Active Protection System:** This project focuses on developing a guided interceptor, warhead and fusing capability that integrates into an Active Protection System providing capability to defeat Tank-Fired Kinetic Energy Long Rod Threats.

**RPG Active Protection System:** This project will provide the capability of hard and soft-kill defeat technologies that increase the survivability of ground vehicles.

**Tactical Vehicle Armor Development:** This project will develop opaque armors for the defeat of direct fire, IED, Shape Charge Jet (SCJ) threats and Active Protection System (APS) residuals and fabricate subsystem armor packages.

**Vertical-launch Architecture Long Range:** Kit avoidance technology that uses guided interceptor integration into vertical launch systems architecture and that includes an alternate fusing for ATGM defeat.

### SBIR Efforts

**Post IED Hull Inspection Tool:** A post IED Hull Inspection Tool(s) will be designed to help maintainers assess structural damage and make a more informed decision on the health of the hull after a blast event.

### DARPA Efforts

**DARPA Adaptive Vehicle Make (AVM):** AVM is a portfolio of programs that address revolutionary approaches to the design, verification and manufacturing of complex defense systems and vehicles. The portfolio consists of three primary programs: META, Instant Foundry Adaptive through Bits (iFAB) and Fast Adaptable Next-Generation Ground Vehicle (FANG). The FANG program encompasses Vehicle FORGE and three prize challenges. Many components of the program involve an open forum information exchange, with the intent of assisting the development of the next generation combat vehicle. The goal of META is to analyze interactions between components and provide verification and validation of designs without prototyping in order to shorten development time. iFAB attempts to design a manufacturing facility that can fabricate vehicles and can be reconfigured to manufacture other systems. The facility would be capable of manufacturing the FANG vehicle. FANG attempts to design an infantry fighting vehicle and concludes with prototypes. The program occurs in three phases. The Mobility/Drivetrain Challenge will last three months and begins in 2013. A prize of $.5–1 million will be awarded for the winning design. The Chassis/Integrated Survivability Challenge lasts three months and begins in the middle of 2013, subsequent to the Mobility/Drivetrain Challenge. A prize of $.5–1 million for the winning design(s) will be awarded. The third challenge, the Total Platform Challenge, lasts six months and begins in early 2014. The vehicle will be capable of amphibious transport and will have requirements similar to the U.S. Marine Corps Amphibious Combat Vehicle program. The vehicle design will be open source.

## 4.2.1 FUEL CONTAINMENT/FIRE SUPPRESSION

Historically, Marine Corps Tactical Ground Vehicles (TGV) have been procured with minimum to no fire suppression/extinguishing equipment. Because TGV fires continue to pose a significant threat to our Marines, critical cargo and vehicle platforms, PEO LS has incorporated a systems approach for addressing these hazards with existing vehicle platforms and future vehicle procurement.

**Challenge:** Providing suitable fuel containment fire detection and extinguishing capabilities presents a serious challenge to vehicle programs given space/weight limitations as well as cost and levels of survivability required. Suitable capabilities include the use of a “Clean Agent,” that

safely and effectively suppresses fire, prevents explosion, and affords rapid evacuation of the crew. PEO LS is specifically exploring an "aqueous based Automatic Fire Extinguishing System (AFES)" that will include the research to identify crew casualty injury criteria for aqueous based AFES. Upon completion of the crew casualty injury criteria, there are future plans to develop and test a prototype aqueous based system.

**Potential Solutions:**

## PEO LS Efforts

**Mitigation of Fuel Tank Fires and Explosions (Small Business Technology Transfer (STTR)):** The objective of this STTR program is to develop and qualify innovative, lightweight, high temperature composite materials that provide ballistic, blast and flame protection to MTVR fuel tanks and engine compartment structures.

**Modular Lightweight External Fuel Tank System (SBIR):** The objective is to design and develop a lightweight, modular fuel tank that can withstand hydrodynamic ramming forces and that provides protection against a ballistic impact from a 14.5 mm AP projectile using a multi-layer laminate design, with a significant reduction in weight compared to existing systems.

## ONR Efforts

**Fuel Tank Protection System for Tactical Wheeled Vehicles:** PEO LS S&T has teamed with the MCSC System Engineering, Interoperability, Architecture and Technology (SIAT), ONR SwampWorks, Naval Surface Warfare Center (NSWC) Philadelphia Division and Army Research Lab (ARL) in an effort to address Fuel Tank Protection Systems for Tactical Vehicles. This effort seeks to develop a new class of integrated fuel tank protection for combat vehicles, which will encompass a coating technology that: 1) self-seals upon small arms ballistic threats/impacts, 2) self-protects against pool-fire threats, and 3) provides fire suppression for IED and Explosively Formed Penetrator events. Additionally, this effort will develop a Joint military specification and qualify potential permanently self-sealing coatings for Tactical Vehicles. This system will be able to be applied to current and future vehicle fuel tanks. The value to the Warfighter is integration of fire suppression and self-sealing technologies into a singular design that will reduce overall costs, streamline procurement efforts, and result in a significantly improved fuel tank with enhanced protection.

**The above photos reveals the "before and after" results of pool fire testing at Aberdeen Test Center.**

## RDECOM & TARDEC Efforts

**Advanced Fire Protection Research and Development:** This project will provide fire protection solutions for the combat vehicle modernization and retrofit programs; it performs basic research and develops system specifications for survivable fuel tanks and materials which increase soldier and system survivability while providing vehicle design flexibility.

**Common AFES:** The goal of this project is to develop a common tactical vehicle AFES that is reliable, maintainable and safe.

**Fire Protection Systems Integration Lab (SIL):** This laboratory will provide in-house

integration and evaluation of fire protection system technologies. The in-house M&S capability will allow prediction of fire extinguishing system performance and compare multiple configurations.

The in-house capabilities include:

- Analyze agent distribution within test vehicles
- Test fire performance of different vehicle configurations in reconfigurable box
- Simulate ballistic threats with variable fuel spray test setup
- Analyze occupant safety for noise, impact force and toxicity levels
- Conduct fire performance simulations with Enhanced (CFD) code
- Reduced integration and test costs
- Enhanced ability to transfer fire protection technologies to vehicle PMs

## 4.2.2 SAFETY

***"Safety is central to the idea of readiness and must not be an afterthought of our actions in combat, in training and while on liberty."*** -Commandants Safety Policy, General James F. Amos, Commandant USMC

While risk is inherent to the actions of the Marine Corps, it must be managed by controlling and mitigating it regardless of operational complexity. Operational objectives are attuned to an organization's mission, vision, goals, and capabilities and are not set in a vacuum. Safety should be at the forefront of the planning process, whether planning for a mission or designing a Tactical Wheeled Vehicle (TWV).

**Challange:** Safety cannot contradict the mission of the Marines Corps' command and operational objectives, but it is required in order to preserve personnel and equipment. Safety involves vehicle stability; safety equipment, including restraint harnesses; fire suppression; clear fields of view; training; policy; procedures; and an open line of communication with the Warfighter.

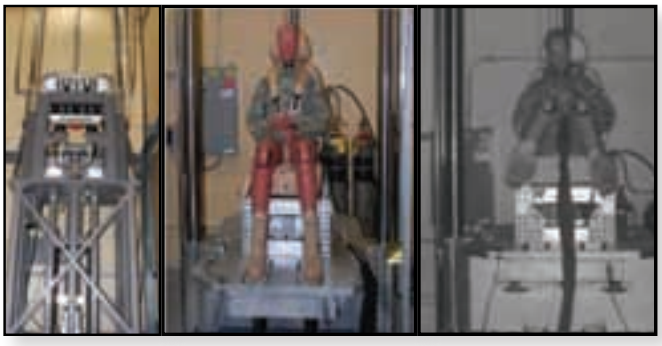
**Potential Solutions:**

**ONR Efforts**

**Integrated Mobility Dynamics Controls:** Provides the HMMWV dynamic stability improvements of 30% in yaw and 20% in roll, for a vehicle with increased ground clearance, at speeds exceeding 25 mph on cross country terrain. This will be achieved by controlling the sprung mass motion about the roll, pitch and yaw axes through a supervisory controller.

**MTVR Noise Mitigation:** Identified/quantified noise levels on the MTVR and identified/quantified transmission paths from noise source; will develop a noise reduction plan and implement the solution.

**Combat Science and Technology Vehicle (CSTV) Shock Mitigating Seats:** This ONR/TARDEC project has the goal of developing seating technology to protect the crew against current/emerging vehicle IED/Mine threats and rollovers. M&S tools for end-to-end threat to occupant characterization will be developed for evaluation of loads and injury assessments. Included in this project is the development of a test-bed for seat concepts, emphasizing lower leg and multi-directional protection shown below.



**The ONR Crew Seating Blast Effects Simulator is used to simulate vehicle blast effects accelerations to validate crew-seat protection concept models and devices.**

## RDECOM & TARDEC Efforts

**Blast Technology Development:** Approaches Soldier/Marine protection from a systems level and leverages defense, automotive/race industry, and medical community in order to integrate IED/mine protection, Personal Protective Equipment crash and rollover protection.

**Active Safety Applique:** This OCP project involves the development of an active system that involves steering, braking, transmission and engine functions of the vehicle.

## SBIR Efforts

**Active Laser Protection System:** Develops innovative technology approaches to protect the eyes of vehicle crewmen from frequency-agile lasers.

**Modular Anthropomorphic Test Device (ATD):** Research, develop and build an inexpensive modular Anthropomorphic Test Device with simulated flesh and bone.

# MOBILITY

***"We must provide adequate protection for our tactical mobility systems. Our goal is to provide a mix of survivable tactical vehicles that are compatible with expeditionary and amphibious deployment means."*** -Marine Corps Vision and Strategy 2025

In addition to the Mobility subsets (Crew Visibility, Corrosion, Autonomy, and Weight Reduction), the Power & Energy focus area will also benefit mobility by providing increased fuel efficiency and increased range. The M&S focus area will support future vehicle concept development by evaluating technology trade-offs. The benefit of enhanced mobility efforts is increased Warfighting effectiveness of the MAGTF.

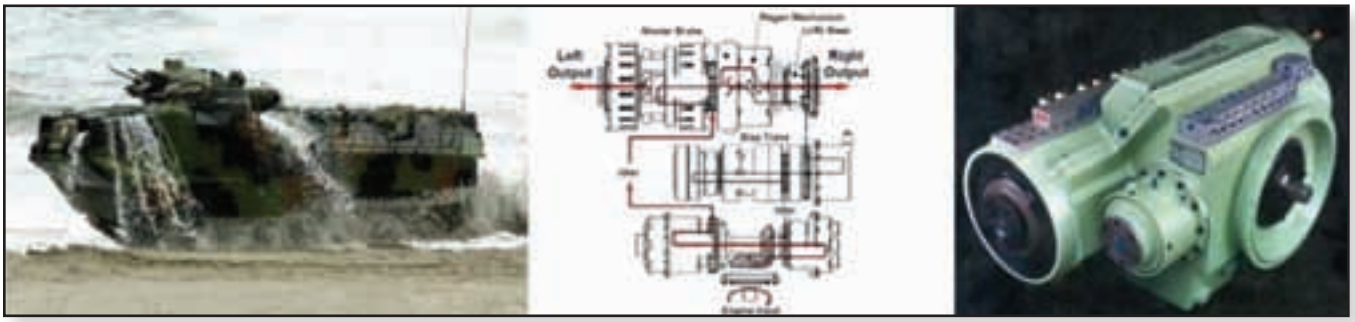
**U.S. Marines and sailors load an Internally Transportable Vehicle onto a CH-53E Super Stallion.**

**Potential Solutions:**

## ONR Efforts

**Advanced Materials for Maintenance Reduction:** Aims at reducing maintenance with advanced materials that are more affordable and improve reliability, availability and maintainability.

**Advanced Transmission Technology:** Develop and demonstrate a 32 speed binary logic transmission with increased transmission efficiency (greater than 90%) and reduced power loss (35% down to 10%) for 20 to 40 ton tracked military vehicles.



**The Advanced Transmission Technology is intended to bring new life into the AAV.**

**CSTV Infinitely Variable Transmission:** The objective is to demonstrate an operationally suitable Infinitely Variable Transmission (IVT) for tactical wheeled military vehicles. The CSTV IVT could potentially improve fuel economy and reduce vehicle gross weight.

**Modular Vehicle Platform:** The project's goal is to demonstrate a single self-loading platform with mobile modular combat capabilities (e.g., remote weapon station, command and control, trauma bay, etc.), housed in standard containers. Enhanced combat capabilities provided by M2C2 and Mobile Trauma Bay modules coupled with the already proven enhancements of the MTVR equipped with OBVP will provide Commanders tactical flexibility and adaptability on the battlefield. Strategic enhancements would include reduced MAGTF footprint and Total Ownership Cost (TOC) savings driven by increased parts commonality, decreased manning/training requirements, and flexible and more efficient power management. Capability enhancements as a result of this EC could have application across several tactical platforms.

**Robust Traversability in Complex Terrains:** The goal is to develop a path planner that uses high-fidelity terrain, kinodynamic vehicle models and nonholonomic trajectories so that unmanned systems will be able to negotiate rugged off-road terrain with the proficiency of at least a junior enlisted Marine without human intervention.

## RDECOM & TARDEC Efforts

**Advanced Propulsion with Onboard Vehicle Power (APOP):** Will develop, characterize and test the enabling technologies to provide increased OBVP from 10-20kW on current systems to 100-160kW

**Advance Powertrain Technologies:** Research, develop and integrate efficient and reliable powertrain technologies that will dramatically improve the energy productivity of existing vehicle engine- transmission while using less

**Convoy of three MTVRs, LVSR and HMMWV to the side.**

space, improving vehicle mobility, decreasing fuel consumption, and reducing thermal load

**Combat Engine Research:** The purpose is to combine high speed combustion, closed loop control, oil cooled, low heat rejection engine research efforts for the development of a high power density diesel engine with power densities greater than 10 Net Hp/cu. ft.

**CBM Technologies:** The project goal is to develop, integrate and demonstrate condition based maintenance algorithms and data acquisition storage and transfer capabilities.

**Continuous High Output Engine Research:** The project's purpose is to continue Research and Development (R&D) activity on high speed engines and implement design change improvements identified during exploratory development phases to increase specific output. The best engine candidates will be identified for further advanced development for next generation diesel engines.

**Elastomer Improvement Program:** The purpose of this project is to develop improved thermoset components that improve track system durability and reliability and reduce life cycle costs. Track system life improvement goal is 50%.

Additional RDECOM and TARDEC S&T projects that are of interest to PEO LS include:

- Adaptive Protection R&D
- Advanced Lubricants
- Advanced Running Gear Mobility Research.
- Advanced Suspension Development (Ride & Handling) Advanced Transmission Technology
- Advanced Vehicle Control Methods
- Alternative Fuels & Petroleum, Oils and Lubricants
- Distributed Soldier Load Through SMART Vehicle Control
- Elastomer Maturation for Increased Track Durability
- High Performance Track Development
- Hybrid Vehicle Testing and Reliability
- Next Generation Combat Engine Multi Cylinder Engine Development (Opposed Piston Opposed Cylinder (OPOC))
- Next Generation Combat Engine Prototype Engine Development (OPOC)

### SBIR Efforts

**Variable Vehicle Cone Index (VCI):** The objective is to develop a system that will enable on-the-move monitoring of road conditions and that automatically adjusts to optimal tire pressure. Running at optimal tire pressure will improve tire life, improve fuel efficiency, and increase mobility on varying terrains.

## 4.2.3 CREW VISIBILITY

Clear and accurate visibility for a vehicle crew member is essential for situational awareness and a better cognitive understanding of the impending battle space.

**Challenge:** Armored tactical vehicles are often burdened with limited visibility due to the cost, weight and manufacturing limits of transparent armor. Increasing the visibility of the Marine Corps vehicles without a heavy penalty on Size, Weight, Power and Cost (SwaP C) presents quite a technology challenge.

***"The whole art of war consists of getting at what lies on the other side of the hill, or in other words, what we do not know from what we do know."*** -The Duke of Wellington, 1769-1852

**Potential Solutions:**

### ONR Efforts

**Transparent Armor Recipe Optimization and Manufacturing:** ONR is working with ARL on two efforts to optimize the formula and manufacturing processes for transparent armor technologies to improve survivability, with total life cycle cost as a major factor. The results of these efforts will determine the next generation of lightweight, low cost, high performing transparent armors for ground vehicles.

### Naval Research Lab (NRL) Efforts

**Transparent Armor Delamination Phase-A Study**: Premature delamination of Transparent Armor (TA) has been costly and affects visibility. The project approach is to conduct a re-bond feasibility study, develop and demonstrate the repair method, and then perform a contingency study to improve delamination performance.

### RDECOM & TARDEC Efforts

**Advanced Directed Energy for Protection for Camera and Eyes:** This OCP project is an ARL, TARDEC initiative that includes:

- **Vision Protection from Lasers:** Crew eyes and optical viewing systems are vulnerable to damage from frequency-agile laser weapons and detection via retro-reflection. The purpose

of this project is to enable future combat vehicles to avoid detection and to protect and maintain vision during exposure to anti-sensor laser weapons.

- **Vision Protection Design Integration to Ground Combat Vehicle (GCV) or Stryker:** The project, part of OCP, will transfer laser protection techniques developed for the Abrams M1A2 fire control to the GCV, Stryker and future vehicles.

**Laser High Energy Threat Research:** The purpose of the project is to determine the impact of short-pulse and high energy lasers on vision and sensor technologies and investigate new technologies for protection.

**Short Pulse High Energy Laser Research (SPHERE):** The purpose of this project is to determine the vulnerability of combat vehicle sights and sensors for very short pulses and high energy laser threats and develop protection concepts.

**Transparent Armor:** The purpose of this project is to research and develop technologies and processes to improve the performance and environmental stability of transparent armor laminates.

**Warfighter Injury Assessment Manikin (WIAMan):** The goal of WIAMan is to develop manikins that will more accurately reflect the effects that shock waves, projectiles and velocity-driven dirt have on troops struck by IEDs.

## 4.2.4 CORROSION

Corrosion is the deterioration of a metal due to a reaction of the metal with its environment. More so than her sister services, the Marine Corps operates in a highly corrosive saltwater environment with high humidity, sand, coral, mud and road debris accelerating the process.

**Challenge**: With the Marine Corps' $460 million annual cost of corrosion, investing in anticorrosion technologies has the potential for a substantial ROI*. Along with the annual cost of corrosion and the Iraq/Afghanistan drawdown comes a tightening Defense budget and dwindling new equipment procurement. The Marine Corps will be required to make do with much of its current gear and its existing vehicle fleet. Service Life Extension

**Corrosion Service Team (CST) members perform corrosion maintenance on site.**

Programs (SLEP), enhanced maintenance and anti-corrosion technologies will be required to extend the life of the Marine Corps' equipment, keeping them operationally viable and ready.

* LMI Government Consulting prepared the report, The Annual Cost of Corrosion for Marine Corps Ground Vehicles, in June 2010 under the aegis of the DoD Corrosion Prevention and Control IPT. The report is available at http://www.marcorsyscom.usmc.mil/cpac/docs/COST-OF-CORROSION.pdf

**Potential Solutions:**

**ONR Efforts**

**Polyfibroblast self-healing paint:** This is a three-year effort to develop a self-healing paint that delays the onset of corrosion and extends the life of the particular system. Self-healing paint works to instantly repair scratches below a maximum width and protects the material below from corrosion.

**MCSC Efforts**

**Corrosion Prevention and Control (CPAC):** Recognized by the Office of the Secretary of Defense (OSD) for its successful corrosion prevention and repair efforts, the Marine Corps Corrosion Prevention and Control program has become a model Service program. The MCSC CPAC Program continues to deliver best-value ROI across all phases of Marine Corps' equipment lifecycle. Since its inception in 2004, the CPAC Program Management Office (PMO) has maintained a viable, comprehensive program that is credited with saving the Marine Corps over $20 million dollars annually. With the expansion of the program and advanced technology, the savings will only continue.

## 4.2.5 AUTONOMY

***"Unmanned systems are proving to have a significant impact on warfare worldwide. The true value of these systems is not to provide a direct human replacement, but rather to extend and complement human capability in a number of ways."*** -DoD, Defense Science Board Task Force Report: The Role of Autonomy in DoD System, July 2012.

UGVs have been playing an increasingly important role in combat operations and the needs for new capabilities have been steadily rising. The Marine Corps and DoD have been intensifying efforts to develop unmanned ground systems that would work together with manned systems in order to augment the capabilities of Marine Corps and save lives.

**Challenge:** Currently unmanned vehicle technology requires a person to operate the vehicle remotely. Vehicles that don't require a human operator tend to move very slowly and have difficulty traversing terrain with minimal obstacles. For unmanned ground vehicles to be truly useful to the military, they must be able to conduct resupply missions without using humans as drivers. It is essential that future unmanned ground vehicles not require troops for protection and are able to cross rugged terrain quickly and easily without requiring human assistance.

**Potential Solutions:**

**ONR Efforts**

**High Level Reasoner/Robotic Controller Integration:** A hybrid architecture using a high-lever reasoner integrated with a low-level robotic controller that can be used to achieve a performance gain of 50% over using only a low-level robotic controller.

**Internally Transportable Vehicle (ITV) Autonomy Conversion - Autonomy Integration:** Partnered with the Marine Corps War Fighting Lab, the goal is to develop the autonomy and perception system spirals in order to

support ITV demonstrations and MCWL Advanced Warfighter Exercise (AWE) for the purposes of enhanced tactical mobility & maneuver and increased mission capability.

**Autonomous Mobility Appliqué System (AMAS) JCTD:** The intent of this JCTD is to implement a convoy solution using a variety of tactical wheeled vehicles with supplemental "driver-assist" safety features. The vehicles will be equipped with a standardized "Autonomy Kit" designed to operate with specific "By-Wire" kits on each platform.

**Novel UGS Behaviors using Genetic Programming:** This effort evaluates academia, industry, and government efforts towards autonomous vehicle software development and automated behavior generation, identifying best-in-class performers and teaming opportunities.

**Perception Computing Techniques for Wingman UGS:** The objective is to develop a roadmap to a stable autonomous wingman platform in order to support the development and input requirements for wingman specific research topics. Researchers require inputs on sensor suite, software and hardware requirements, so technologies have convergent evolution for platform development.

**Robust Traversability in Complex Terrains:** A path planner that uses high-fidelity terrain, kinodynamic vehicle models, and nonholonomic trajectories that will enable navigation to be 20% faster and with 25% less interventions.

Additional ONR S&T projects that are of interest of PEO LS include:

- Applied Spatial Phase Imaging for UGV Perception
- Autonomous Wingman Resupply Vehicle
- Autonomy Component Integration
- Wingman Next Generation Autonomy Algorithm Development

**RDECOM & TARDEC Efforts**

**AMAS:** A collection of individual projects that have been developed to support the necessary advancements of autonomous vehicle architecture.

**Improved Mobility and Operational Performance through Autonomous Technologies (IMOPAT):** Provides local SA thru electro-optic indirect vision (EOIV) technologies during manned/unmanned platform operations.

## 4.2.6 WEIGHT REDUCTION

***"We need to significantly lighten the MAGTF, which will require considerable paradigm shift across the Marine Corps and will have a significant impact on research and development, programmatic budgeting, acquisitions, doctrine development, and employment of future systems."*** - Marine Corps Operating Concepts (MOC) Third Edition June 2012.

The Weight Reduction Focus Area was initiated by the Commandant's Directive to "Lighten the MAGTF". Lightening the MAGTF will increase the ability to traverse harsh terrain, enhance maneuver from the sea and provide the combat multiplier of speed.

**Challenge:** Successful weight reduction efforts will generate such benefits as: expanded range, superior mobility, increased energy efficiency and greater speed. The challenge is implementing weight reduction measures that are not at the detriment of platform capability.

**Potential Solutions:**

**ONR Efforts**

**Expeditionary Light Armor Seedling Development:** The hypothesis is that by expanding

existing ballistic performance design equations, it will be possible to develop properties-based equations for state-of-the-art and emerging ceramic composite armor systems. Possible equation parameters could include ceramic hardness, yield and fracture toughness; and composite yield, elongation, and stiffness.

**High Strength-High Ductility Nano Composites:** Develop nanoscale reinforcements, in combination with a dispersion strengthened matrix and coarse grained region that has tailorable plasticity to yield a high strength-high ductility multi-scale nano composite aluminum.

**Light Tactical Vehicle Technology Advancement - RIF:** This RIF project has the objective to develop high fidelity computational physics methods, tools, and models to support survivability improvement efforts within the USMC TWV community by Modeling lightweight structural composites, Human body injury comparison to ATD response and novel joining technologies used in lightweight vehicle structures. The results will be lighter, more survivable, cost effective vehicles.

Additional ONR projects of interest of PEO LS are:

- Efficient Powertrain Technologies Integration (Partnered with TARDEC)
- Fuel Efficient MTVR (project includes weight saving principles)

## RDECOM & TARDEC Efforts

**Advanced Combat Vehicle Armor Development (ACVAD):** This is the development of opaque armors for the defeat of direct fires, IED, SCJ threats, and APS residuals. The payoff is lighter weight that will provide a similar level of protection, but allow for enhanced mobility and payload.

**Architecture, Maturation, Evaluation of Defense Aid Suites (ARMED):** This project focuses on developing and validating improved techniques and capabilities to integrate and test advanced medium and heavy appliqué armors for combat platforms, with the goal of providing improved bolted/bonded joints, closeouts, and grilles for medium and heavy armor.

**Multi Threat Armor Development:** The goal is to develop and mature lightweight advanced multi-threat B-kit and C-kit armor solutions received from ARL and industry for transition and ensure that the B-kit and C-kit armor designs can withstand residual projectiles from various APS technologies. The result will be lighter weight armor solutions that allow for greater vehicle payload and performance and that shrink the vehicle's overall visual signature.

**Left Photo:** The weight of the up-armored HMMWV had resulted in maintenance and logistic issues. **Right Photo:** Contrasting HMMWV, the ITV is light weight and highly transportable.

**The massive, but highly capable LVSR transports the heavy, but survivable MRAP.**

**Ultra-Light Weight and Multifunctional Materials for Personnel and Vehicle Protection Advanced Technology Objective (ATO):** This lightweight materials project initiative is also of interest to the Marine Corps.

## SBIR Efforts

**Composite Trailer & Water Tank:** This project uses composites to lighten trailer weight and increase payloads, resulting in fewer trucks on the road and reduced fuel consumption.

**Modular Lightweight Armor System:** The goal is to develop a lighter weight armor system for tactical vehicles that meets or exceeds current ballistic protection levels.

***"We will be light enough to leverage the flexibility and capacity of amphibious ships, yet heavy enough to accomplish the mission when we get there."*** -The Posture of the United States Marine Corps, 2011 Report to Congress, General James F. Amos, Commandant USMC

The Survivability & Mobility Focus Area Charts on the following pages highlight critical efforts monitored and supported by the PEO LS S&T Director.

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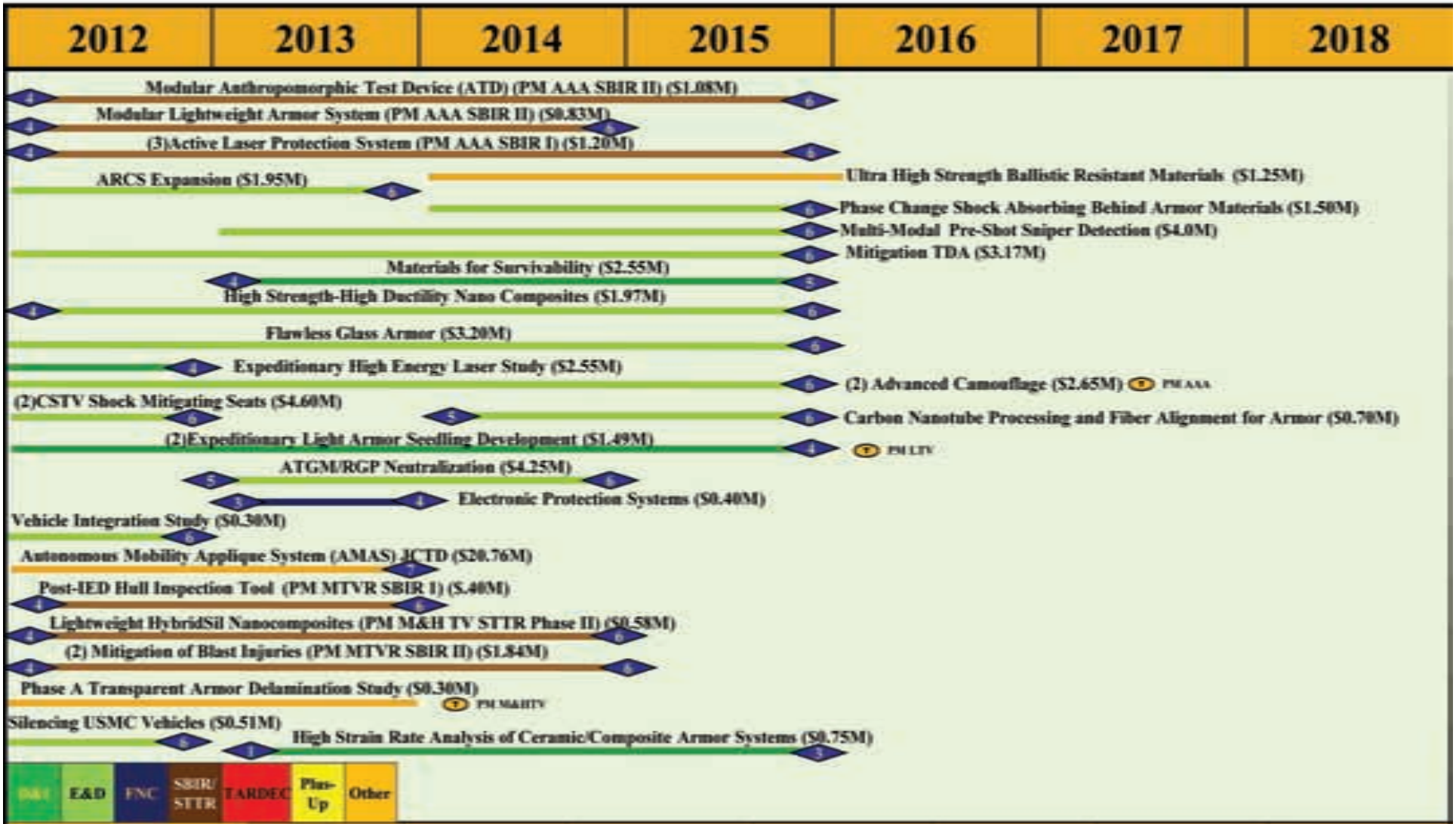
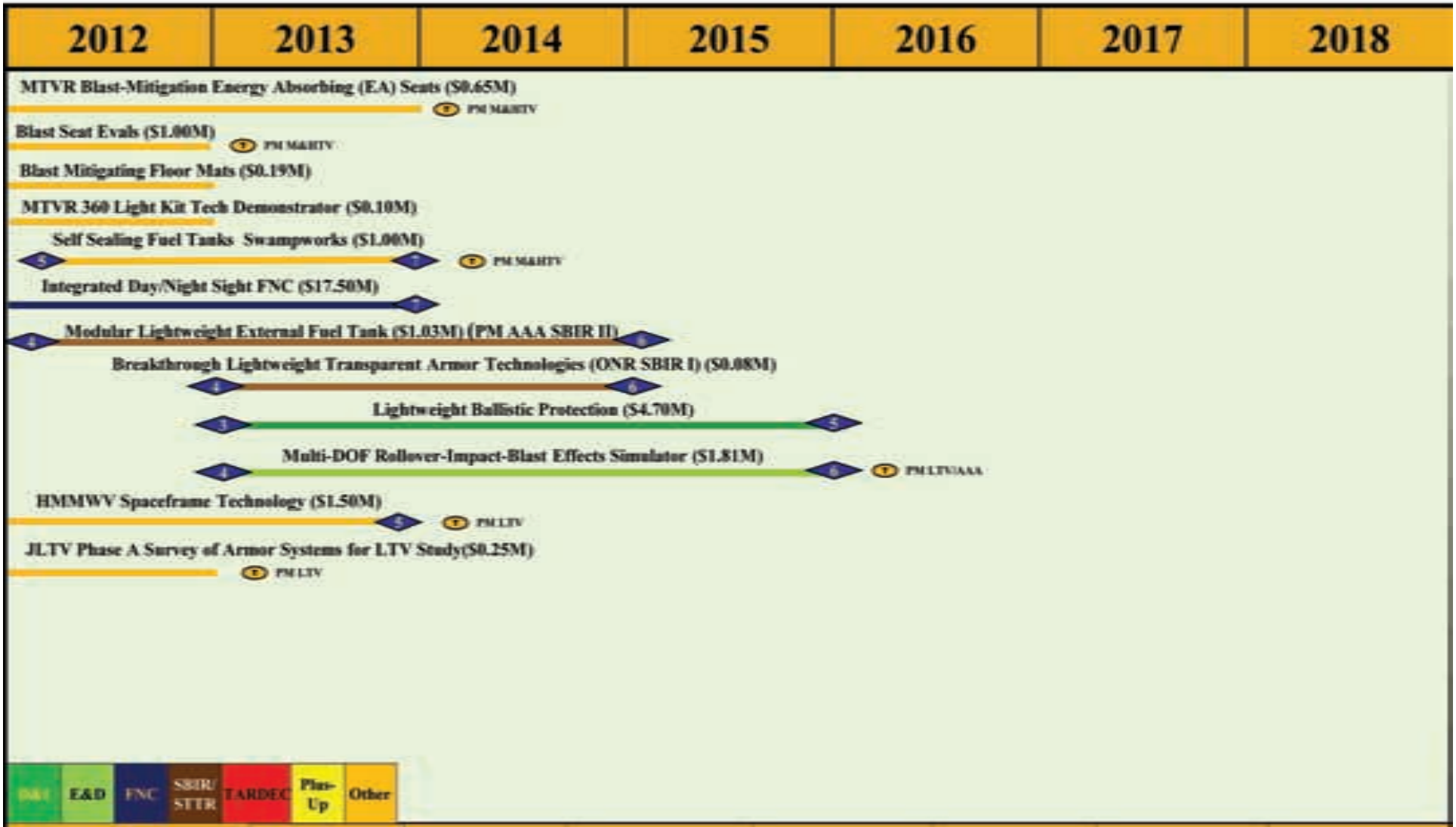
# Survivability



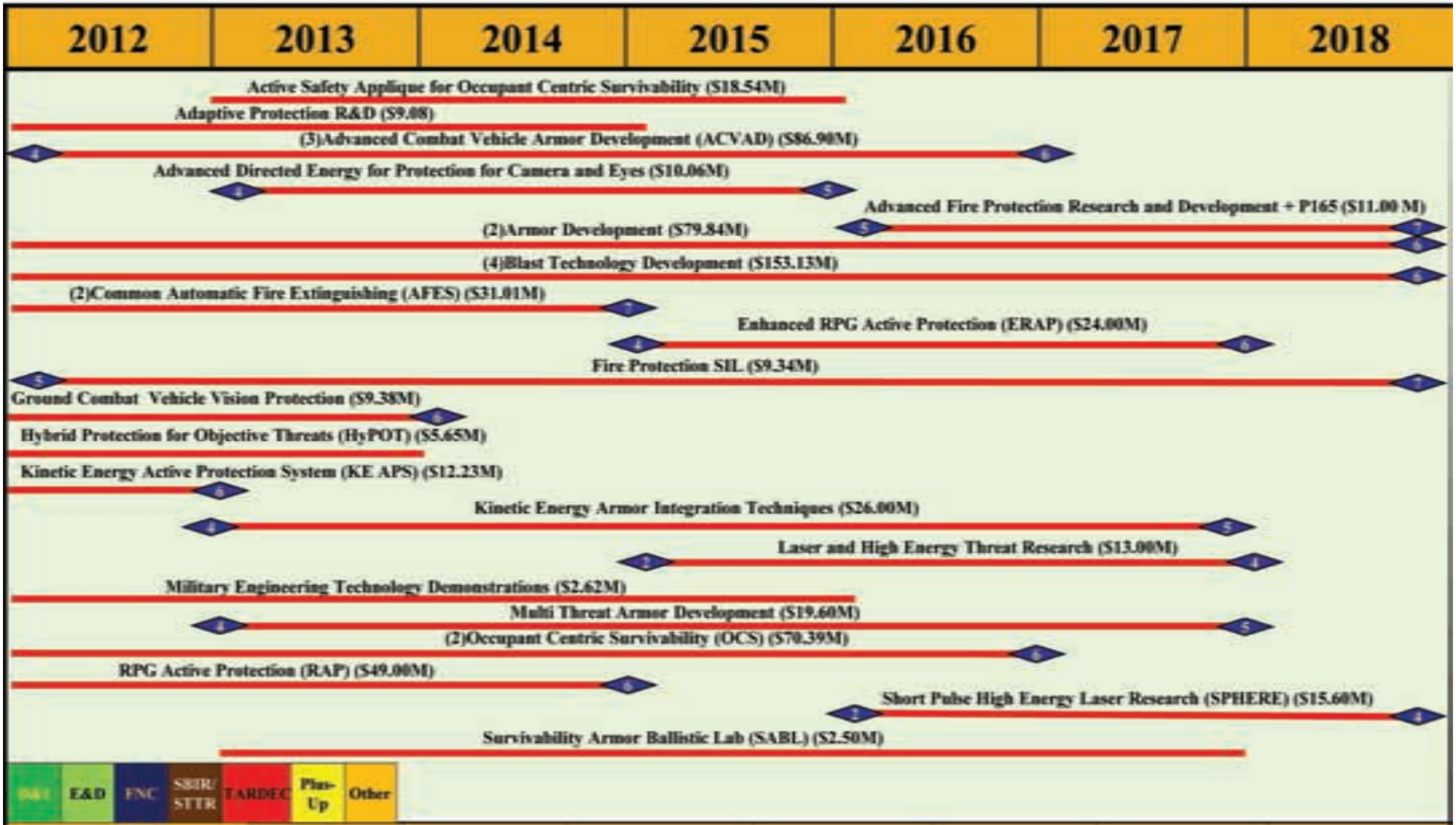

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 17.51 | 22.33 | 12.11 | 6.73 | | | |

# Survivability



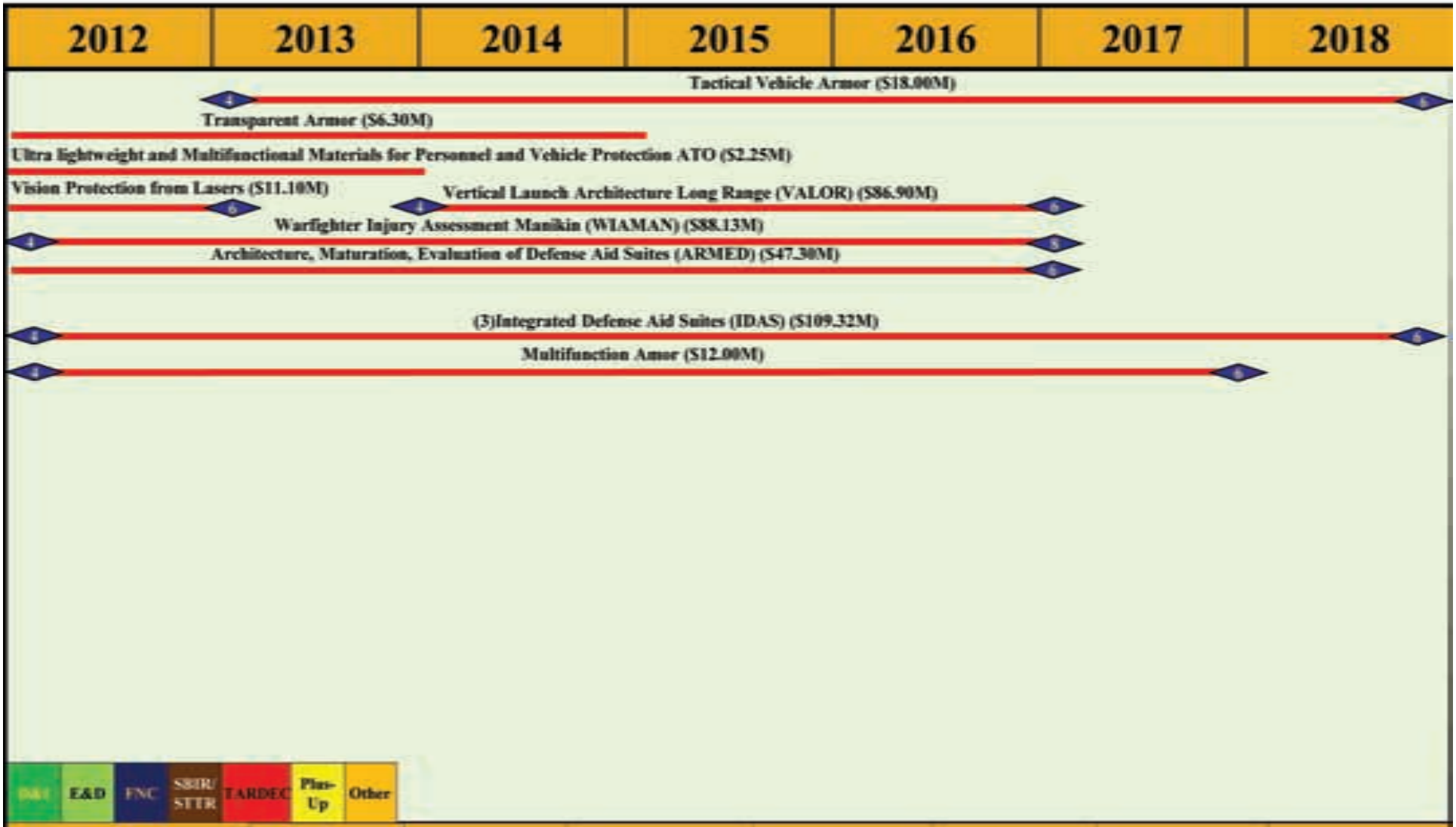

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 6.39 | 11.00 | 2.12 | 2.12 | | | |

# Survivability



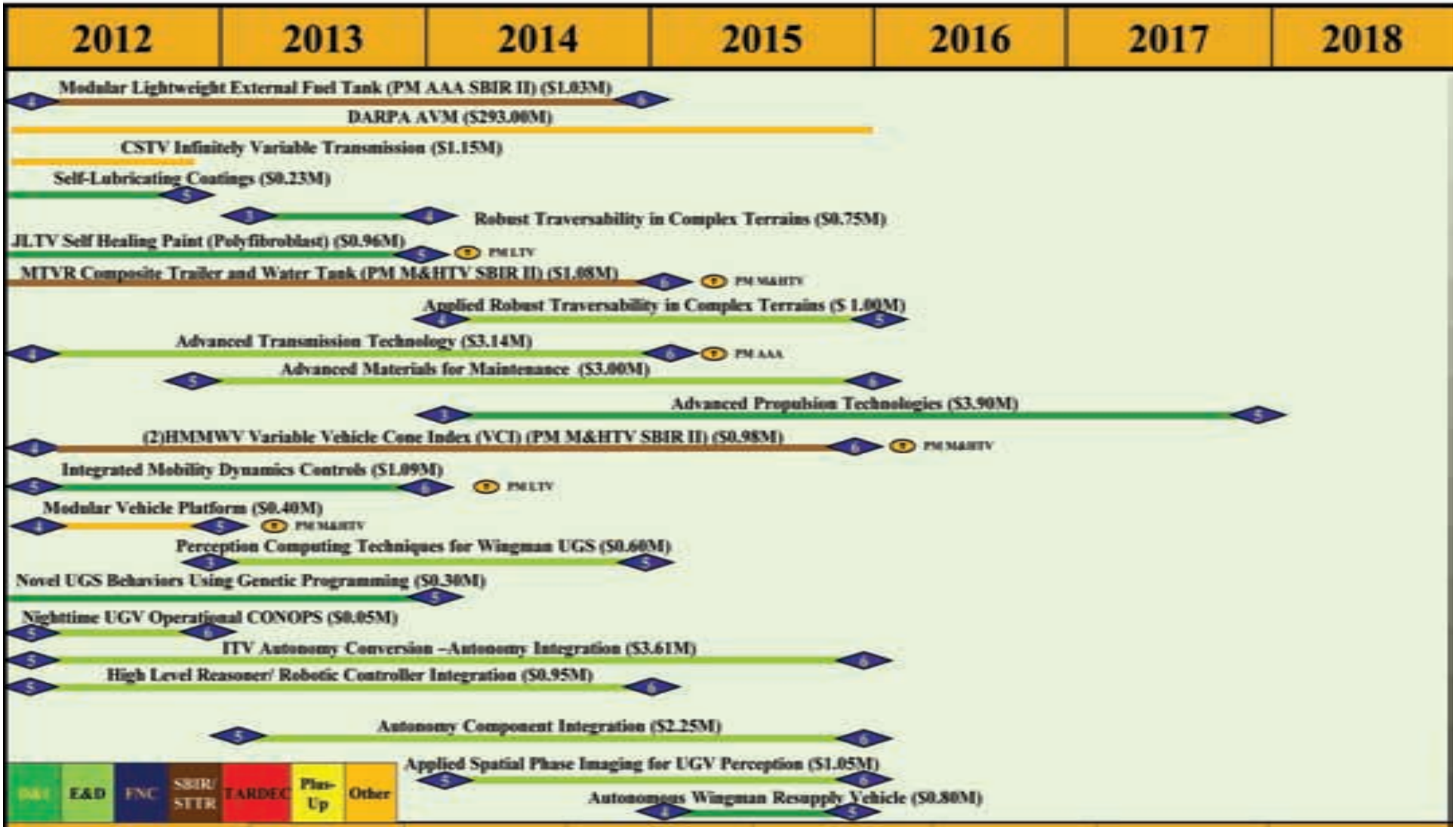

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 82.12 | 114.25 | 104.45 | 88.09 | 83.90 | 64.20 | 50.16 |

# Survivability



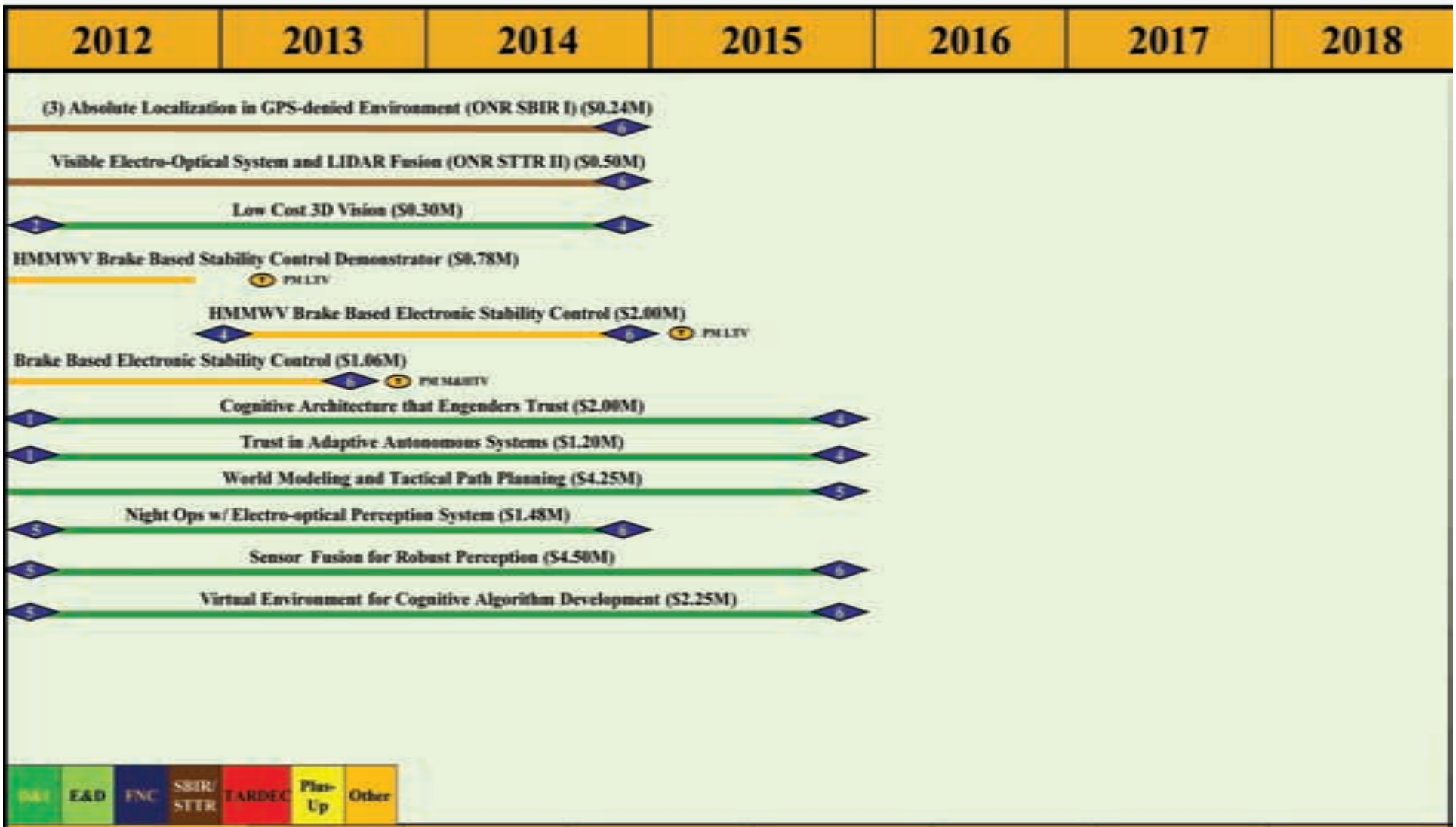

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 44.29 | 51.45 | 78.58 | 77.74 | 71.26 | 27.67 | 20.60 |

# Mobility



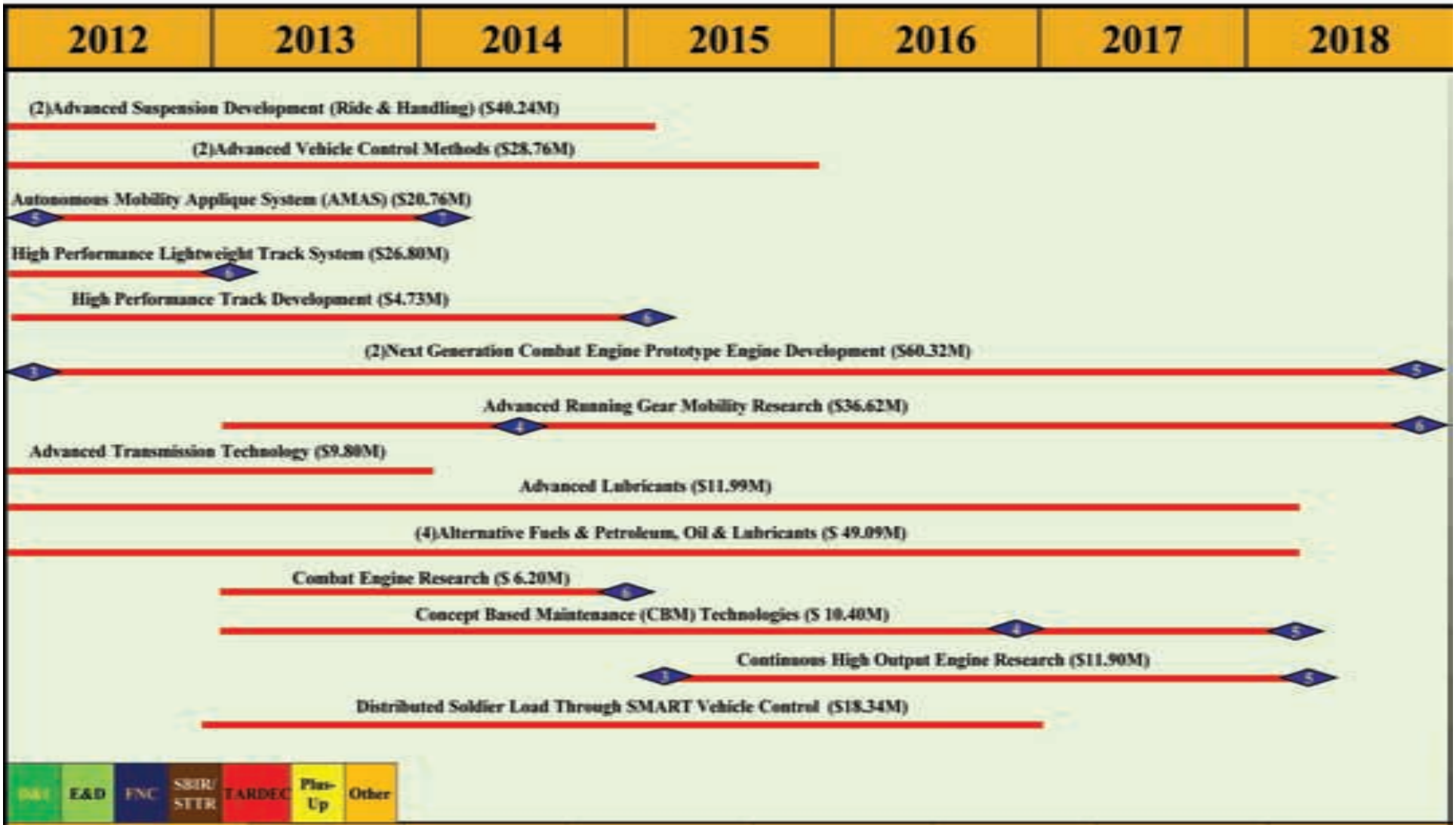

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 64.43 | 107.46 | 42.40 | 40.92 | 1.00 | 1.00 | |

# Mobility



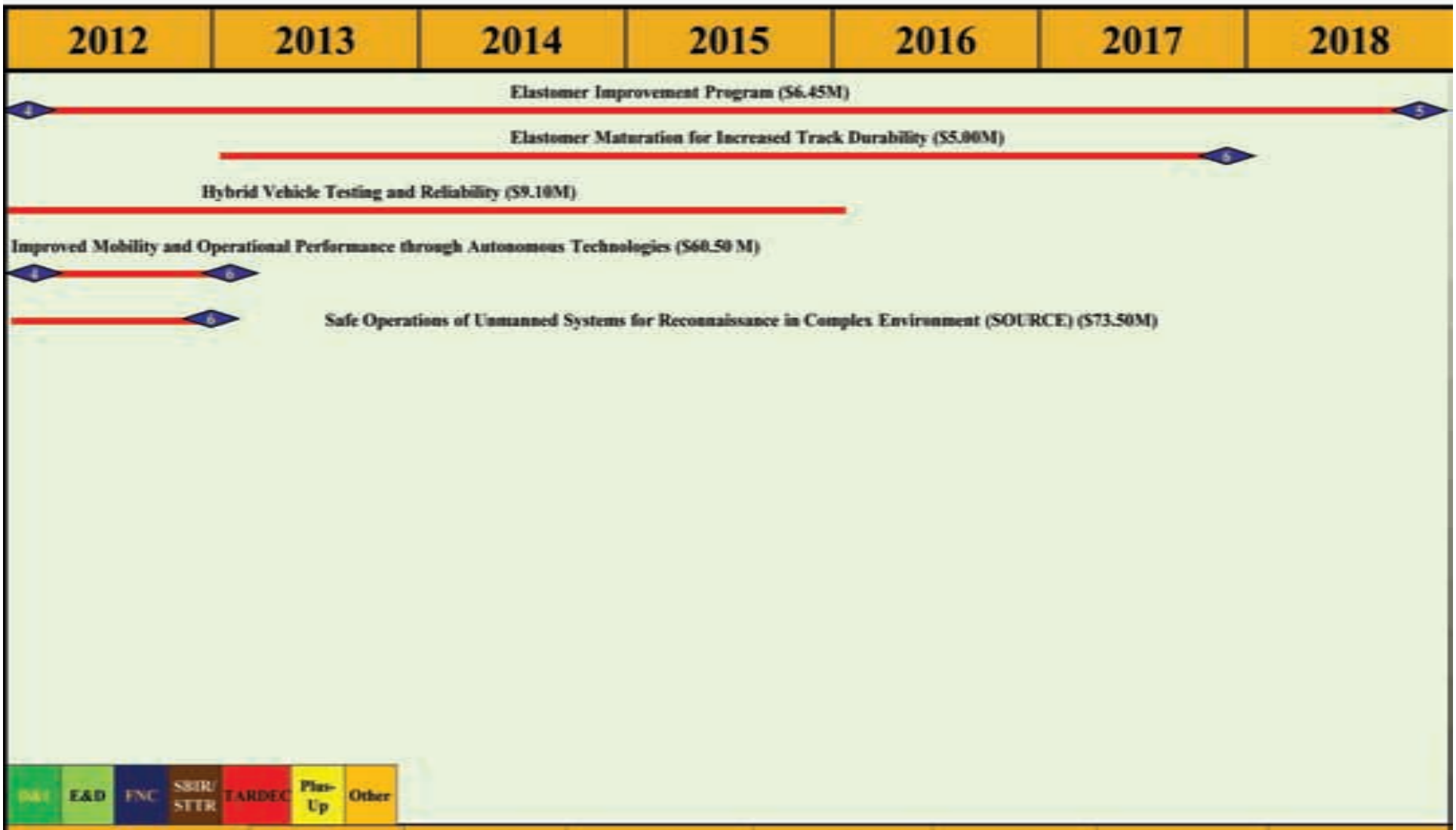

| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 5.88 | 5.30 | 5.03 | 3.45 | | | |

# Mobility




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 52.66 | 55.05 | 40.55 | 50.53 | 42.44 | 36.47 | 28.08 |

# Mobility




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY 15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 26.50 | 4.30 | 4.40 | 3.90 | 1.98 | 1.97 | 1.00 |

# 4.3 MODELING & SIMULATION (M&S)

PEO LS has a requirement for an integrated suite of M&S tools that can be used to support the development and modification of ground tactical vehicles throughout their acquisition life cycle.

M&S can and should play a critical role in the acquisition process. Among the many significant benefits that a simulation-based acquisition (SBA) approach can provide are:

- Identification of system requirements that are realistic and achievable
- Ability to optimize system requirements and perform requirements trades
- Reduction in cost and schedule
- Enable "virtual" vehicle designs to be functionally tested on computers
- Assess candidate vehicles against critical performance parameters
- Ability to evaluate potential new technologies and assess technology readiness levels (TRL)
- Significant reduction in the total life cycle cost (LCC) of the system

The ultimate value of a fully integrated M&S-based Systems Engineering (SE) capabilities toolset is that it can maximize the effectiveness of limited resources in bringing optimized, focused capabilities to the Warfighter.

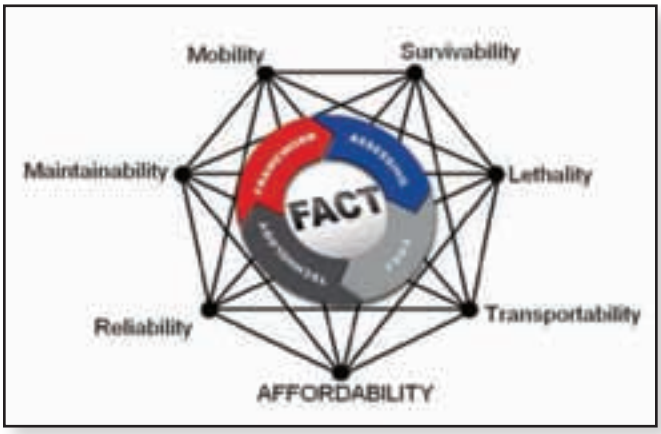
**The Challenge:** High fidelity M&S is required to significantly reduce program cost, schedule and performance risks across the PEO LS portfolio. The challenge for this focus area resides not only in developing these 'high fidelity' models but also in understanding the fidelity of current models.

The following initiatives describe some of the current efforts that potentially provide solutions to this challenge.

**Potential Solutions:**

## PEO LS and MCSC Efforts

**Framework Assessing Cost Technology (FACT):** The FACT project is a System-of-Systems engineering toolkit that allows concurrent design trade modeling in a web based application. Modeling the trade-offs concurrently results in faster decision timelines and potentially limits the costly 'test and fix' approach often employed. FACT uses the common language (SysML) system and is 'model agnostic,' allowing the inclusion of multiple trade space models currently being utilized by the program managers.




### HMMWV

One of the efforts within the FACT project is the development of a high fidelity HMMWV trade space model that will provide a foundation for a general design tool for light tactical vehicles. The objective of this effort is to provide a framework for integrating numerous models to assess the fidelity of current models and evaluate the available trade space.

### ACV/AAV

Program Manager Advanced Amphibious Assault (PM AAA) received delivery of the FACT toolkit in February 2012 to conduct analysis on thresholds delineated in the Capability Development

Document (CDD) for the ACV program. The tool provides the Program Manager with an understanding of the possible trade-offs where further investment may result in enhanced capability.

**Lightweight 155 Howitzer (LW-155)**
The LW-155 FACT initiative, to begin in the second half of FY13, is endeavoring to break new ground in trade space modeling. This will be the first time the FACT M&S toolkit is used on a weapons system vice a tactical wheeled vehicle. In addition, it will be venturing beyond the conceptual design efforts already attempted and into the engineering and manufacturing phases of a fielded system. The objectives of the initiative are:

- Increase the strength (reliability) of the re-engineered components and the system as a whole
- Decrease Mean Time Between Repair
- Decrease the cost of repair parts
- Increase system availability
- Open competition for manufacturing repair parts to domestic sources of supply (potentially including government fabrication)

**JLTV:** The objective of this project is to develop a physics-based model that accurately predicts both soil/structure interaction and gross vehicle/crew response to underbody blasts. The underbody blast (UB) M&S efforts will: 1) provide the Joint Project Office (JPO) insight into force protection levels (initially from a structural standpoint and evolving to a crew response standpoint); 2) support engineering design analyses and modifications; and 3) provide supplemental information to support Key Performance Parameter analyses.

## ONR Efforts

ONR has a broad mix of projects, many focused on ground vehicle programs, which add to development of a comprehensive suite of M&S tools for the Marine Corps:

**Survivability Analysis of Alternatives Tool:** Develop an M&S tool to conduct Analysis of Alternatives (AoA) that establish key survivability performance parameter thresholds for crew casualty and that help balance the weight allocated between underbody blast protection and other protection features in order to provide insight into where to invest for survivability.

**Modeling and Simulation of Advanced Armor Systems:** Increasing fidelity in innovative armor predictive modeling and simulation tools. The ultimate aim is to provide designers and engineers with the ability to accurately model new designs and constructions.

**Human Surrogate Development:** Johns Hopkins University Applied Physics Laboratory is working to develop a human surrogate model of the brain to study the mechanisms that cause traumatic brain injuries and to discover innovative ways to mitigate the blast trauma.

**Composite Armor Modeling and Optimization:** Determine if sub-component (fiber, resin, and weave) contributions of today's Fiber Reinforced Plastic (FRP) composite armor can be adequately represented through numerical modeling; then validate against test data. The final product will accurately model new FRP armor compositions at reduced development costs.

**Novel Ceramic Armor Configuration Modeling:** Develop an accurate model to predict measurements of penetrator induced shock loads in ceramic armor.

**Improved Survivability Modeling and Injury Prediction Correlation to Operational Requirements-Based Casualty Assessment (ORCA):** Enhance ORCA blast module to more precisely predict injuries from IED and other blast events.

**Armor Threat Level Survivability Model (ATL)** Develop a tradespace model that will optimize warfighter load out, to include weight and movement constrictions of personal armor systems. The program will model bio-dynamics associated with acquire, aim, and shoot movements and investigate how it is affected by armor system worn in different threat environments.

## TARDEC Efforts

**Ground Vehicles M&S Playbook:** TARDEC has been tasked by the Governance Board of the Joint Center for Ground Vehicles to develop an M&S Playbook to identify the M&S tools and best practices associated with each phase of the acquisition process. This data call is different because it is structured around the acquisition life-cycle as opposed to being a catalog or list of M&S tools. The objective is to understand and capture the best application of M&S for each specific phase of the acquisition process to emphasize the "how" (e.g., processes, inputs, decisions affected, etc.) rather than the "what" (i.e., the tools).

**Safe Operations of Unmanned Systems for Reconnaissance in a Complex Environment:** Provide perception, intelligence, control and tactical behavior technologies for autonomous collaborative unmanned systems for conducting safe operations in dynamic urban environments

**OCP M&S:** The OCP program is focused around technologies and platforms that are deliberately designed around the Soldier and Marine. M&S initiatives include:

- Exterior Protection: Develop protection designs, supplemented by advanced material and manufacturing solutions, that provide optimized protection for the occupant to the full spectrum of underbody threats (blast and penetrator).
- Interaction of Sub-Systems: Develop a detailed understanding of the interaction and fidelity of each sub-model of an end-to-end underbody event simulation.
- Threat Loading: A detailed understanding of the loading applied to a vehicle (and subsequently to the occupant) from all relevant UB threats.
- Structural/Material Response: Foundation for the development of a Material Specification for Formidable, Weldable Blast Resistant Materials by investigating material and structure processing-property relationships.

**Threat Oriented Survivability Optimization Model (TOSOM) Improvements:** TOSOM will provide optimized software with quantifiable metrics to assist in the streamlining of the concept definition phase for new programs. This streamlining will be accomplished through advanced and innovative capabilities to perform system level trades using a mathematical assessment of the benefits and burdens of both traditional and non-traditional survivability technologies in the development of Survivability options for vehicle platforms.

- Soldier Vehicle Blast Protection: This component of TOSOM was developed to provide a detailed analysis of the impact of underbody blasts on the military's ground vehicle fleet. The tool takes into account system-wide evaluation of the detonations' effects on ground vehicles, providing a comprehensive look over a range of variables.
- Survivability Analysis and Optimization: A component of TOSOM instrumental in performing rapid turnaround, first order analyses of survivability trade-offs in the design or modernization of military systems.

**Hit Avoidance SIL:** A tool to aid in the development and integration of Hit Avoidance Systems for ground-based combat vehicles.

## SBIR Effort

**Software for First Order Affects (FOA) of Blast & Ballistic Impact on Vehicles:** This Phase 1 SBIR effort is developing a series of fast-running algorithms to improve the time to analyze first order screening of armor based solutions for tactical vehicles. Current finite element analysis can take days or weeks to develop a model and hours of work to adjust configurations. This solution can improve time to test various configurations, enhancing trade-off analysis processes.

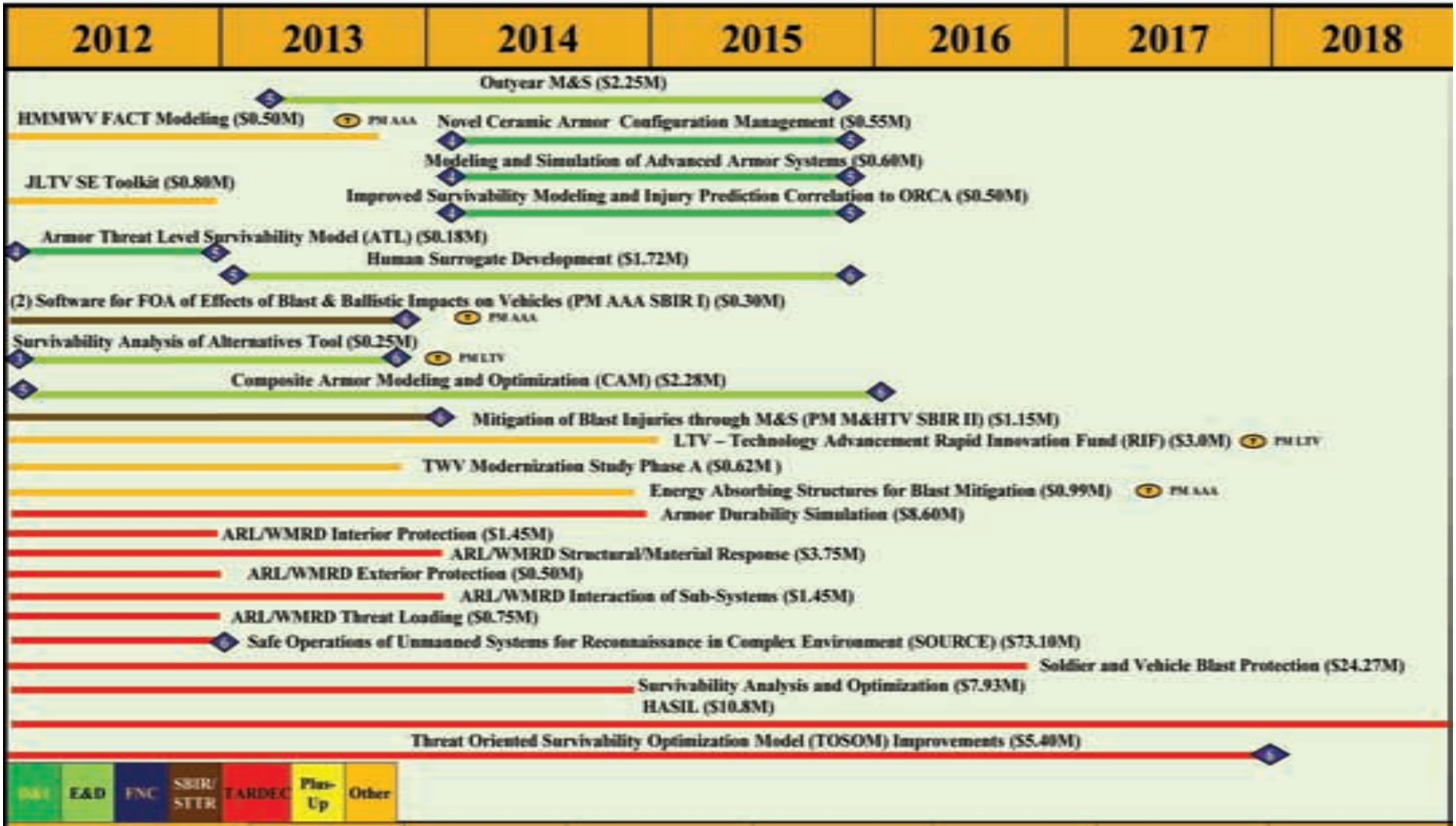
## Other Efforts

**Adaptive Vehicle Make:** The DARPA AVM is a portfolio of programs attempting to address revolutionary approaches to the design, verification, and manufacturing of complex defense systems and vehicles. The three primary programs are META, iFAB and FANG Ground Vehicle (GV) programs. Components of the program leverage crowd-sourcing and will be open source, with the ultimate intent to develop a next generation combat vehicle program from introductory modeling through manufacturing and production.

The META program portion of AVM is endeavoring to transform the timeline required in the existing systems engineering approach to developing, integrating, and testing new defense systems. The project centers around computer model based techniques, massively expanding their capabilities, and designing a program that will encompass a complete cradle-to-grave analysis for a new ground vehicle system design.

The M&S Focus Area Charts on the following pages highlight critical efforts monitored and supported by the PEO LS S&T Director.

# Modeling and Simulation




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 33.59 | 18.52 | 18.46 | 9.83 | 5.28 | 1.70 | 5.00 |

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# 4.4 OPEN PLUG & PLAY COMMUNICATIONS ARCHITECTURE

***"I want a knowledge based force that leverages seamless enterprise capabilities across the spectrum of conflict in order to enhance decision making, achieve knowledge superiority and gain tactical, operational, and strategic advantage over our Nation's adversaries."***
-BGen Kevin J. Nally, USMC, Marine Corps Information Enterprise Strategy, 2010

**MRAP WITH C4ISR EQUIPMENT**

As the Marine Corps continues to develop a comprehensive C4ISR Standard, PEO Land Systems will work with partners to integrate new systems and architectures into tactical Marine vehicles. Upgrading legacy vehicles and developing new platforms provide opportunities to enhance combat effectiveness and ensure Marines maintain their combat edge.

**The Challenge:** The rapid development and employment of complex C4ISR tools has stressed the power systems, data networks, and overall effectiveness of the Marine Corps fleet of tactical vehicles. Current systems were not designed to support the multiple new technologies that have been added to enhance combat operations. The development of a modular, scalable, affordable and universal architecture to enable a plug-and-play mission capability across all tactical vehicles will enable rapid vehicle modernizations, more intelligent resource allocation, and tactical agility for both current and future vehicle programs.

**Potential Solutions:**

## ONR Efforts

**Modular Vehicle Platform:** This ONR 30 effort is focused on developing a scalable, reusable, and subdivided vehicle system that will employ a series of self-contained functional modules (medical, Combat Operations Center (COC), remote weapons station, etc.). While the program is exploring potential solutions to a variety of technical challenges, it will require an open plug-and-play architecture to support the various modules and platform elements. This C4ISR backbone will permit system wide power and thermal management and provide common interfaces for the different modules, enabling vehicle mission optimization. This S&T effort, attempting to integrate new systems into a legacy platform, will inform PEO LS of possible architectures and interfaces to feed current and future tactical vehicle programs.

**Dynamic Tactical Communications Networks:** This Enabling Capability under the FORCENET FNC aims to develop algorithms and protocols to create and maintain networks at the tactical edge. The program's goal is to configure a 200 node network in 2 minutes and reconfigure it in 30 seconds to support C4ISR information over IP in a resource-constrained environment.

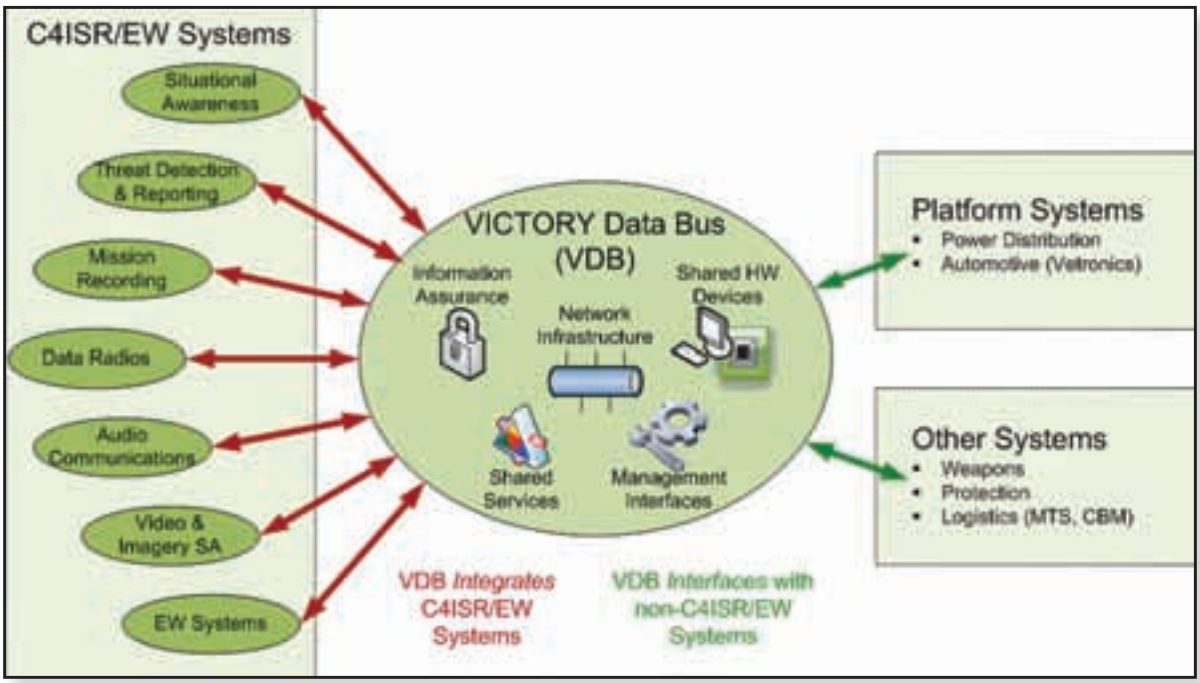
**C4I Interoperability Architecture:** This program is a future Code 30 effort to develop a standardized C4I architecture throughout the Marine Corps. As PEO LS modernizes current vehicles and builds new systems that will support the future MAGTF, the S&T effort will develop future specifications for tactical vehicles for enhanced interoperability.

## PEO LS and MCSC Efforts

**Networked User Control of Locally Embedded and Unique Systems (NUCLEUS):** MCSC SIAT sponsored an effort by NSWC Dahlgren and Space and Naval Warfare Systems Command (SPAWAR) to rapidly develop a common display for the MTVR. The NUCLEUS display is a Government-owned hardware and software architecture for vehicle data displays on selected Marine Corps vehicles. MTVR will be the first USMC vehicle to install the NUCLEUS display, but the hardware and software will be able to be reused on other USMC vehicle platforms. The design shall be an open architecture design using common standards-based hardware supported by multiple vendors, and Government-owned software based on open software architecture standards. PM M&HTV intends to integrate the first five systems into the MTVR for a Field User Evaluation in 2013.

**Potential MVP Construct**


**Dynamic Tactical Communications Networks**




**VICTORY Architecture Concept**

## TARDEC Efforts

**Vehicular Integration for C4ISR/ Electronic Warfare Interoperability (VICTORY) SIL:** The VICTORY SIL is established and developed at the U.S. Army TARDEC. The lab will be utilized for the development and integration of an extensive set of C4ISR/Electronic Warfare (EW) technologies that are to be systematically down selected to provide the comprehensive VICTORY services and infrastructure required in the development of mission capabilities of the Army's tactical and combat vehicles. A fully functioning VICTORY SIL will be utilized for validation and independent verification of the Army's and the vendor-provided C4ISR/EW subsystems. The lab will emphasize the importance of testing the data, power and physical interface strategy of the subsystems in a low-cost laboratory environment before integration onto a vehicle. This section describes how the VICTORY SIL will advance the RDECOM's vision for a standardized electronic architecture for ground vehicles as well as the strategy and process for the design, development and testing of the infrastructure and the VICTORY core services.

**The VICTORY SIL is a Tool for Advancing Standardized Ground Vehicle Electronic Architecture and Provides These Advantages:**

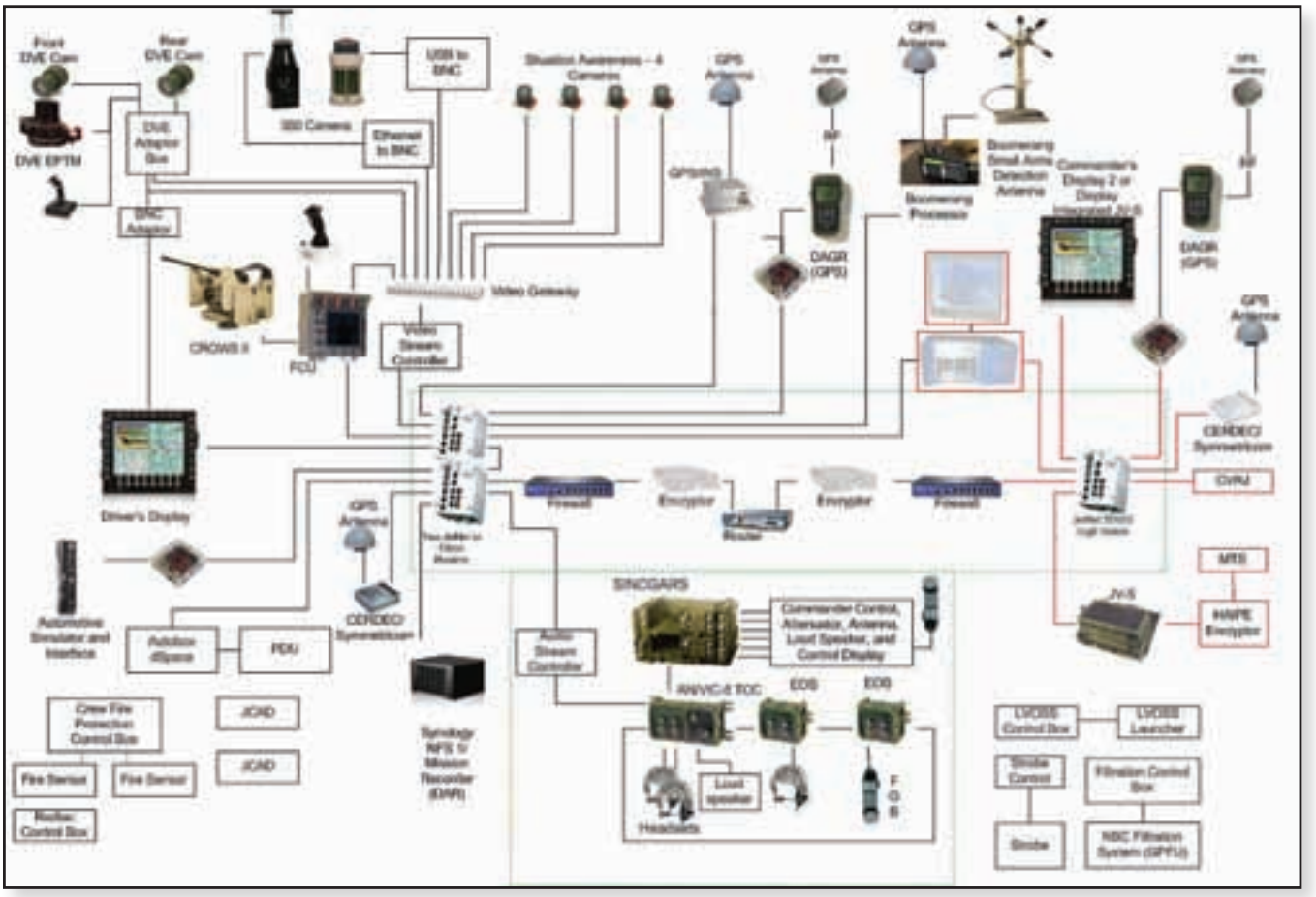
- Build In-house Environment and Knowledge Base to Support Future R&D Capability Regarding Vehicle Electronics and Architecture
- Capability to Test and Verify Vendor Components and Subsystems
- Advance SWaP-C with Porting and Testing VICTORY Implementations to Small, Open and Powerful Process Modules
- Provides an Independent Implementation of the VICTORY 1.0 Standards
- Provides Validation and Verification of the VICTORY 1.0 Standards
- Advances VICTORY Standards from "Proposed" to "Draft"
- Identifies and Clarifies Issues with the VICTORY 1.0 Standards

- The SIL will continue to evolve and change over time as new VICTORY Standards are released.
- Utilize a representative vehicle cabin to demonstrate the VICTORY 1.0 [Fully Mission Capable in September 2012]
- Standards developed in a system level vehicle environment

## SBIR Efforts

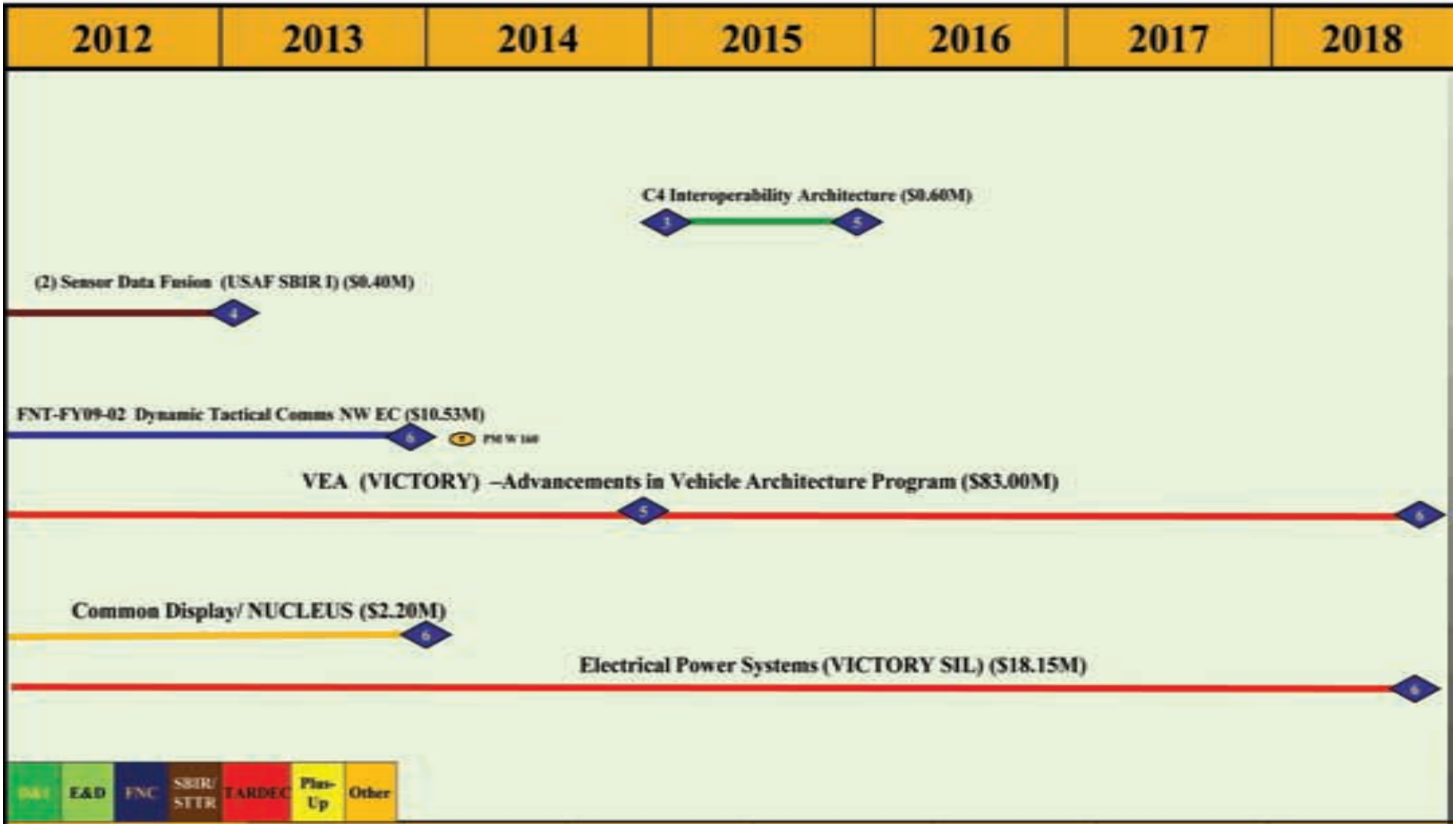
**Sensor Data Fusion for Intelligent Systems Monitoring and Decision Making:** This Air Force funded SBIR aims to develop a framework to integrate data from various air and ground sensor systems employed in an urban environment to collect data on moving/stationary vehicles and dismounts.

The Open Plug & Play Communications Architecture Focus Area Charts on the following pages highlight critical efforts monitored and supported by the PEO LS S&T Director.




**VICTORY 1.0 SIL: End State Architecture**

# Open Plug & Play Comms Architecture




| Funding Profiles ($M) | FY 12 | FY13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 16.23 | 16.62 | 15.32 | 16.58 | 13.72 | 13.80 | 11.34 |

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# 5.0 PEO LS PROGRAMS

## Advanced Technology Investment Plan

The following sections discuss the Technology Investment Plan for each PEO LS program. The various PEO LS programs are introduced, top technical issues are highlighted, active S&T initiatives are listed and a roadmap presented that aligns the S&T initiatives with the program schedule and funding.

Each PEO LS program has a dedicated section that addresses the specific program's top three technical issues and is broken down into three parts:

INTERNALLY TRANSPORTABLE VEHICLE (ITV)

**Program Description**

The ITV program has been developed to field a family of light attack vehicles in support of expeditionary forces. The ITV-LSV will replace the Interim Fast Attack Vehicle (IFAV) as well as fill the tactical void created by the disposal of all M151 Jeep variants. The ITV is designed to be internally transportable within both the MV-22 tilt-rotor aircraft and CH53D/E rotary wing aircraft. ITV has been fielded as a system of systems. Light Strike Vehicle supports Infantry, Recon, and SOF while Prime Mover tows Expeditionary Fire Support System mortars and ammunition trailers.

**Program Status**

Production and fielding completed in December 2012. Support will transition from CLS to organic support in FY14. The ITV Improvement Initiative (I3) is under way to identify safety and reliability issues. Reliability and performance testing is being conducted at Aberdeen Test Center along with engineering and design analysis to improve system deficiencies. Efforts outside of the Program Office are exploring operational concepts to aid in lightening the MAGTF, including the Autonomous resupply mission.

**ITV'S Top Three Program Technology Issues:**

**1. Stability/Braking**

The ITV was designed with a narrow wheel base driven by the requirement to fit in the MV-22. Due to the unconventional vehicle wheel base the front brake proportioning valve has been adjusted to compensate for system design. This design has led to stability and breaking issues. System performance could be greatly improved with the addition of an Anti Lock Braking System.

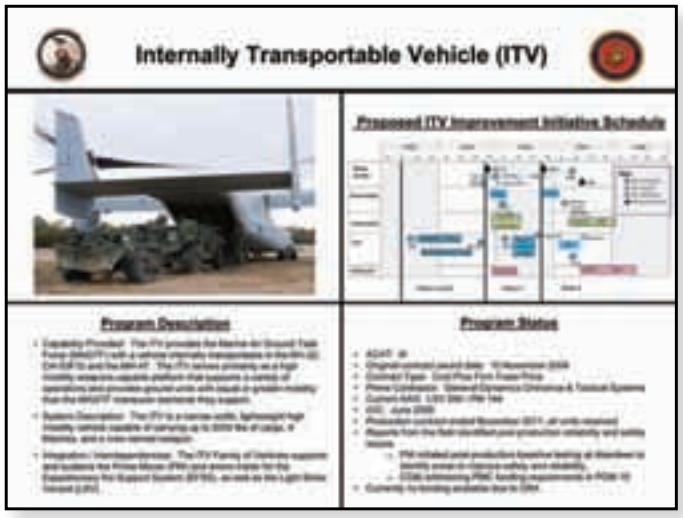
**2. Reliability/Durability**

Primary vehicle areas that lack adequate reliability include the following: Drive shaft, half shafts, and rear steer system. These issue areas are being addressed through the I3 effort.

**3. Corrosion**

Improper Chemical Agent Resistant Coating painting procedures during ITV production and lack of operator preventive maintenance, checks, and services has led to significant corrosion issues for the ITV fleet. The Program Office is currently working with the CPAC team to address the corrosion issues encountered in the ITV fleet.

**Part One - Progam Description, Program Status & Top Technical Issues**

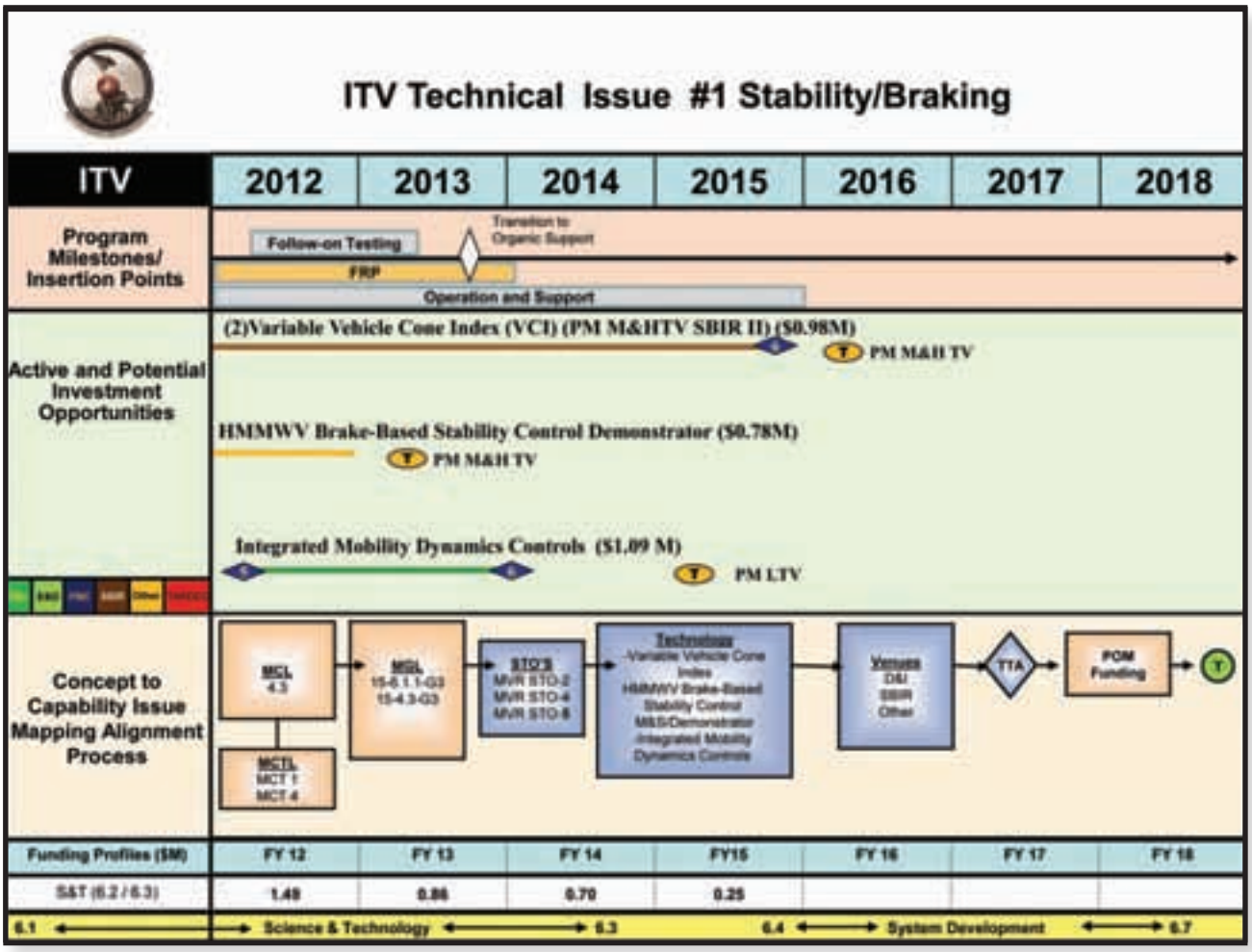



**Part Two - Program Quad**

**Part One** contains the individual program's description, program status, and top three technical issues.

**Part Two** contains the individual program's quad chart, which addresses the program's fundamental information and characteristics.

**Part Three** graphically addresses the top three technical issues by breaking down each issue individually and aligning it from the concept to the capability it will provide (see chart on following page). This process traces the issue from the MCL, identifies the Gap in capability via the MGL, identifies the STOs and various S&T technology venues that address the technical issue, and illustrates the transition of the technology to the POR.




**Part Three - Example of an Advanced Technology Investment Plan/Process for ITV**

The Part Three chart above provides an example of an Advanced Technology Investment Plan/Process for the ITV program. The top area identifies the program major milestones. The next area is the S&T initiatives that may help resolve the technology issues identified. The symbol (T) is used at the end of a project to identify the program that is being targeted for insertion of the new technology. The yellow section maps the top issue to the capability (Marines Corps Capability List), describes the gap (Marines Corps Gap List) the capability is intended to address, and shows the transition period to transition the capability to the POR. The bottom white area shows the funding profile associated with the S&T initiatives for each listed year.

The color-coded key on the middle far left of the roadmap identifies types of S&T venues.

D&I **Discovery and Invention (D&I)** programs consist of basic and applied research.

E&D **Exploitation and Development (E&D)** focuses on incorporating that research into systems in preparation for inclusion into acquisition programs.

FNC **Future Naval Capabilities (FNCs)** provide the best technology solutions to formally defined capability gaps, and usually leverage past D&I and E&D success.

SBIR/ STTR **Small Business Innovation Research (SBIR)/ Small Business Technology Transfer (STTR)** programs for small business innovation.

Other **Other** is a variety of other investment types, including projects involving the Office of the Secretary of Defense, initiatives that are sponsored by the program office, such as Phase "A" studies, congressional "plus ups", and all those not otherwise covered.

TARDEC **Tank and Automotive Research, Development and Engineering Center**, located in Warren, Michigan, is the U.S. Armed Forces' research and development facility for advanced technology in ground systems. It is part of the RDECOM, a major subordinate command of the United States Army Materiel Command. Current technology focus areas include GVPM, Ground System Survivability and Force Protection Technology, among others.

1 The diamond shapes depict the Transition Readiness Levels (TRLs). TRLs are used to measure the maturity level of the S&T activities and initiatives.

TRL 1 – Basic principle observation and report
TRL 2 – Technology concepts or applications (or both) formulated
TRL 3 – Analytical and experimental critical function or characteristic proof of concept (or both)
TRL 4 – Component or breadboard validation in a laboratory environment
TRL 5 – Component or breadboard validation in the relevant environment
TRL 6 – System/subsystem model or prototype demonstration in a relevant environment
TRL 7 – System prototype demonstration in an operational environment

## *Goal: Use all S&T venues to leverage resources for PEO LS programs to close Warfighter Gaps and solve Program Technology Needs.*

The mapping alignment process traces the technology issue/S&T initiative from the required capability to the transitioned technology. Using ITV as an example, 4.3 (Maintain Equipment) identifies the capability that is associated with the technical issue. MGL 15-6.1.1G3 (On-the-move capability) identifies the gap. Maneuver STO-2 identifies the S&T Objective. The issues are then traced through potential technologies and venues to the funded transition of that advanced technology capability.

In summary, the Advanced Technology Investment Plan for each program captures the active S&T initiatives that are currently being pursued by the program office and are aligned to high priority technical issues and capability gaps in order to "Focus the Future Faster" by delivering gap closing capabilities to the Warfighter.

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# ASSAULT AMPHIBIOUS VEHICLE (AAV7A1 RAM/RS)

## Program Description

Initially fielded in 1972 and subsequently upgraded to the current "A1" configuration in the late 1980s, the Assault Amphibious Vehicle (AAV) remains the primary general-support armored personnel carrier for Marine infantry. The AAV is scheduled to remain in service until at least 2030, requiring upgrades as a bridge to the arrival of the Amphibious Combat Vehicle.

AAV variants consist of the standard AAVP7A1 RAM/RS and two supporting mission-role variants: AAVC7A1 RAM/RS Command and AAVR7A1 RAM/RS Recovery. The AAV7A1 RAM/RS vehicles provide ship-to-shore-to-objective mobility as well as direct fire-support with organic weapons.

Upgrades will improve force protection and platform survivability by integrating mature technologies into the existing AAV. These upgrades include belly and sponson armor, blast-mitigating seats, and spall liners, and they may also include fuel tank protection, deck liners, and automotive and suspension upgrades. These upgrades are currently slated for approximately 392 AAVP7A1 RAM/RS, as well as potential select upgrades to the Command and Recovery variants.

## Program Status

The AAV Upgrade Program is expected to enter the acquisition cycle at Milestone B during FY 2014 and begin the engineering, manufacturing, and development phase. Developmental testing is planned for late FY 2015. Milestone C, authorizing entrance into the production and deployment phase, is scheduled for late FY 2016, with an Initial Operating Capability slated for late FY 2018.

## AAV'S Top Three Program Technology Issues:

### 1. Survivability

Technologies that provide advances in ceramic and layered armor to improve survivability and reduce weight are needed for the AAV upgrade and will likely include a combined internal and external belly armor solution. Additionally, advances in blast seats and spall liners are also required for the AAV upgrade.

### 2. Weight/Buoyancy Management

Enhancing survivability will likely add weight to the AAV platform. There exists a critical need for advances in technology that will provide alternative lightweight, economical materials, along with design improvements to increase and protect buoyancy.

### 3. Sustainment/In-Service Engineering

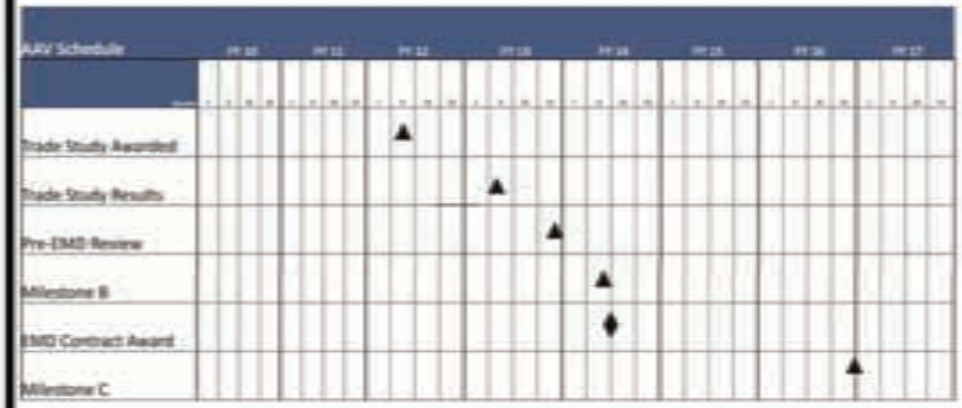
The AAV is a 40-year old platform that will remain in service for years to come. The day-to-day logistics, maintenance and technical challenges of managing such a dated platform require advances in technology that will increase reliability and reduce operation and maintenance support costs.

A U.S. Sailor assigned to the amphibious assault ship guides amphibious assault vehicles into the well deck of the ship while under way for local operations in the Pacific Ocean. Photo by Senior Chief Mass Communication Specialist Joe Kane.

Amphibious assault vehicle traversing in the water.

**Amphibious Assault Vehicle carrying Marines to shore.**

# Assault Amphibious Vehicle (AAV)




## Program Description

• AAV Upgrade AAO provides 4 Infantry Battalions lift capacity to the MAGTF

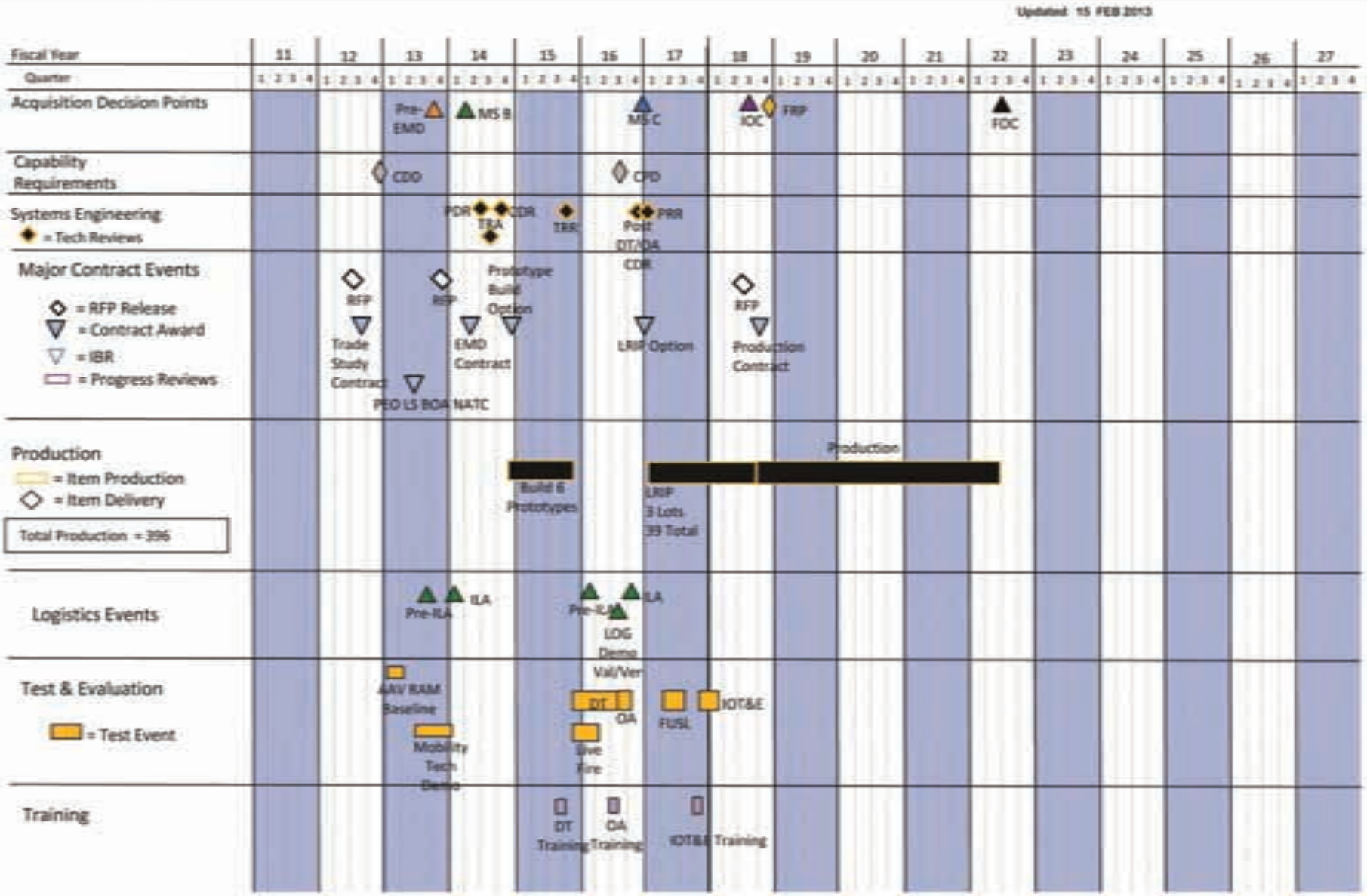
• The AAV Upgrade is to be a **bridge capability** to ACV. *Focus* - restore operational relevance to the AAV by updating outdated protection attributes

**Mission:** General Support Lift / Amphibious Mobility
**Dimensions:** H: 130 in
W: 130 in
L: 321 in
Wt: 46,330 lbs (curb wt)
**Weapons:** HMG
**Payload:** 21 Infantry Marines + 3 Marine crewmen
**Range:** 200 miles
**Speed:** Effective with M1A1 off-road / 6 knots in water

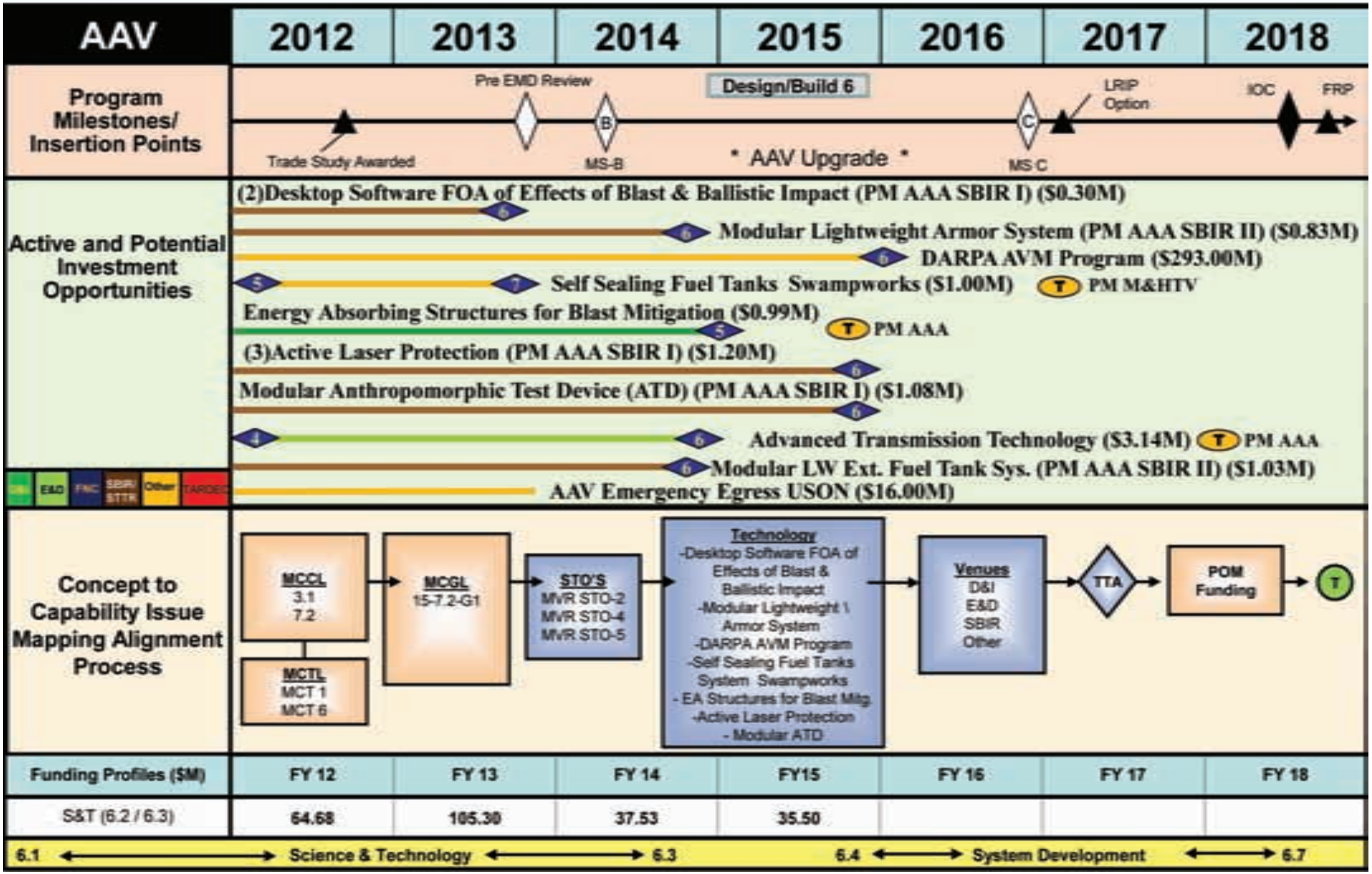
## Program Status

**Acquisition Status:** Pre MS-B
**Acquisition Objective:** 392
**IOC/FOC:** FY17/FY23

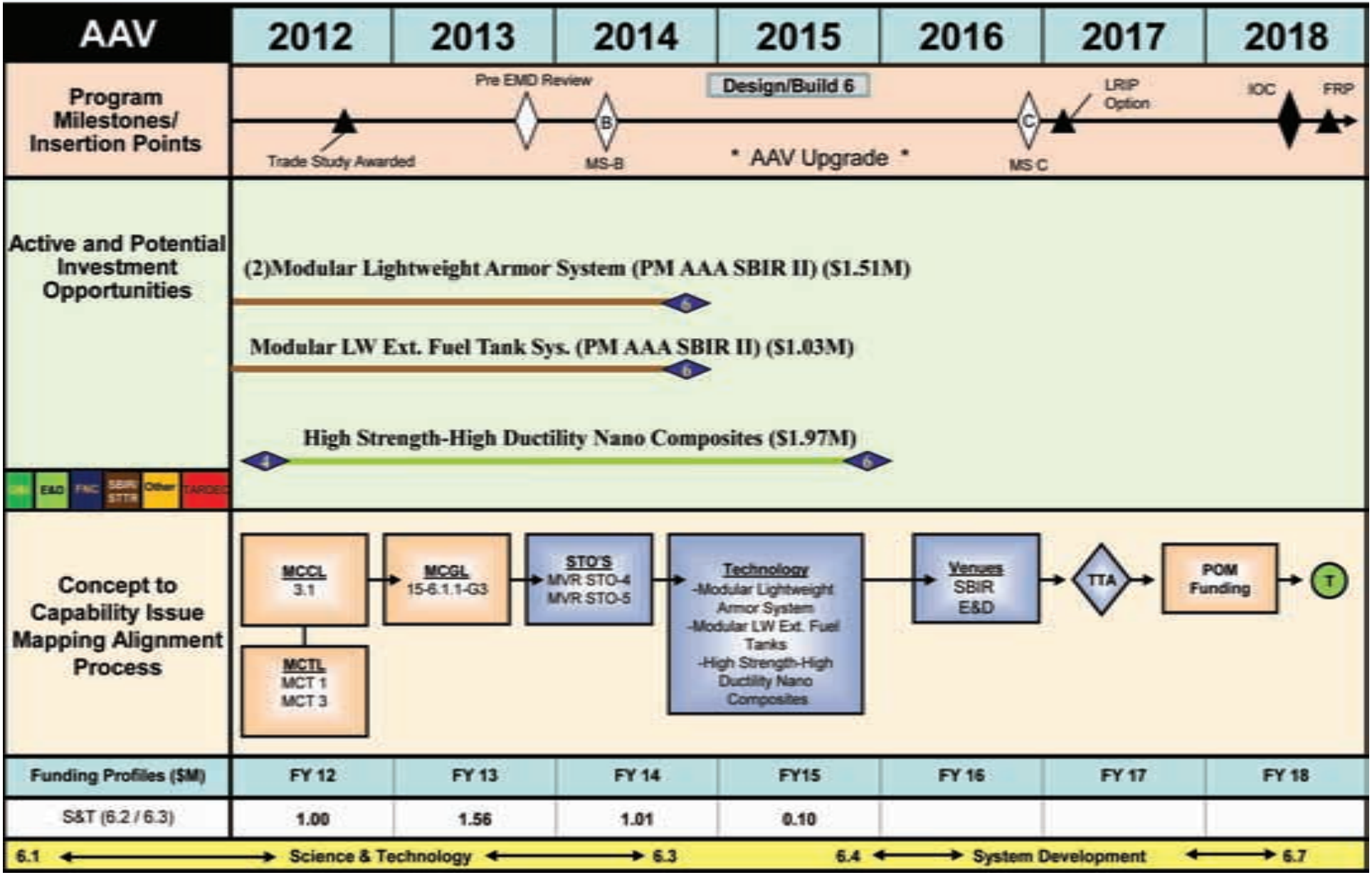
# Assault Amphibious Vehicle (AAV)



# AAV Technical Issue #1 Survivability



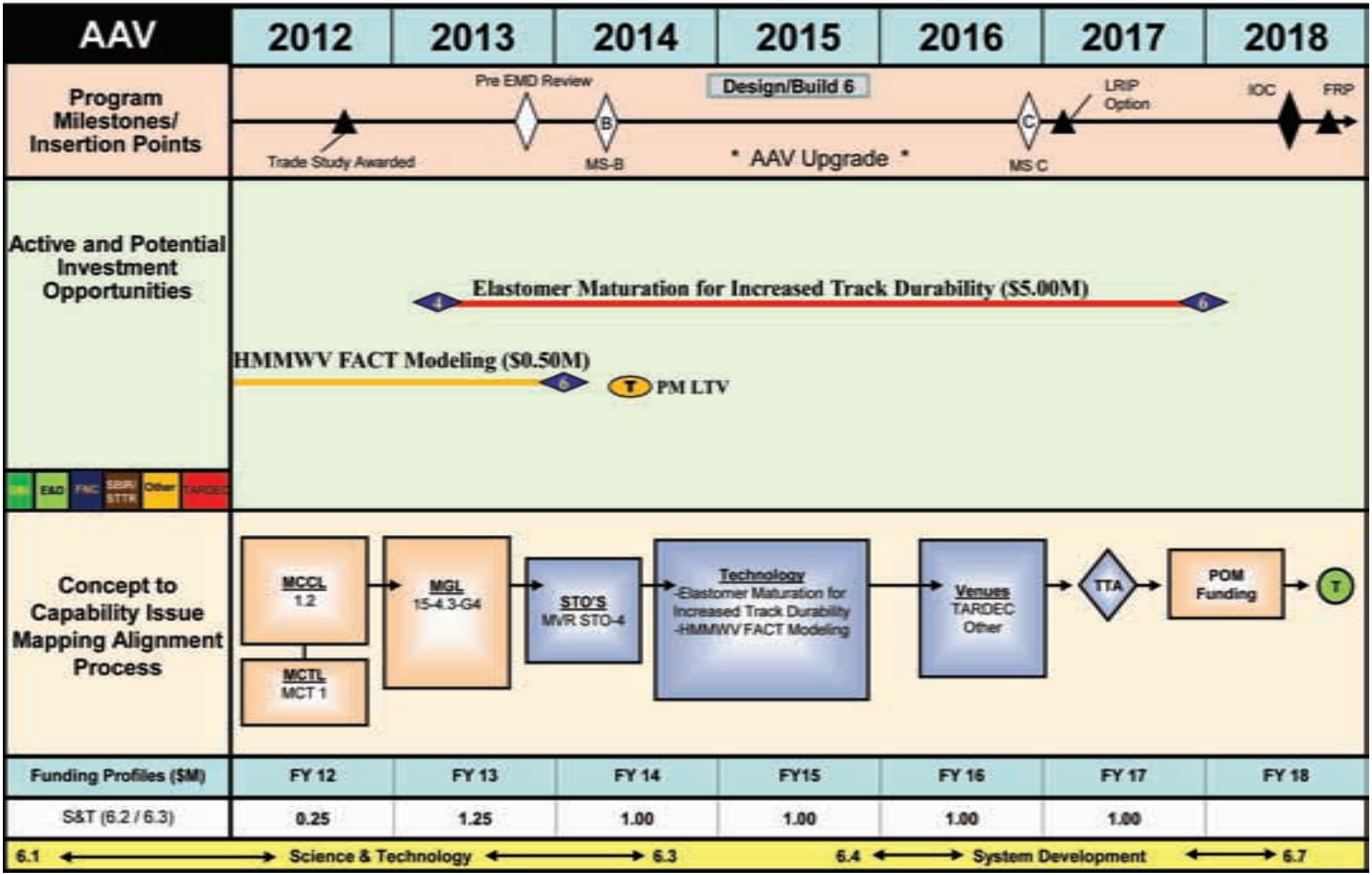
# AAV Technical Issue #2 Weight/Buoyancy Management




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.00 | 1.56 | 1.01 | 0.10 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# AAV Technical Issue # 3 Sustainment/In-Service Engineering



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Artist rendering of the ACV

# AMPHIBIOUS COMBAT VEHICLE (ACV)

## Program Description

A new start, pre-Major Defense Acquisition Program (pre-MDAP), the ACV will replace the AAV and serve as an advanced generation, armored, amphibious combat vehicle. The ACV will be the primary surface means of tactical mobility for the Marine rifle squad, both at sea and ashore, and will deliver the assault echelon from amphibious shipping at launch distances at or beyond the visual horizon. The ACV will possess the speed to enable the rapid buildup of combat-ready Marines ashore.

The Marine Corps requirement is for an amphibious vehicle that provides increased force protection, water speed, land mobility, lethality, and survivability, while balancing capacity, mobility, transportability and total ownership costs over the current AAV. The ACV will provide superior ground mobility and speed to the Marine Air-Ground Task Force during sustained operations ashore and will provide organic, direct fire support to dismounted infantry in the attack. The ACV will protect the force during both offensive and defensive operations, providing 360-degree protection against direct fire, indirect fire, mines, and improvised explosive device threats.

## Program Status

The ACV is in the Material Solution Analysis Phase of the Joint Capabilities Integration and Development System process. The recently completed Analysis of Alternatives includes development of life cycle cost estimates for each alternative, considering major cost drivers, acquisition and sustainment strategies, as well as the fully burdened cost of energy.

## ACV'S Top Three Program Technology Issues:

### 1. Increase Survivability

Technologies that protect both the occupants of the vehicle and the vehicle itself from emerging threats are critical. These include technologies that: increase armor protection while maintaining current weight (or with minimal weight gain), decrease impacts to the occupants and vehicle due to battle damage, as well as fuel system containment and fire suppression improvements.

### 2. Increased Weight Margin

The ACV will need to balance vehicle survivability with the overall mobility performance and sea-keeping capability. Technologies that increase the weight margin of the ACV are essential and would include such items as lightweight composite materials and armor.

### 3. Crew Visibility

The ACV crew must maintain direct sensory knowledge of their surroundings in order to safely and effectively employ the system. This includes, but is not limited to, fully blacked out land/water operations, station keeping, obstacle detection (including near-surface obstacles), and operation in urban environments. Technologies that provide the necessary situational awareness for the crew are critical in the execution of the ACV mission.

**Artist rendering of the ACV**

# Amphibious Combat Vehicle (ACV)


TBD

## Program Description

**Mission:** General Support Lift / Amphibious Mobility / Firepower
**Dimensions:** Similar to EFV footprint for transportability

**Weapon:** Lethality Options under analysis
**Fire control:** Modern, Stabilized Day / Night Optics
**Capacity:** 17 Infantry Marines + 3 Marine Crewmen
**Range:** 200 mile
**Speed:** Mobility effective with MAGTF Maneuver Task Force

## Program Status

**Acquisition Status:** MDD
**Acquisition Objective:** ~600
**MS B/MS C:** TBD
**IOC/FOC:** TBD
**Comments:**

- AAO will provide lift for 8 Infantry Battalions

# Amphibious Combat Vehicle (ACV)

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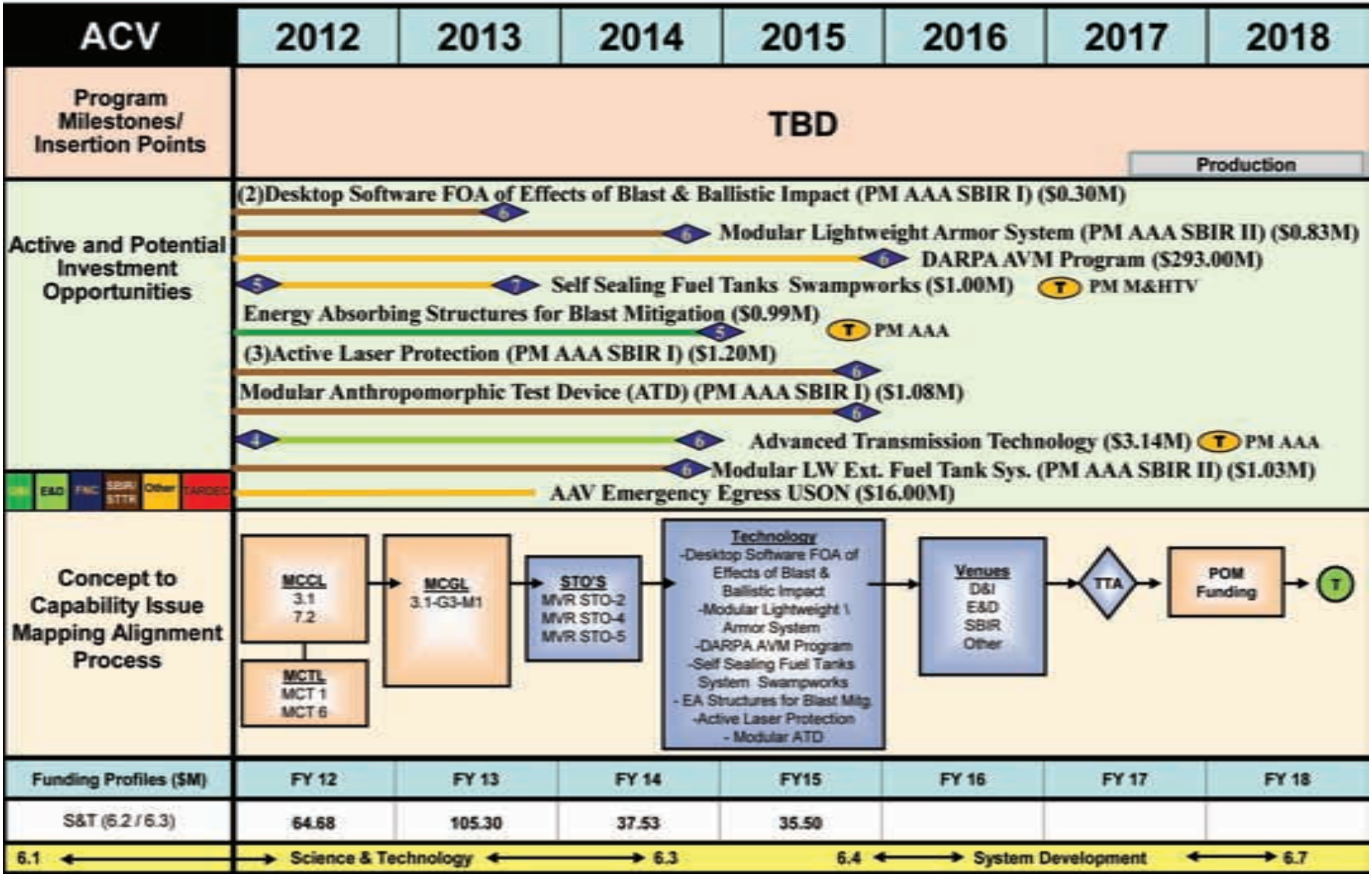
# ACV Technical Issue #1 Increased Survivability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 64.68 | 105.30 | 37.53 | 35.50 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

# ACV Technical Issue # 2 Increased Weight Margin

| ACV | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Program Milestones/ Insertion Points | TBD | | | | | | |

**Active and Potential Investment Opportunities**

(2)Modular Lightweight Armor System (PM AAA SBIR II) ($1.51M)

Modular LW Ext. Fuel Tank Sys. (PM AAA SBIR II) ($1.03M)

High Strength-High Ductility Nano Composites ($1.97M)

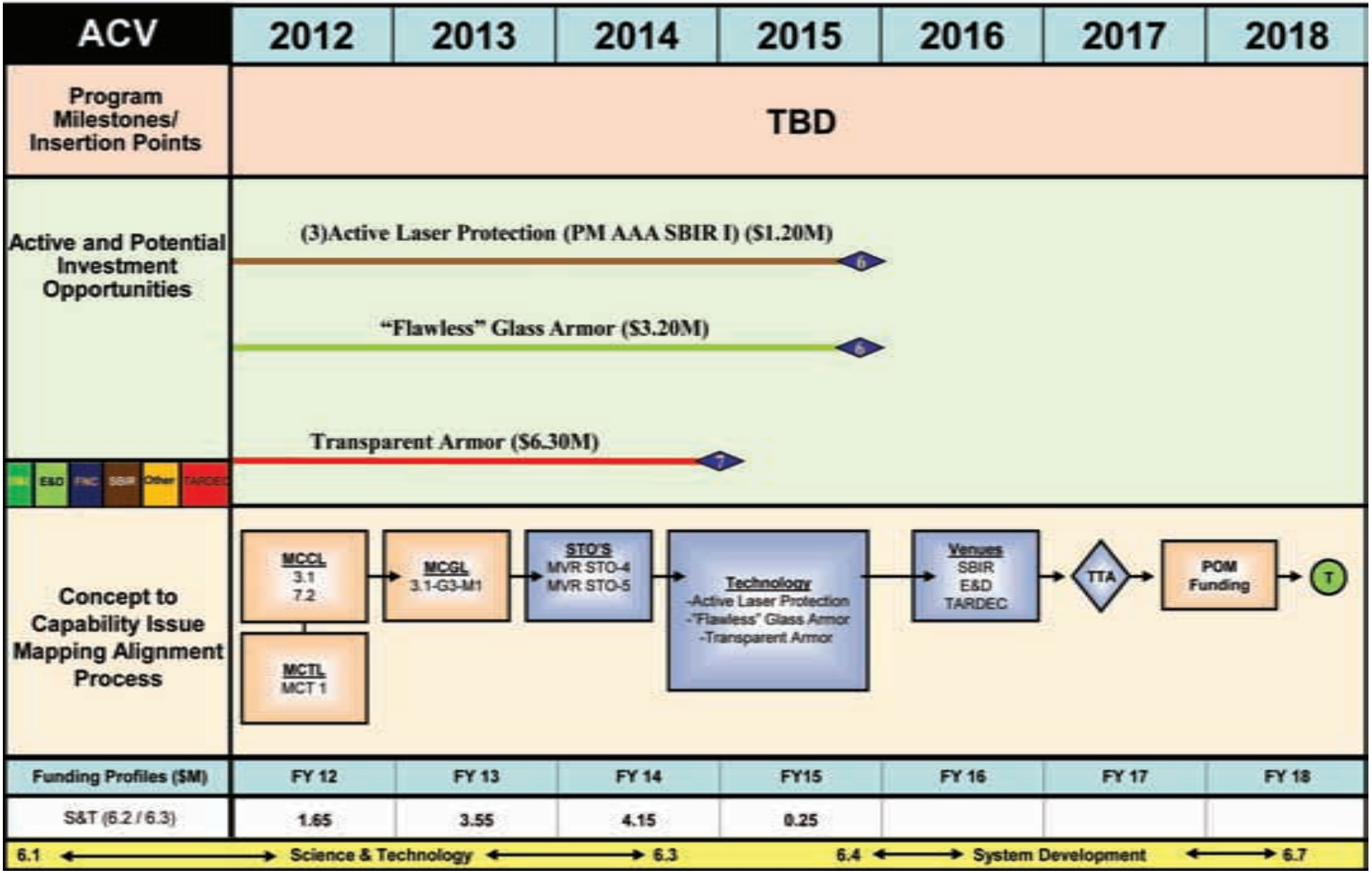
S&T | E&D | PAC | SBIR/STTR | Other | TARDEC

**Concept to Capability Issue Mapping Alignment Process**


| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.00 | 1.56 | 1.01 | 0.10 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# ACV Technical Issue #3 Crew Visibility




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.65 | 3.55 | 4.15 | 0.25 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

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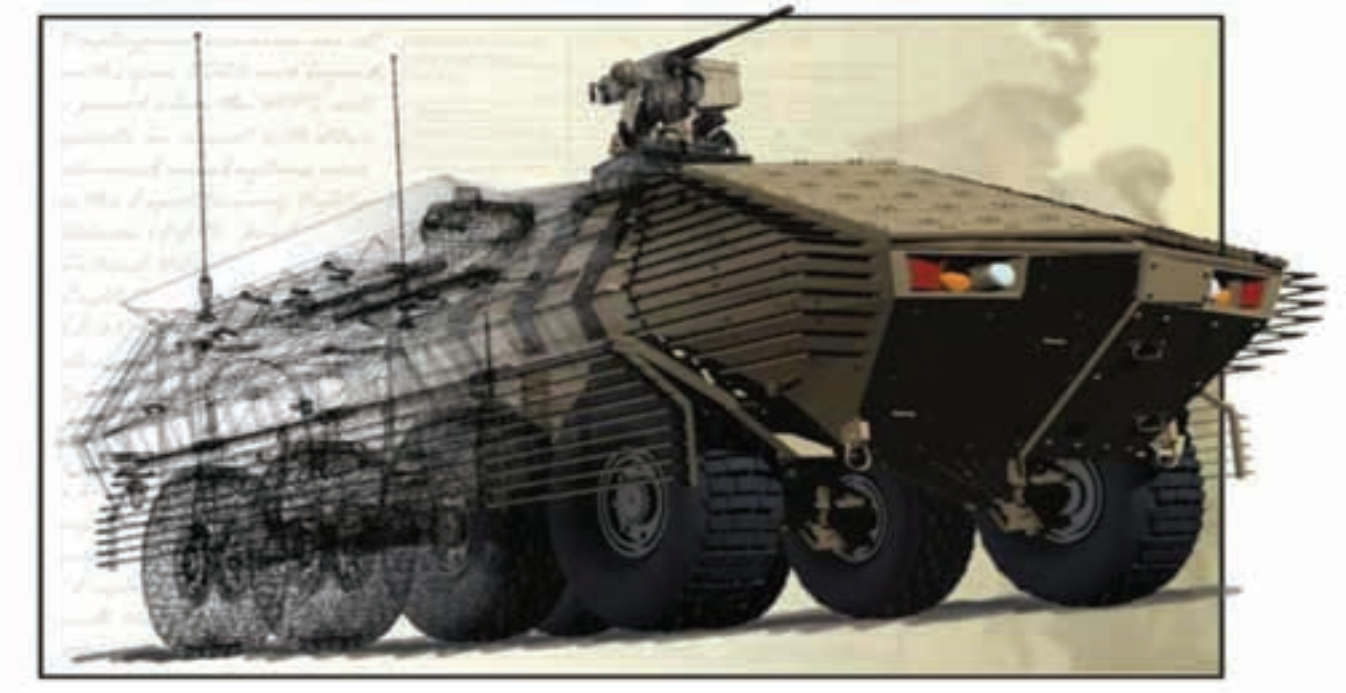


# MARINE PERSONNEL CARRIER (MPC)

## Program Description

While the ACV will be designed to replace the legacy AAV, the MPC was not designed nor intended to replace an existing capability, but rather complement the capabilities of existing protected transport as provided by the AAV in the Assault Amphibian Battalion. The MPC program intends to field a base vehicle MPC-Personnel (MPC-P), and two supporting Mission Role Variants: MPC-Command (MPC-C) and MPC-Recovery (MPC-R). Two MPC-Ps will provide lift for a reinforced rifle squad. The MPC-C supports mobile battalion command echelon/fire-support coordination center functions, while the MPC-R fulfills mobile recovery and maintenance requirements. Marine Corps Concepts envisions an MPC Company lifting an infantry battalion in conjunction with the infantry's organic wheeled assets. Operationally, the MPC will be employed in such a manner that allows combat units to continue the inland fight toward the objective, after the ACV has established an initial beachhead. Arriving as follow-on support assets, the MPCs will provide a very robust combat capability, with features ranging from MRAP Level survivability to the amphibious ability to operate ship-to-shore in the littorals, with capability to negotiate two-foot significant wave height and four-foot plunging surf, as well as robust swim capability for inland waterways.

## Program Status

The MPC is currently a pre-Milestone A program. Contracts were awarded to BAE, ST Kinetics/ Science Applications International Corporation (SAIC), General Dynamics, and Lockheed-Martin (in August 2012) to provide prototype vehicles and hulls that will be used for demonstrations of

water mobility, blast protection and human factors engineering, with a specific focus on Marines and Days of Supply requirement. Each of the contractors will provide a "full up" vehicle, with the first of those vehicles slated for delivery to the Amphibious Vehicle Test Branch at Camp Pendleton in February 2013, and with completion of Survivability in October 2013

## MPC'S Top Three Program Technology Issues:

### 1. Survivability

Technologies that provide lightweight survivability solutions, with specific focus on blast and direct fire protection, are needed.

### 2. Weight

Technologies that provide lightweight solutions for vehicle materials and components are needed in order for MPC to meet its requirements for survivability, buoyancy, reserve weight, and troop/equipment capacity.

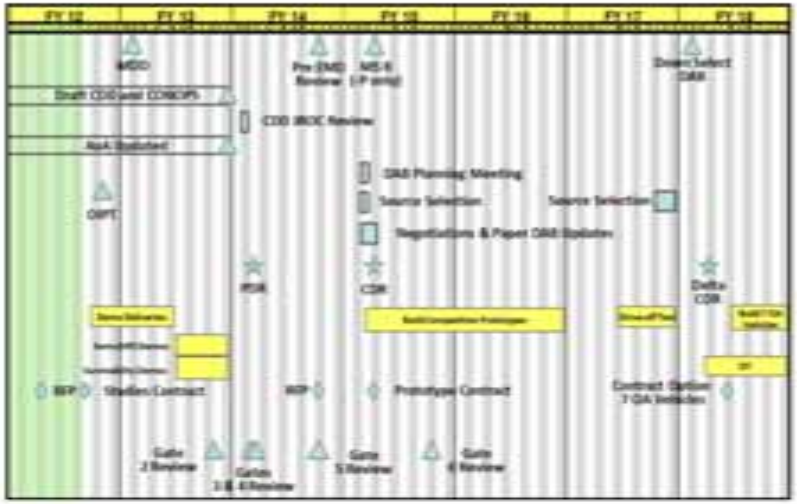
### 3. On-Board & Exportable Power

Technologies are needed that provide efficient internal and exportable power for the MPC when the vehicle is stationary. There is a need to incorporate power generation, management and distribution technologies to enable adequate power distribution to include on and off vehicle applications, including silent watch capability.

Industry competitors as represented here are poised to show their wares once an MPC Request for Proposals is launched. **Top Left:** Lockheed Martin/Patria Havoc 8X8 armored personnel carrier. **Top Right:** ST Kinetics/Science Applications International Corporation (SAIC) Terrex 8x8. **Bottom Left:** BAE Systems/Iveco Defense Vehicles SuperAV 8x8 armored personnel carrier. **Bottom Right:** General Dynamics Land Systems' MPC proposal.

# Marine Personnel Carrier (MPC)

## Resource Sponsor: CD&I



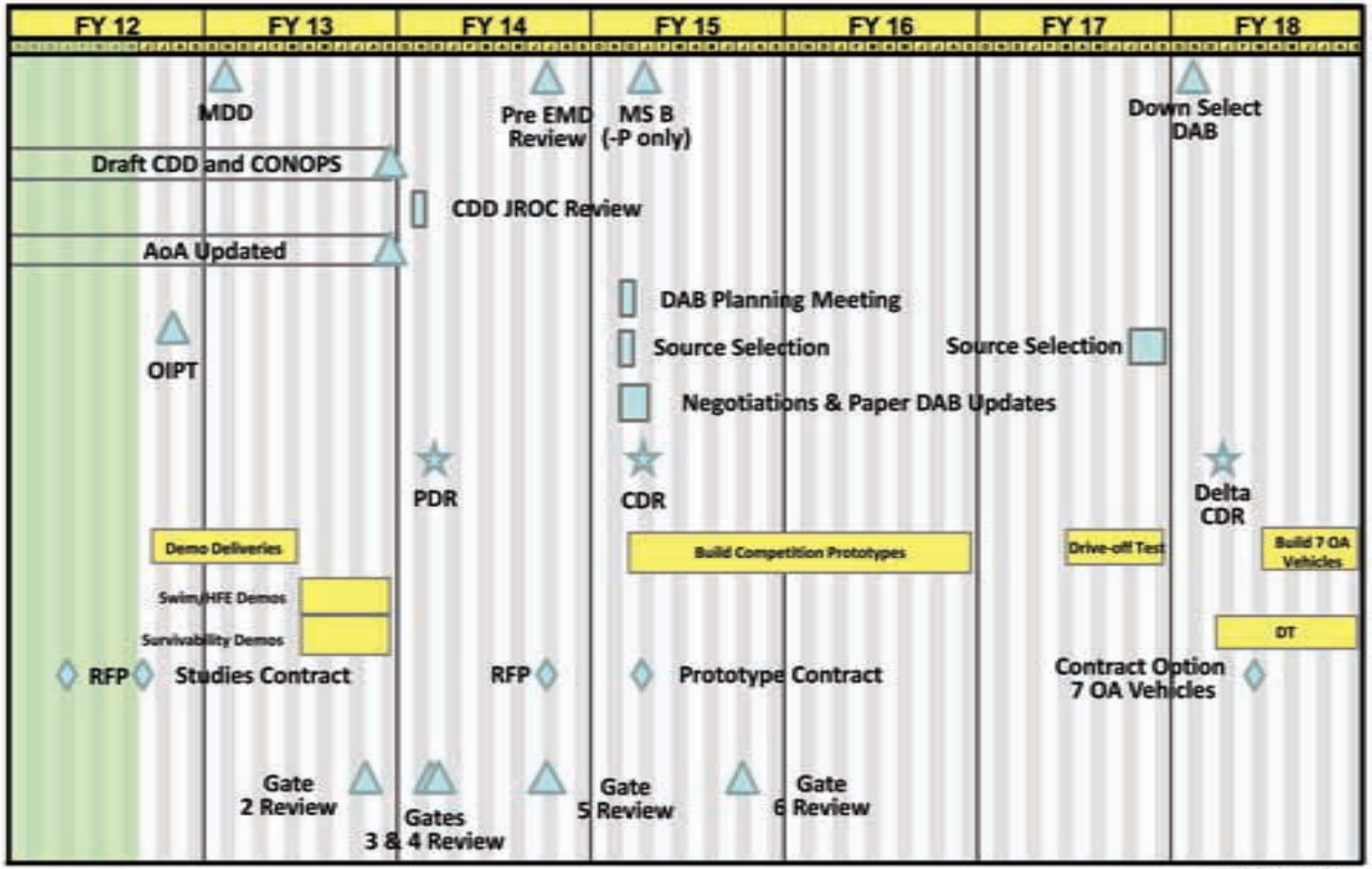
## Program Description

- The MPC will provide four battalions of armored personnel carrier-based, general support lift to the GCE of the MAGTF
- The MPC will be effective across the range of military operations during sustained operations ashore and reinforce the ACV-equipped assault echelon during forcible entry operations
- An MPC Company is designed to lift an infantry battalion in conjunction with the infantry's organic wheeled assets
- MPC will field a base vehicle (MPC-Personnel) and two supporting mission role variants: MPC-Command and Control (MPC-C) and MPC-Recovery (MPC-R)

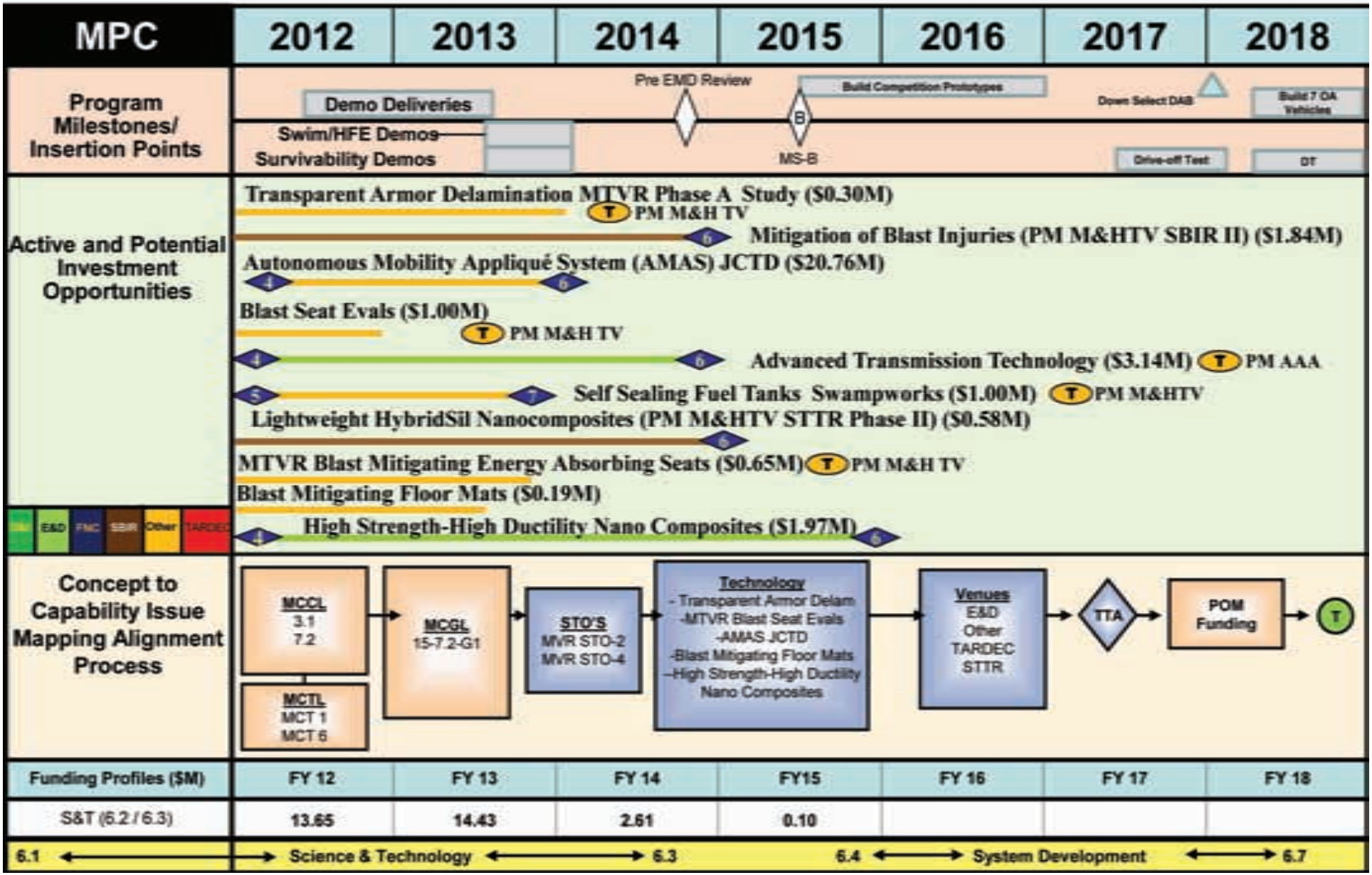
## Program Status

- The MPC program is pre-Milestone A.

# Marine Personnel Carrier (MPC)



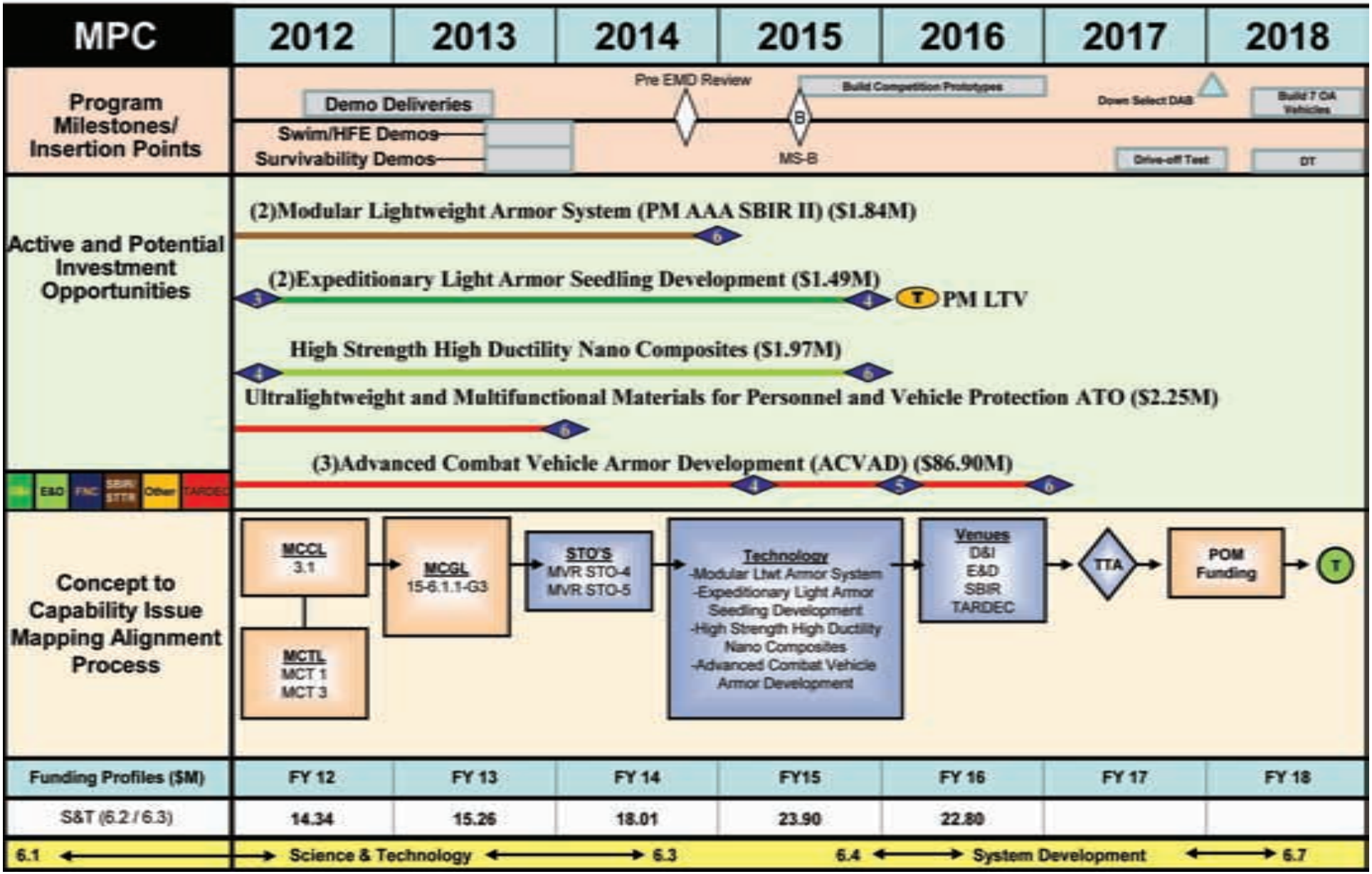
# MPC Technical Issue #1 Survivability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 13.65 | 14.43 | 2.61 | 0.10 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

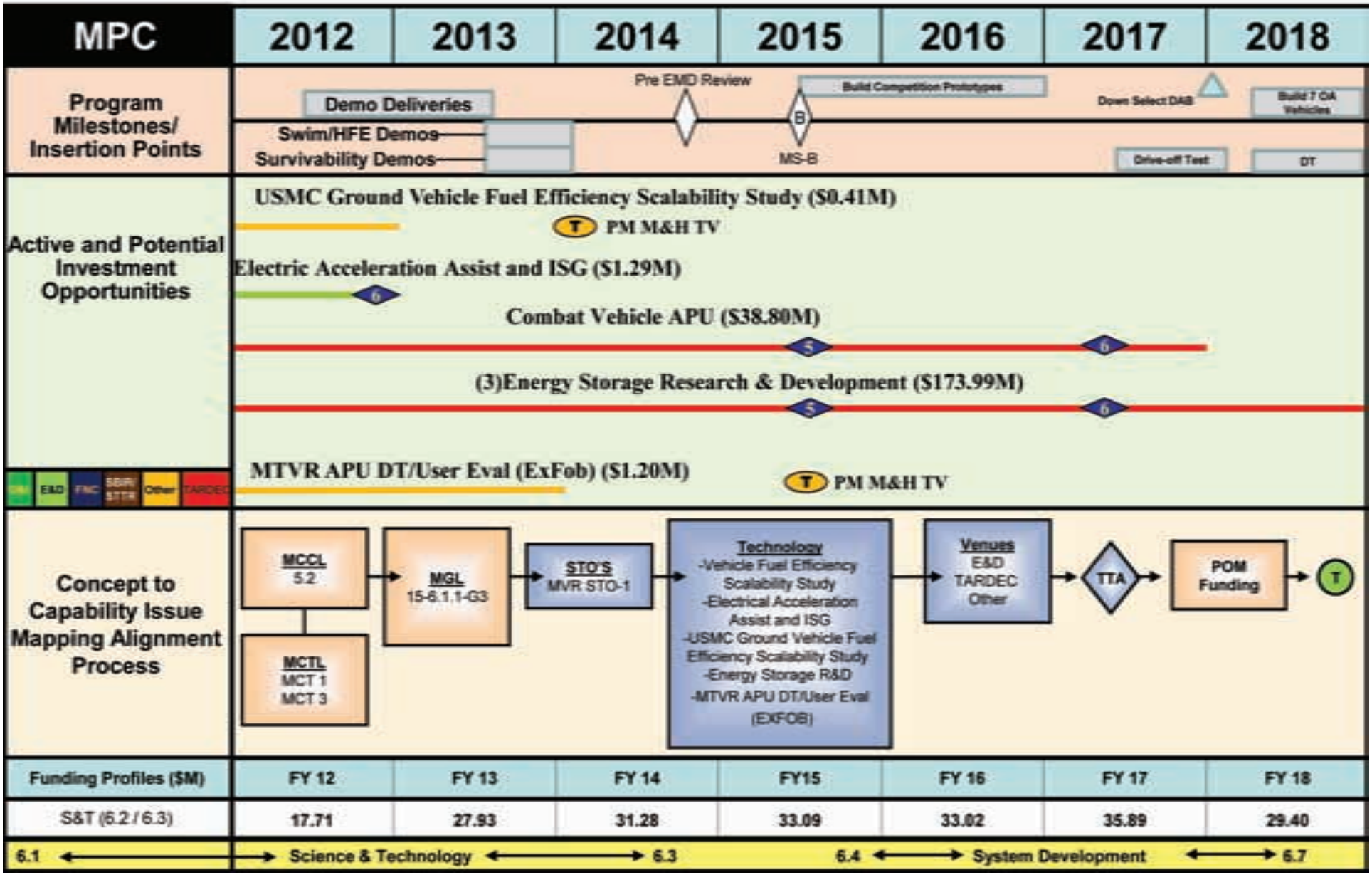
# MPC Technical Issue #2 Weight




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 14.34 | 15.26 | 18.01 | 23.90 | 22.80 | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# MPC Technical Issue #3 Onboard and Exportable Power




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 17.71 | 27.93 | 31.28 | 33.09 | 33.02 | 35.89 | 29.40 |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

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# COMMON AVIATION COMMAND & CONTROL SYSTEM (CAC2S)

## Program Description

CAC2S is a modernization effort to replace the existing aviation command and control equipment of the MACCS and to provide the Aviation Combat Element (ACE) with the necessary hardware, software, equipment, and facilities to effectively command, control, and coordinate aviation operations. CAC2S accomplishes the MACCS missions with a suite of operationally scalable modules to support the MAGTF, Joint, and Coalition Forces. CAC2S integrates the functions of aviation command and control into an interoperable system that will support the core competencies of all Marine Corps' warfighting concepts. CAC2S, in conjunction with MACCS organic sensors and weapon systems, supports the tenets of Expeditionary Maneuver Warfare and fosters Joint interoperability.

The CAC2S program employs an evolutionary acquisition strategy utilizing an incremental and phased approach for development and fielding of the CAC2S. The Capabilities Production Document identifies two increments to achieve the full requirements of CAC2S. Increment I of the CAC2S modernizes the assault support, air support, air defense, and ACE battle management capabilities of the MACCS.

Increment I of the CAC2S is accomplished through a two-phased approach. The CAC2S PMO structured Phase 1 to accommodate rapid fielding of operationally relevant capabilities, to include mobility, situational awareness, tactical communications, information dissemination and operational flexibility. Phase 1 establishes the baseline CAC2S capabilities for the MACCS and improves overall Aviation Command & Control performance and effectiveness. Phase 1 is accomplished by upgrading fielded MACCS equipment with mature, ready technologies and establishes an initial product baseline for a Processing and Display Subsystem (PDS) and Communications Subsystem (CS).

Phase 2 addresses the requirements for remaining ACE Battle Management and Command and Control requirements and implements the Sensor Data Subsystem to fuse input from expeditionary sensors, as well as real-time and near real-time data from ground force C2 centers, weapon systems,

and Joint Strike Fighter sensors into a common operational picture of the battlespace. Phase 1 Limited Deployment Capability was achieved in 4QFY11. Phase 2 will accommodate the integration of technologies necessary for CAC2S to meet remaining ACE Battle Management and Command and Control requirements. Phase 2 completion will result in the delivery of the full CAC2S Increment I capabilities and will begin full deployment fielding in FY16.

Although requirements beyond Increment I are not yet defined, it is envisioned that CAC2S will continue to be developed in an evolutionary acquisition approach; follow-on increments will be defined and captured in subsequent Joint Capabilities Integration and Development System documents. Those increments will potentially focus on capabilities for an airborne node, integration of Air Traffic Control functionality, ground based air defense node, advanced decision support tools, Unmanned Aerial Systems ground station interoperability, Integrated Fire Control, Single Integrated Air Picture, Integrated Architecture Behavior Model, and full Network Enabled Command and Control.

## Program Status

Phase 1 achieved limited deployment during 2QFY12 and is now in full rate production. Engineering, integration, and production of the Phase 1 systems are performed by the NSWC Crane Division. NSWC Dahlgren Division supports NSWC Crane with software integration and testing. The Phase 1 systems are being fielded to the Marine Air Control Squadrons, Marine Air Support Squadrons, and Marine Tactical Air Command Squadrons within the Marine Air Control Groups. To date, 12 of 20 PDS and 32 of 75 CS systems have been fielded in fulfillment of Phase 1. Delivery of Phase 1 systems to fleet users will be completed in 4QFY13.

The PMO recently competitively awarded the Phase 2 Engineering, Manufacturing, and Development contract to General Dynamics C4 Systems in Scottsdale, AZ. Development is under way, with Operational Testing scheduled to begin during 3QFY15.

## CAC2S Top Program Technology Issues:

### 1. Direct Air Cooling

The CAC2S Program responds to "Lightening the MAGTF" initiatives by seeking ways to reduce its system size, weight, and power footprint. To this end, the program is seeking alternative technologies and methods to cool electronic equipment without the use of large, heavy Environmental Control Units (ECU). The current Phase 2 contractor is using a Direct Air Cooling system to cool the CAC2S Phase 2 PDS using high velocity, high capacity fans to accelerate air across the equipment. Cooling of electronic equipment without ECUs continues to be a technical challenge for the program. The program seeks efficient methods of cooling and heating electronic systems without ECUs to further reduce its footprint and power consumption.

### 2. Self-Healing Networks

CAC2S is a Mission Assurance Category 1 (MAC-1) system. As such, the program seeks "self-healing" network technologies that automatically allow failover capabilities in case of an IT casualty. CAC2S processes real-time, near real-time, and non real-time data maintained in a global track manager database to accomplish its mission. Self-healing network technology should allow replication of databases in real-time to ensure continuity of operations in the event of equipment failure or casualty.

### 3. Contextual Search Engines

CAC2S processes inputs from aircraft, sensors, data links, and other C2 systems. The data is stored and fused in a global track file and displayed to the operator for situational awareness and decision making. Typically, operators in C2 systems get overwhelmed by "too much information" and

suffer from the "glare" of information. Data typically flows through the system but the operator cannot locate or access the data when it is needed. The PMO seeks technologies that can determine the themes and relationships among data in unstructured content. Search results can identify relevant results based on context, not just keyword matches, by examining contents of a document as well as the files by which it is surrounded.

## 4. C2 Command Tools

Collaboration between staff members and other commanders is one of the major contributors to a Commander's SA. To improve SA decision making for the Commander, the CAC2S Program is seeking technologies that address information load and the cognitive demands of future network-centric forces. The program seeks new human-machine systems that translate high-rate inflow of battlespace data into a high-agility battle commands. The PMO seeks integration and awareness tools that continuously and autonomously fuse data into a high-quality shared information portrait. Moreover, the program seeks execution tools that support human-controlled automation of intelligence information, maneuver and air control measures, fires, and battle damage assessment.

## 5. Video Compression

The proliferation of unmanned aerial vehicles in the battlefield has presented a new challenge for the C2 systems and command posts. The large volume of video downloaded from these systems presents a technical challenge for storing and sharing the video products in a low-bandwidth environment. The PMO seeks technologies to effectively compress videos but retain attributes that make them effective for situational awareness and decision-making.

## 6. Multiple Interface Formats

Technologies that provide better data interfaces or translators are needed to fuse and display track data from multiple sources. The MACCS is uniquely required to integrate and display for controllers and commanders data from numerous sources, such as ground and air tracks, air defense information, and intelligence information from numerous sources. This growing volume of data must be fused into a single coherent display to aid in rapid decision making.

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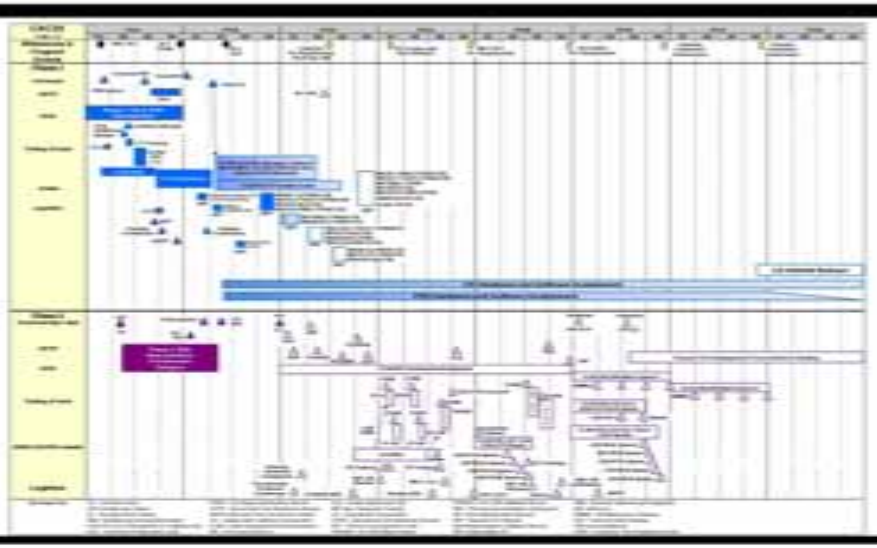
# Common Aviation Command and Control System (CAC2S) Program Overview



## Program Description

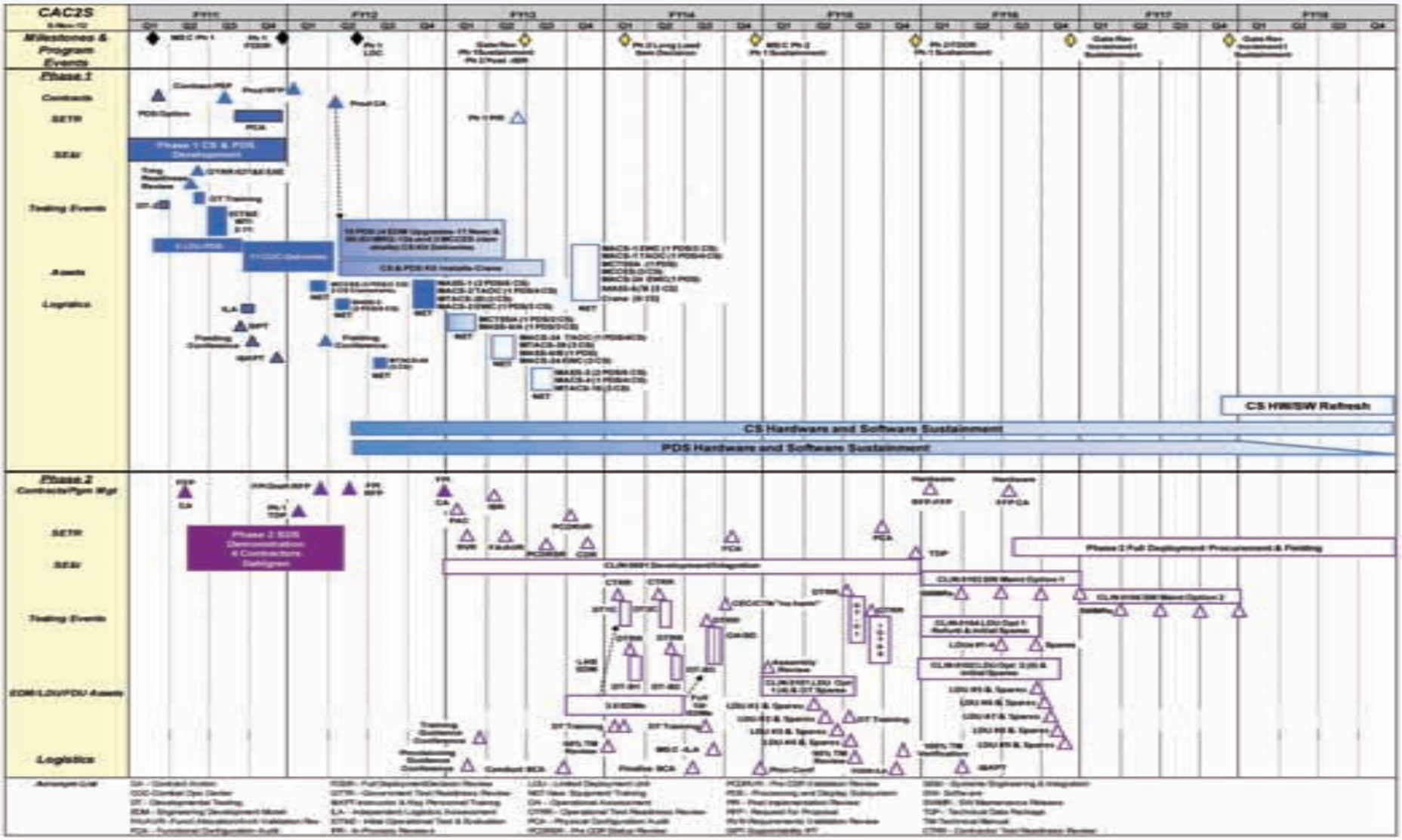
The Common Aviation Command and Control System (CAC2S) is a coordinated modernization effort to replace the existing aviation command and control equipment of the Marine Air Command and Control System (MACCS) and to provide the Aviation Combat Element (ACE) with the necessary hardware, software, equipment, and facilities to effectively command, control, and coordinate aviation operations. The CAC2S system will accomplish the MACCS missions with a suite of operationally scalable modules to support the Marine Air Ground Task Force (MAGTF), Joint, and Coalition Forces. The CAC2S integrates the functions of aviation command and control into an interoperable system that will support the core competencies of all Marine Corps warfighting concepts. Increment I of the CAC2S will be accomplished through a two phased approach. Phase 1 will accommodate fielding of operationally relevant capabilities by upgrading fielded MACCS equipment with mature, ready technologies and will establish an initial product baseline Processing and Display Subsystem and Communications Subsystem. Phase 2 is structured to accommodate the integration of technologies necessary for the CAC2S Sensor Data Subsystem to meet remaining ACE Battle Management and Command and Control requirements. Phase 2 completion will result in the delivery of the full CAC2S Increment I capabilities.

## Program Status

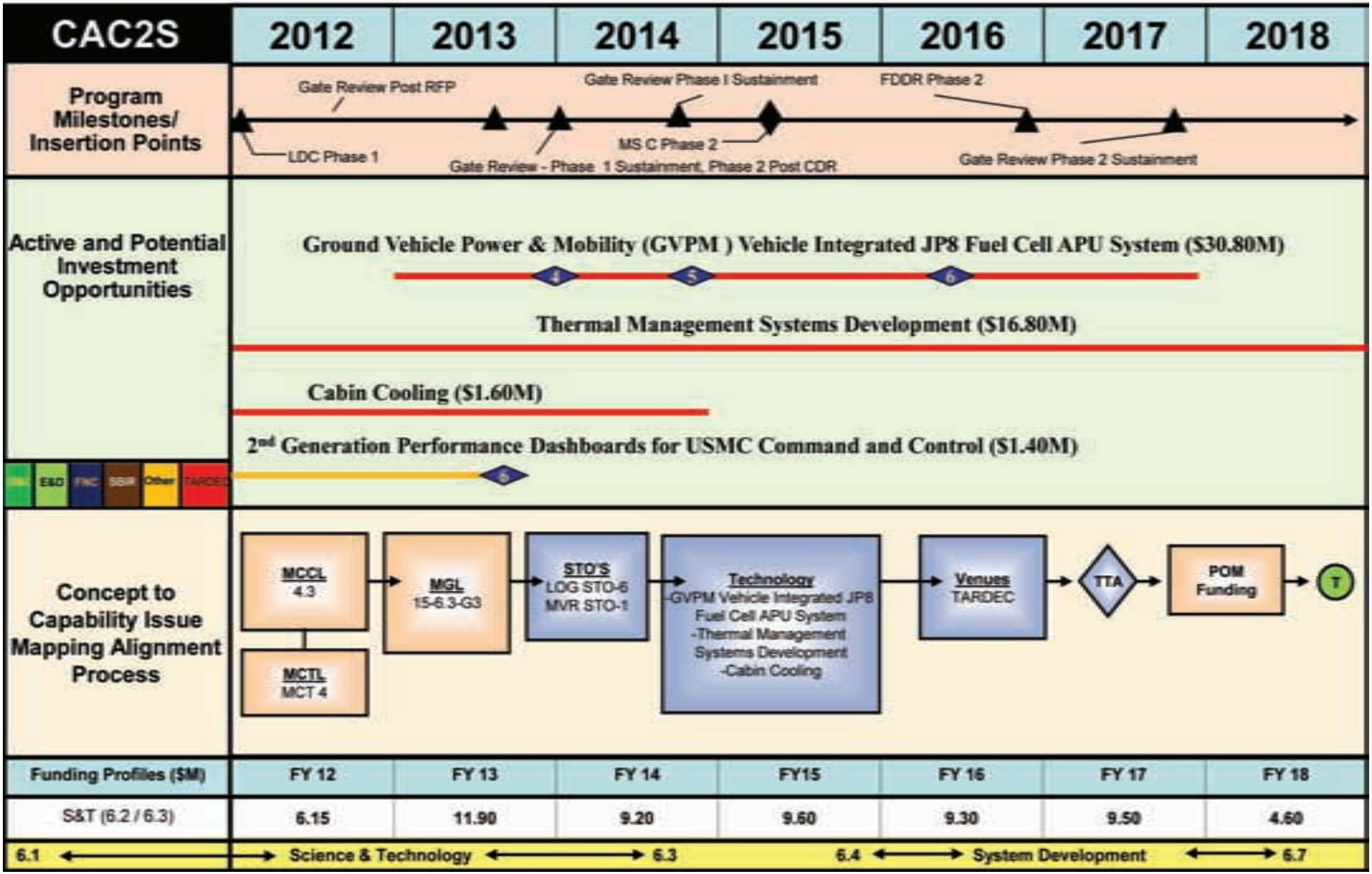
Phase 1 in Production and Deployment
- NSWC Crane and NSWC Dahlgren System Integrators
- Fielding complete 4th Qtr FY13

Phase 2 in Engineering & Manufacturing Development
- Contract Award to General Dynamics C4IS Sept 2012
- Phase 2 CDR is scheduled for Oct 2013

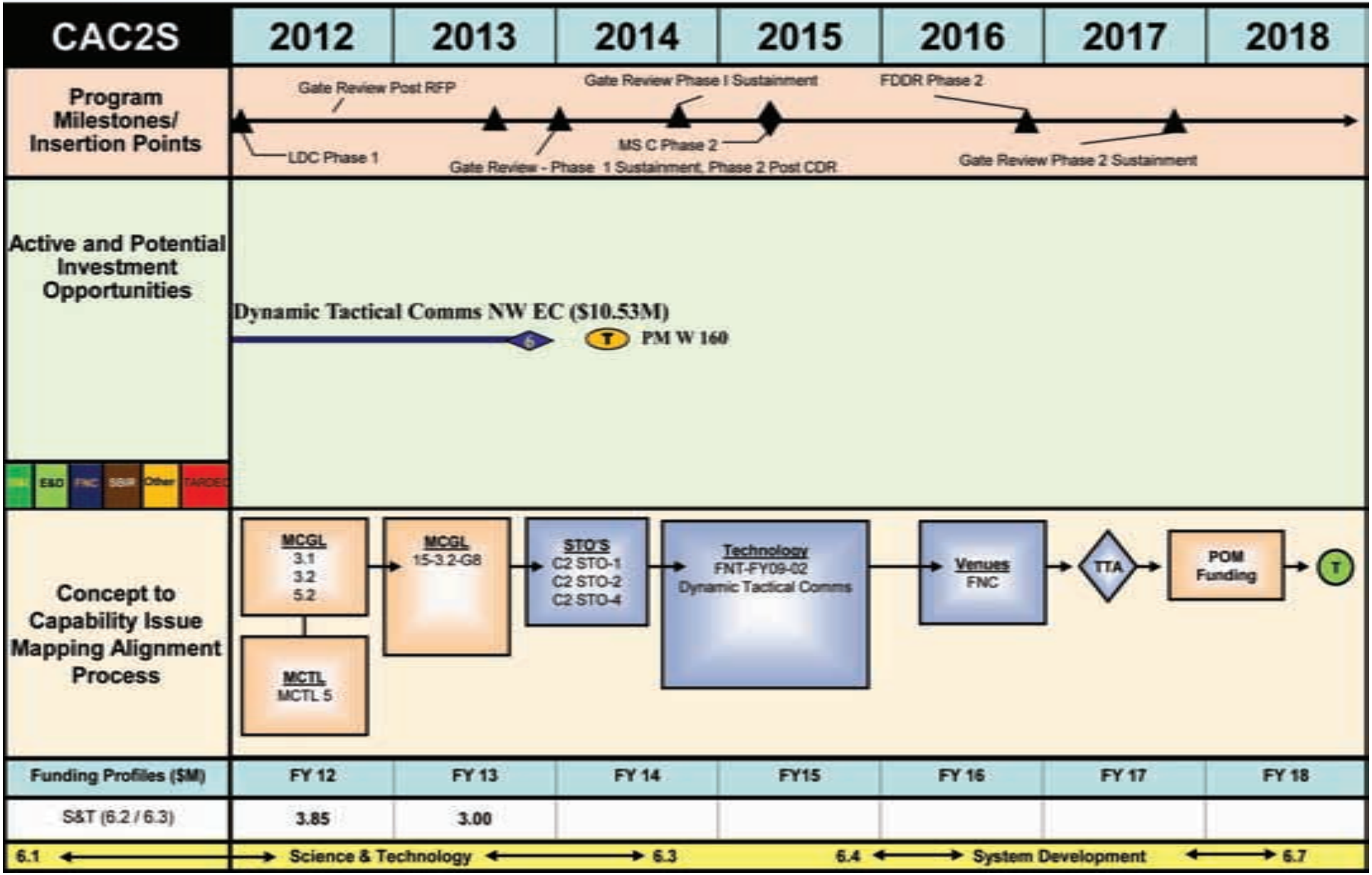
# Common Aviation Command and Control System (CAC2S) Program Overview



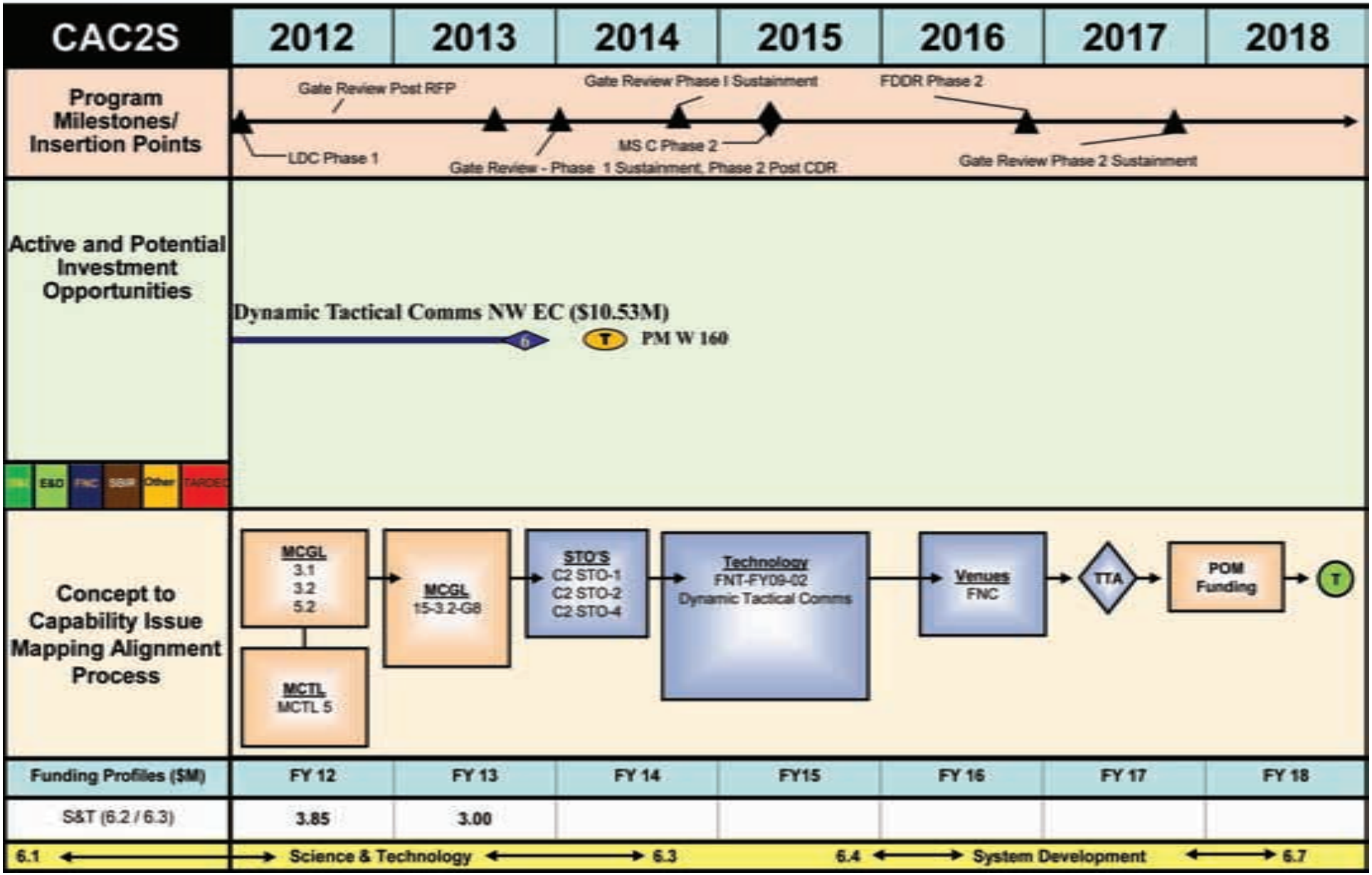
# CAC2S Technical Issue # 1 Direct Air Cooling



# CAC2S Technical Issue # 2 Self-Healing Networks



# CAC2S Technical Issue # 3 Contextual Search Engines



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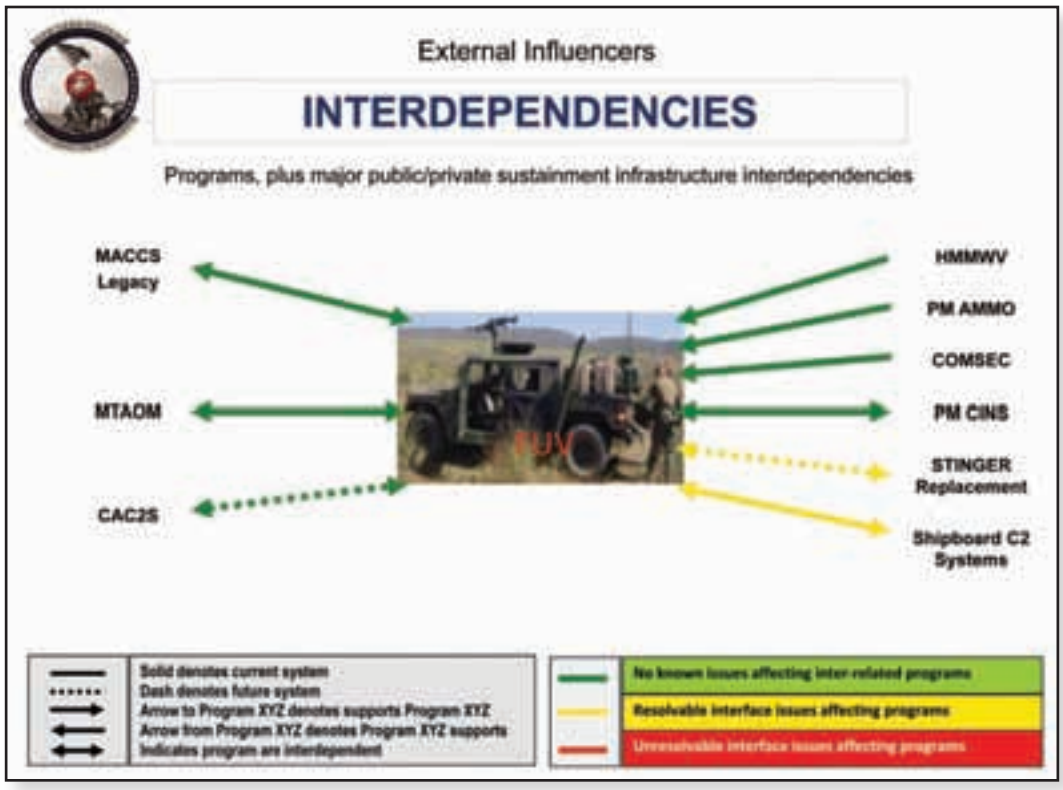



# GROUND BASED AIR DEFENSE (GBAD)

## Program Description

GBAD provides the Marine Corps ground based air defense and uses the Stinger missile as its primary weapon for air defense. Programs and projects included in the GBAD portfolio are the:

- Stinger Missile SLEP
- Advanced Man-Portable Air Defense System (A-MANPADS) Increments 0 & I
- Low Altitude Air Defense (LAAD) Sustainment
- Directed Universal Needs Statement (D-UNS) for Stinger Night Sight Replacement

## Program Status

Stinger Missile SLEP

- USMC will no longer meet the War Reserve Munitions Requirement (WRMR) of 1,081 missiles or have sufficient training rounds after 2019
- SLEP must be conducted in order to mitigate the potential gap

A-MANPADS Increment I

- Designated an Abbreviated Acquisition Program (AAP) in 2005
- The program is executing a single-step to full capability acquisition strategy by integrating Commercial Off-The-Shelf (COTS) and Non-Development Item (NDI) subsystems
- Approved Acquisition Objective (AAO) 37 Section Leader Vehicles (SLV) 138 Fire Unit Vehicles (FUV); Actual Acquisition Quantity (AACQ) 13 SLV 50 FUV

LAAD Sustainment

- Target support; Six Firing Exercises (FIREX) planned for FY13

- Ground Support Equipment (GSE) support; 47 Tracking Head Trainer (THT) repaired ready to fill shortfalls
- Improved Moving Target Simulator (IMTS) expecting a Request For Proposal (RFP) release by the Program Manager for Training Systems (PM TRASYS) in December and contract award in March

D-UNS for Optics

- AN/PAS-18 Stinger Night Sight replacement being investigated.

## GBAD Top Program Technology Issues:

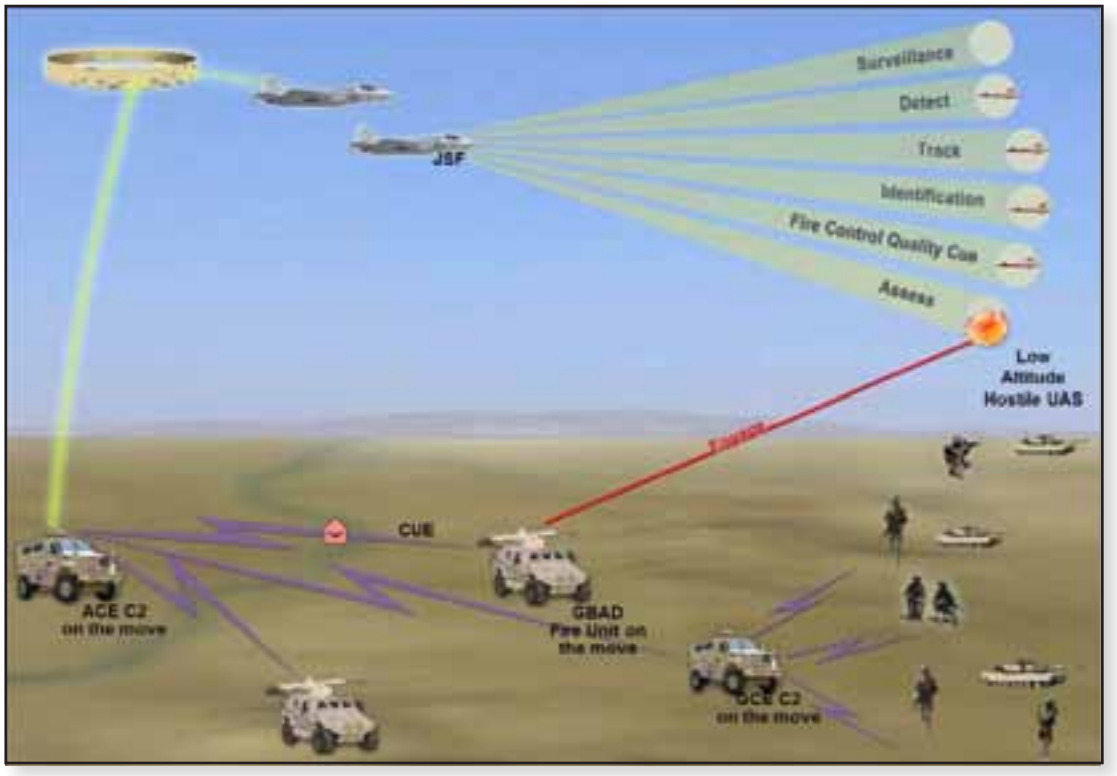
**1. Stinger Night Sight Replacement D-UNS**

Technologies are needed to produce a Stinger missile mountable day/night sight with the following characteristics:

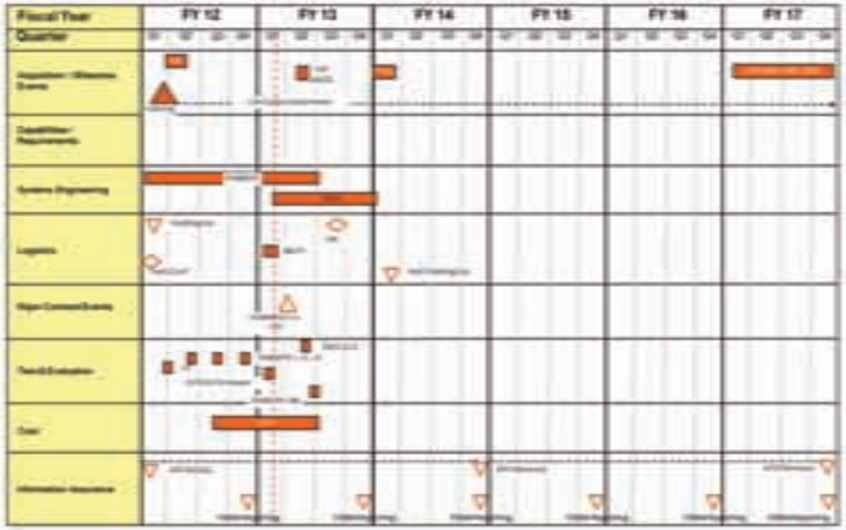
- Multi-spectral infrared in Low and High wavelengths and electro-optical to detect traditional air-breathing as well as emerging small/light unmanned aerial systems (UAS) and cruise missiles
- Large focal plane array (1280x1024 or higher) and optical/digital zoom capability to enable both detection and identification of the target at maximum ranges
- Wide Field of View of 20 degrees horizontal and 10 degrees vertical
- Cooled or uncooled technology with a maximum time from off to operate, or standby to operate, of 10 seconds
- Capable of using Mil-SPEC batteries with an operating time of 6 hours and standby time of 12 hours
- SWAP comparable to AN/PAS-18 or smaller

**2. Frangible .50 and 7.62mm Rounds**

The Stinger missile has an inter-launch boundary which is mitigated through the use of M2 .50 or M240 7.62mm machine guns. These weapons also provide for negation against close-in (less than 500m distant) small UAS targets. In order to increase lethality against these targets a frangible type round is desired which would produce multiple projectiles and achieve an increase in the probability of a kinetic hit against the target.



# Ground Based Air Defense (GBAD)


## Program Description

- Designated an AAP in 2005
- The program is executing a single-step to full capability acquisition strategy by integrating COTS and NDI subsystems

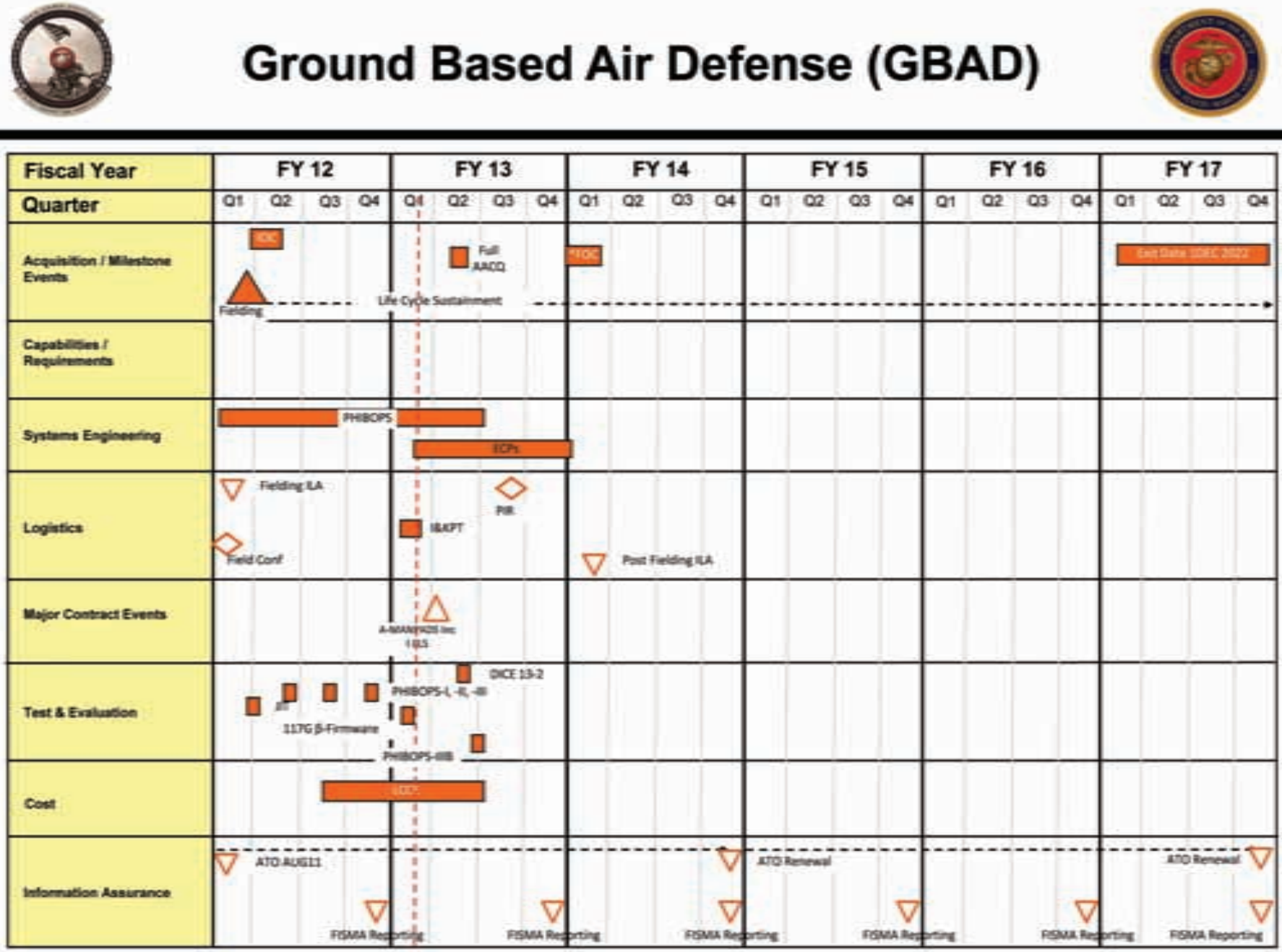
AAO : 37 SLV 138 FUV

AACQ : 13 SLV 50 FUV

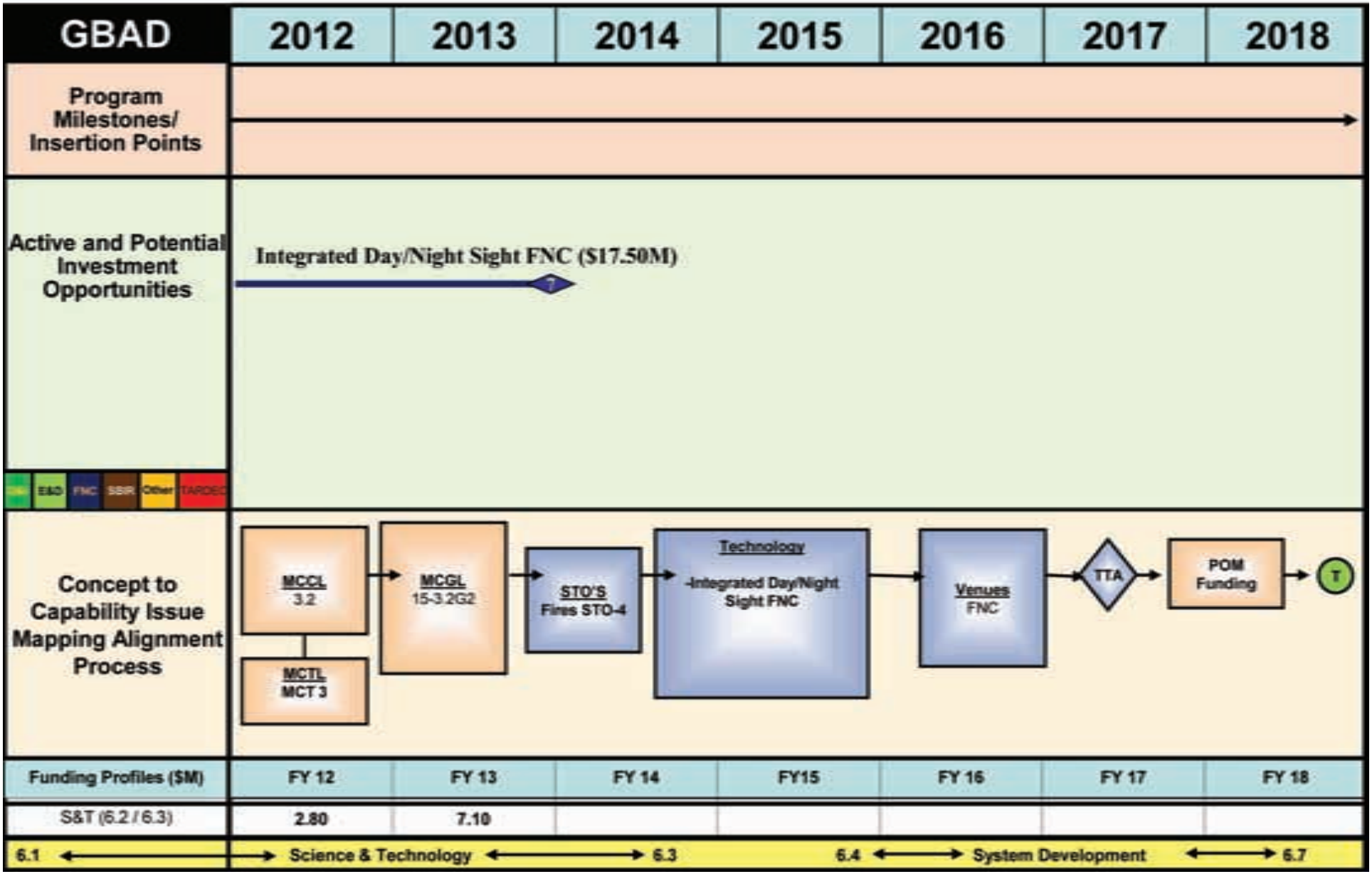
## Program Status

- Acquisition Strategy approval dated 16 March 2007
- Milestone C/Full Rate Production (FRP) decision15 July 2011
- Fielding Decision 29 November 2011
- 8 of 12 sections have been fielded to the LAAD Bns, will complete March 2013
- Instructor and Key Personnel Training (I&KPT) scheduled for December 2012 at 29 Palms, CA

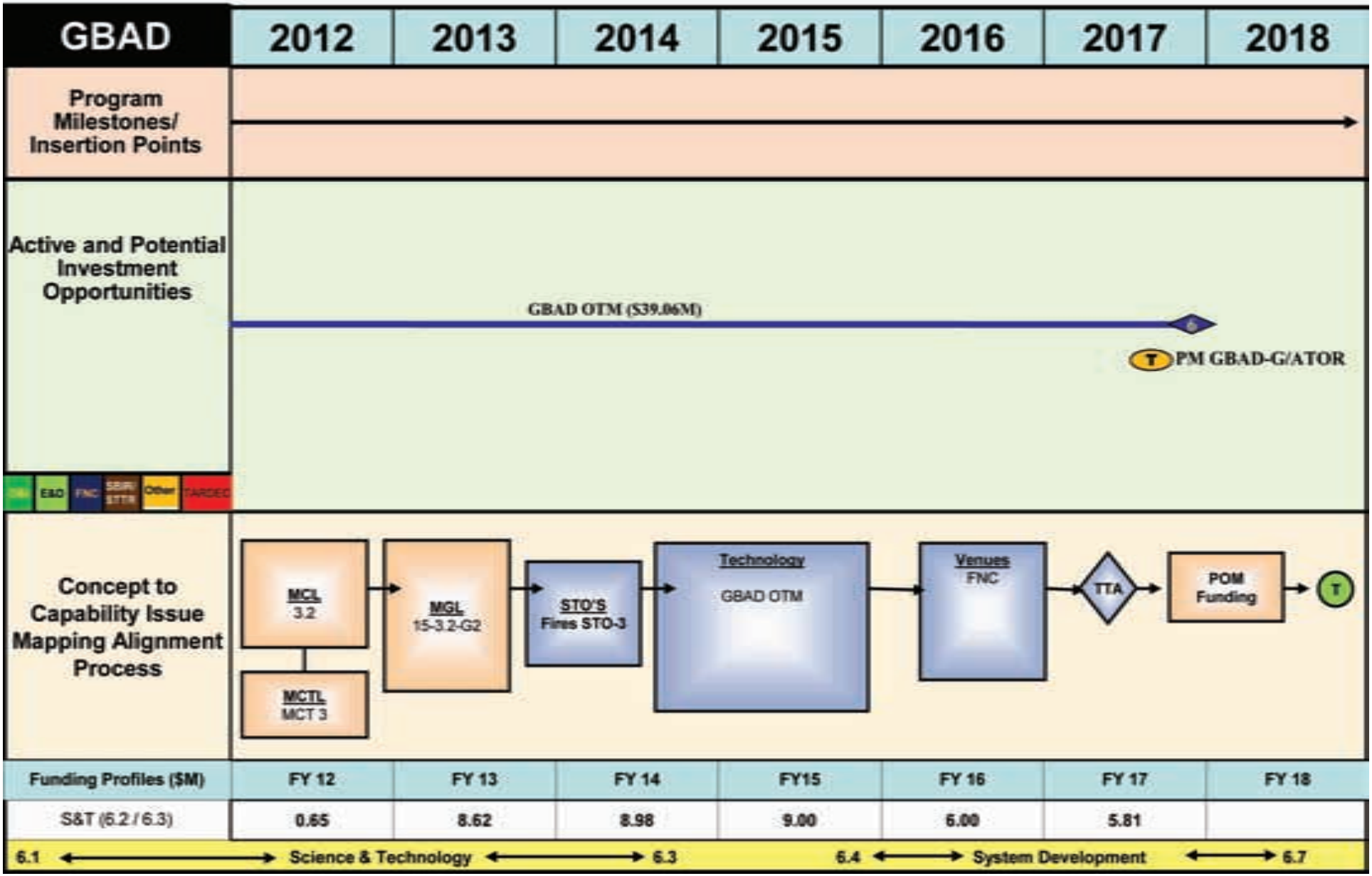
# Ground Based Air Defense (GBAD)



# GBAD Technical Issue #1
# Stinger Night Sight Replacement D-UNS



# GBAD Technical Issue #2
# Frangible .50 cal and 7.62mm Rounds




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 0.65 | 8.62 | 8.98 | 9.00 | 6.00 | 5.81 | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# GROUND AIR TASK ORIENTED RADAR (G/ATOR)

## Program Description

G/ATOR is a three-dimensional short-to medium-range tactical radar designed to detect, identify, and track low level cruise missiles, manned aircraft, and Unmanned Aerial Vehicles (UAV) as well as rockets, mortars, and artillery fire. G/ATOR capabilities include the ability to track hostile UAVs, assist in air traffic control, serve as a fire control system, support ground-based air defense, and detect rockets, artillery, and mortars in order to direct the counter fire.

Developed by prime contractor Northrop Grumman Electronic Systems in Baltimore, Md., G/ATOR will replace legacy radar systems to perform air surveillance, cue air defense weapons, determine hostile indirect fire firing locations, and provide data to air traffic controllers.

## Program Status

In late July 2012, Northrop Grumman announced the delivery of its AN/TPS-80 G/ATOR system to Surface Combat Systems Center Wallops Island in eastern Virginia for the government to begin its first and second phases of Developmental Testing (DT). The final phase of DT and the Operational Assessment for G/ATOR will be conducted in Yuma, Arizona, in 2013.

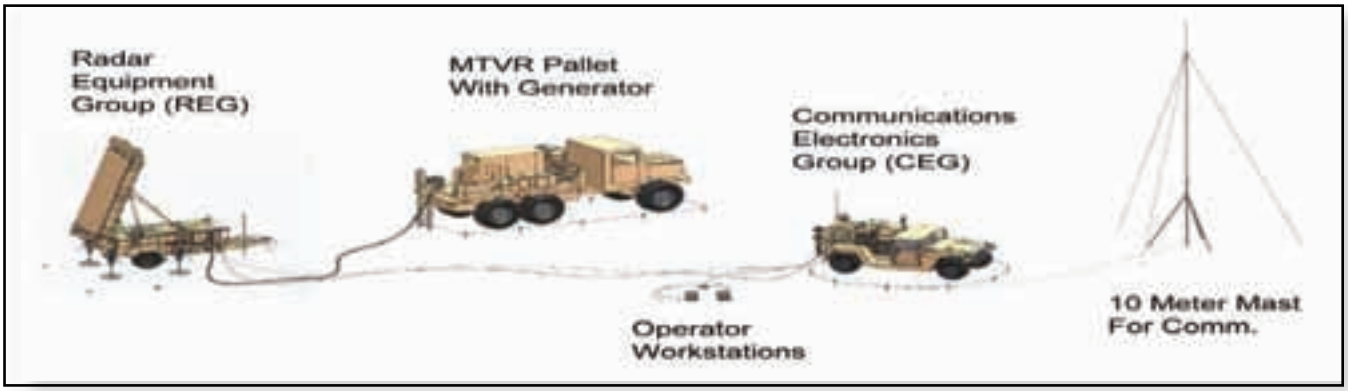
## G/ATOR's Top Three Program Technology Issues:

### 1. Lowering Manufacturing Costs

Technologies are needed that reduce manufacturing costs across multiple areas of production, including: 1) Air ducts that provide precise mounting and cooling of the Transmit/Receive (T/R) Modules and array elements. The air duct is very time consuming to produce and assemble and thus very expensive. 2) T/R module packaging requires expensive materials and hermetic sealing which reduces yield. 3) Circulator Isolator Resistor Filter boards required for T/R Module require multi-step medium yield manufacturing process.

### 2. T/R Module Efficiency

The G/ATOR system currently operates at the limit of its prime power source. As the largest aggregate



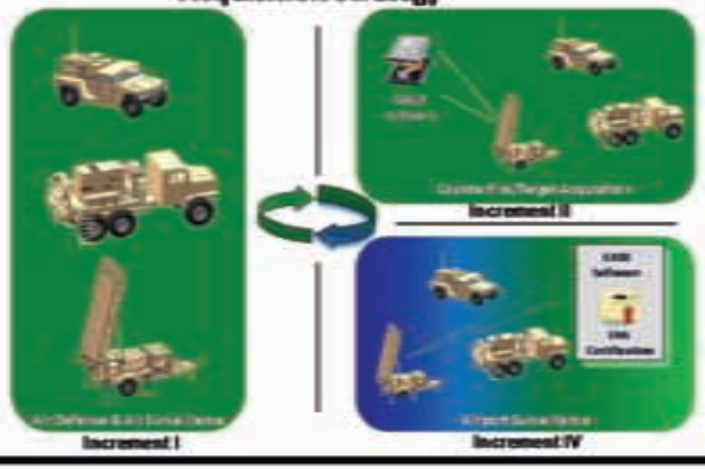

consumer of power, technologies are required for the T/R modules that increase power efficiency, such as: 1) higher efficiency power amplification; 2) higher efficiency DC/DC power supply; and 3) greater integration of components.

### 3. GaN Reliability

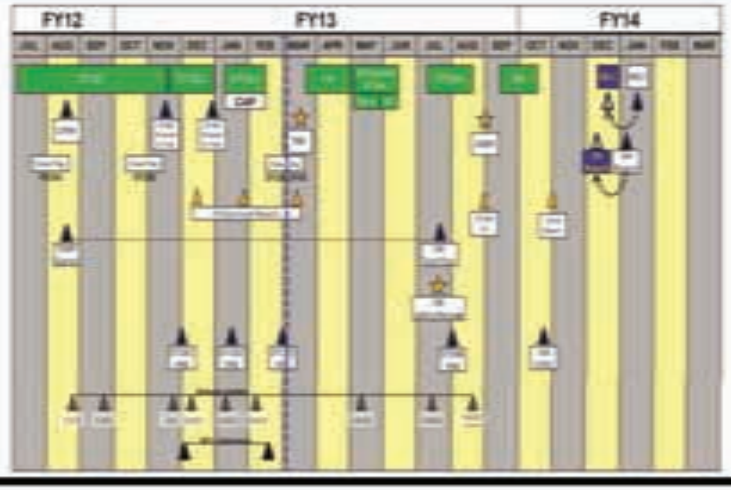
Technologies are needed that enhance the GaN based integrated circuits and potentially reduce costs and increase performance for the T/R modules of the radar.

# Ground/Air Task Oriented Radar
# AN/TPS-80 G/ATOR

## Acquisition Strategy




## Phase 1 Schedule




## Mission & Requirements

- 3D, short/medium range multi-role radar designed to detect unmanned aerial systems, cruise missiles, air breathing targets, rockets, artillery and mortars.
  - Satisfies Warfighters' expeditionary needs across MAGTF spectrum
- Replaces five legacy radar systems with a single MAGTF solution:

| | | |
|---|---|---|
| AN/UPS-3 Tactical Defense Alert | GB1 | Air Defense/Surveillance |
| AN/MPQ-62 Continuous Wave Acq | GB1 | Air Defense/Surveillance |
| AN/TPS-63 Air Surveillance | GB1 | Air Defense/Surveillance |
| AN/TPQ-46 Counter-Battery/ Target Acq | GB2 | Ground Weapons Locating |
| AN/TPS-73 Air Traffic Control | GB4 | Air Traffic Control |

## Capability/Improvements

- Increased range, accuracy, tactical mobility and reliability
- One system through tech insertion leveraged from prior variants:

| | | |
|---|---|---|
| GB1: | Air Defense/Surveillance Radar (ADSR) | Qty 17 |
| GB2: | Ground Weapons Locating Radar (GWLR) | Qty 28 |
| GB4: | Expeditionary Airport Surveillance Radar (EASR) | Qty 12 |
| | | **AAO Qty 57** |

## Recent History

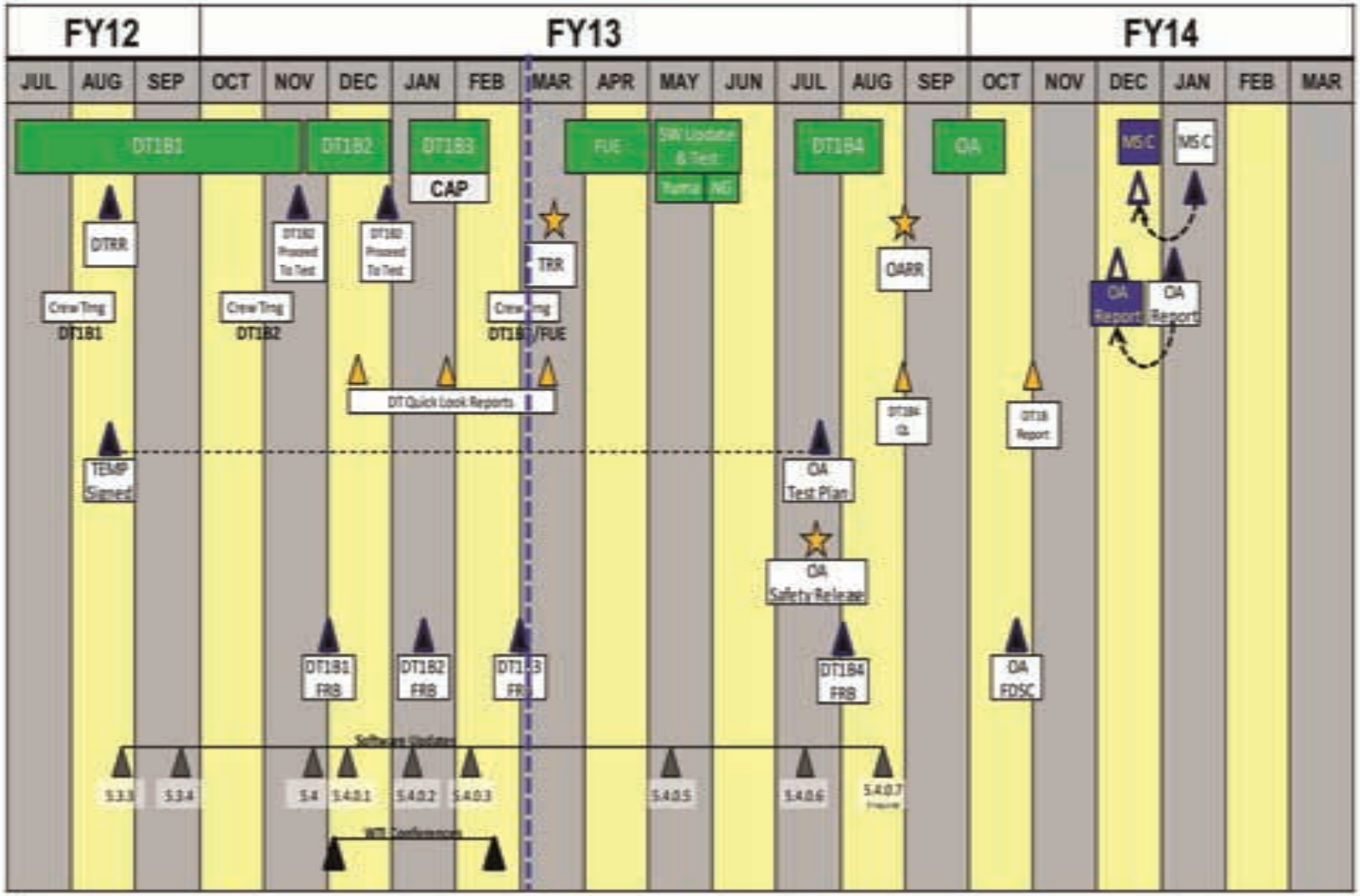
- MROC of March 2010 endorsed proposed program plan
- GB3 Mode 5/S capability absorbed into GB4-all other GB3 capabilities deferred
- Resourced in PB 12, PB 13, and OSD 14
- GB4 funding is now a BISOG 15 issue
- Designated ACAT IC by AT&L ADM 28 Oct 2011
- ACAT IC ACQ STRAT approved 12 March 2012
- ACAT IC APB approved 22 May 2012
- Block 1 CPD approved 3 Dec 2012
- Developmental Testing: DT 1B1/1B2 complete

## Upcoming Events

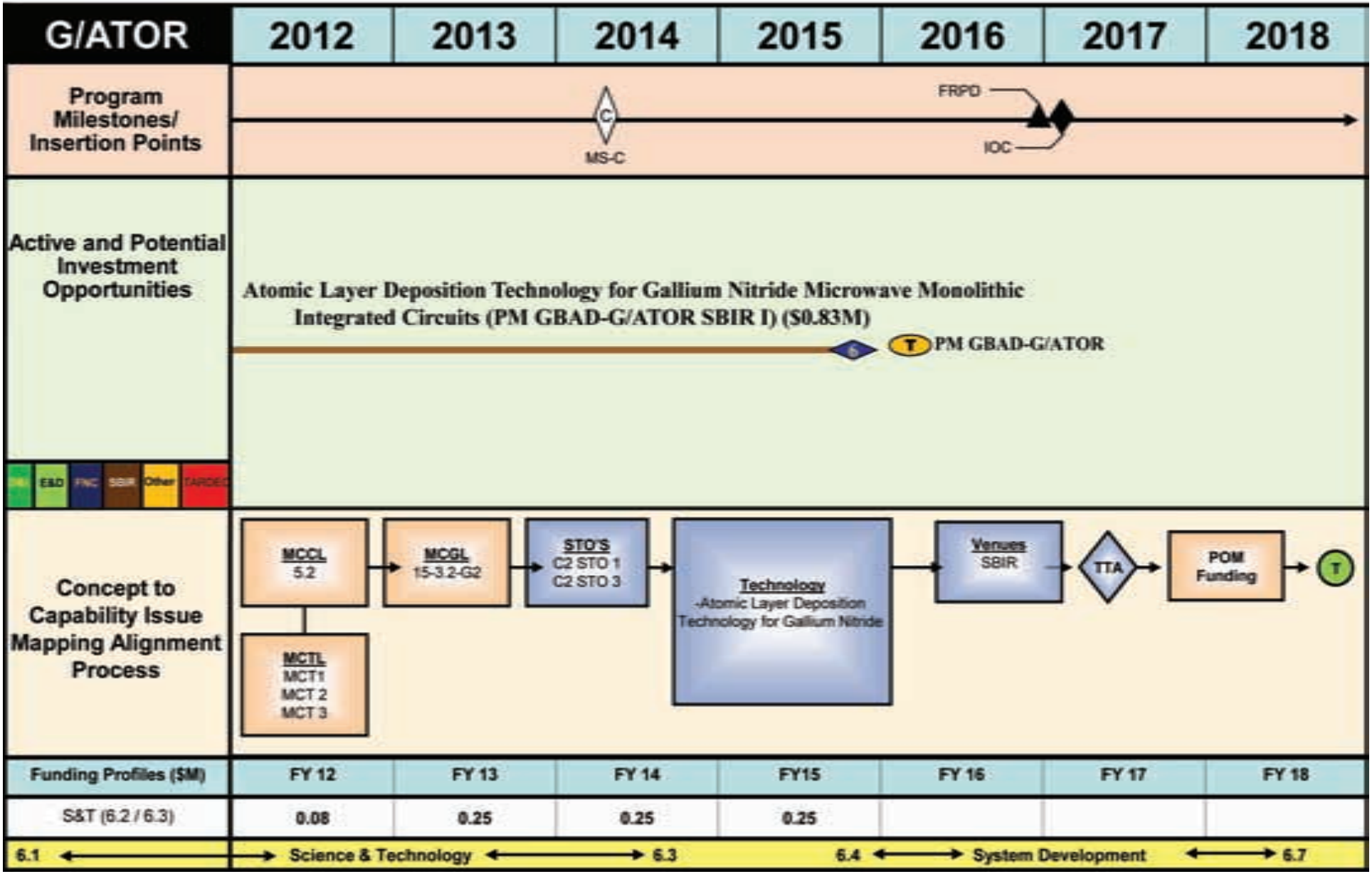
- FY12
  - Developmental Testing: DT 1B3 at Wallop's Island and MCAS Yuma
- FY13
  - Production Readiness Review
  - DT1B3 and Operational Assessment: MCAS Yuma
  - Milestone C Decision
  - LRIP contract award

# Ground/Air Task Oriented Radar
# AN/TPS-80 G/ATOR

## Phase 1 Schedule



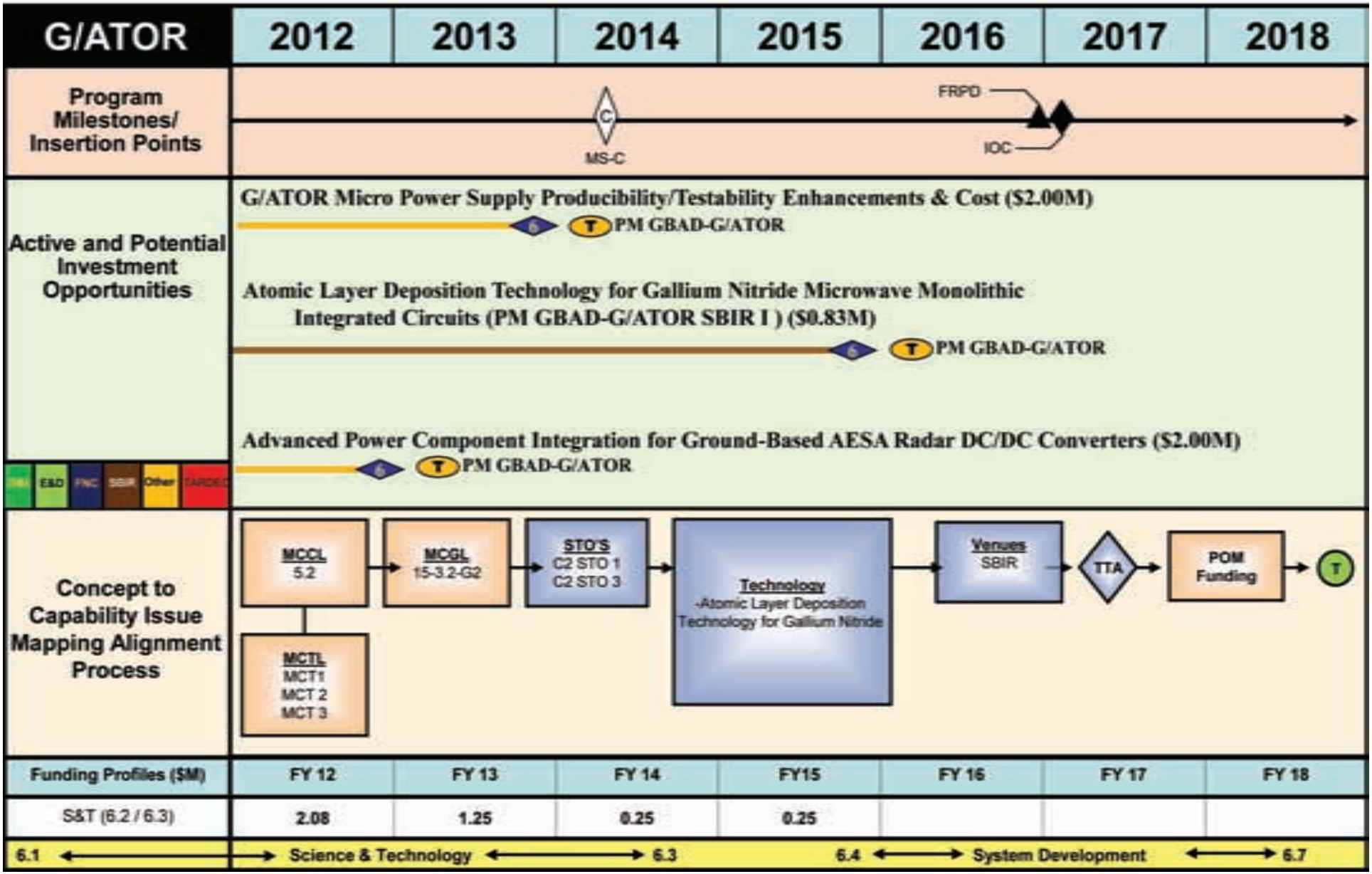
# G/ATOR Technical Issue # 1 Lowering Manufacturing Costs




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 0.08 | 0.25 | 0.25 | 0.25 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

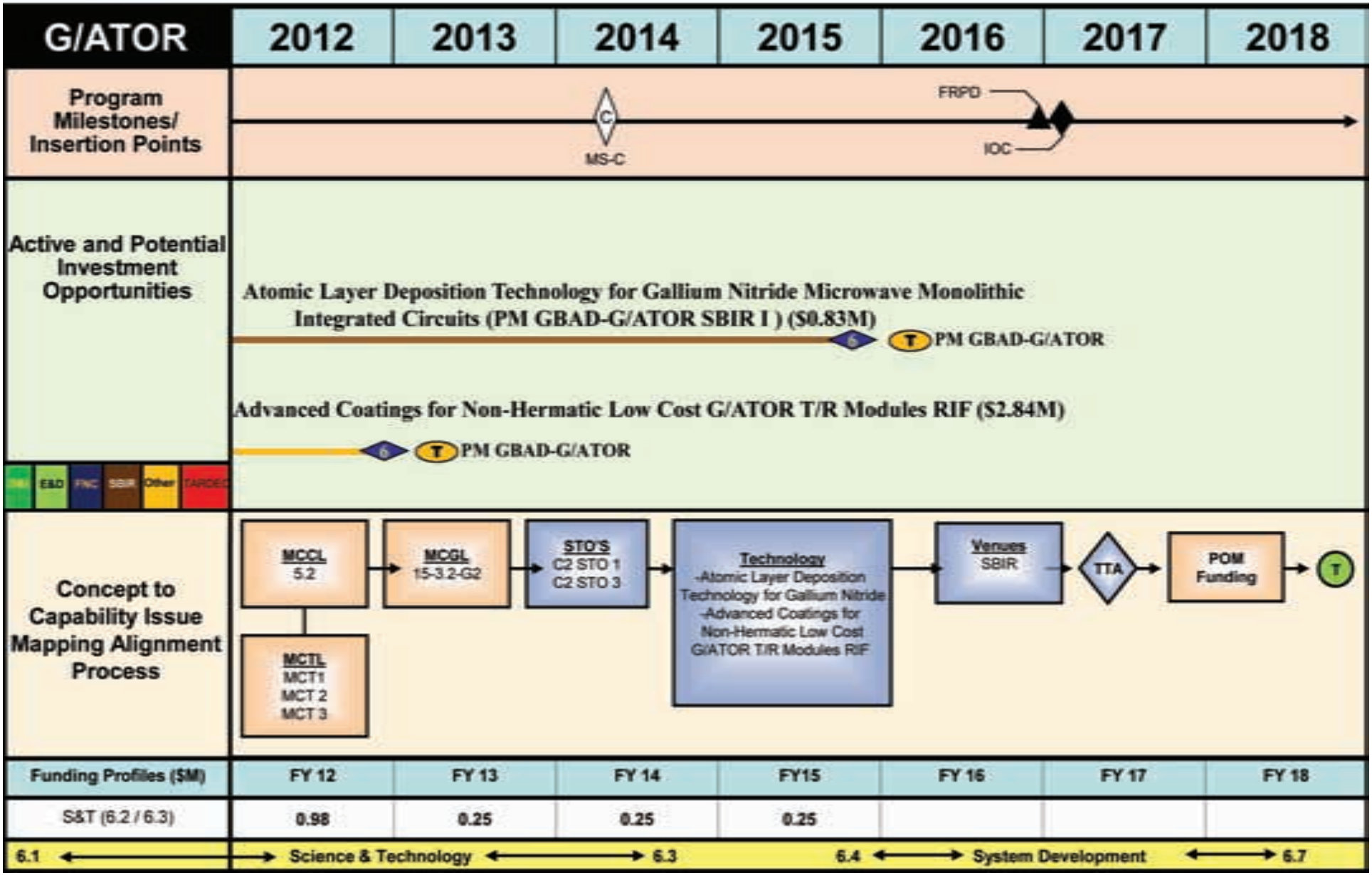
# G/ATOR Technical Issue # 2 T/R Module Efficiency (Power)




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 2.08 | 1.25 | 0.25 | 0.25 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# G/ATOR Technical Issue # 3 GaN (Gallium Nitride) Reliability



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**Left:** Oshkosh LATV **Center:** AM General BRV-O **Right:** Lockhead Martin JLTV

# JOINT LIGHT TACTICAL VEHICLE (JLTV)

## Program Description

The JLTV is a major Army-Marine Corps defense acquisition program addressing a new-generation tactical wheeled vehicle to replace a portion of the Services' HMMWV fleet. The program's aim is to develop a new multi-mission light tactical vehicle family with superior crew protection and performance when compared to today's HMMWVs. The JLTV family will balance critical weight and transportability constraints against performance, protection, and payload requirements – all while ensuring an affordable solution for the Army and USMC.

The development of the JLTV reinforces the Services' approach to interoperable platforms that provide expeditionary and protected maneuver capabilities to forces currently supported by HMMWVs. The JLTV will also improve payload efficiency through state-of-the-art chassis engineering, enabling the vehicles to be deployed with the appropriate level of force protection through the use of scalable armor solutions. Expected JLTV fleet reliability and fuel efficiency targets will be significantly greater than the current HMMWV fleet, bringing millions of dollars in savings over the JLTV lifecycle.

## Program Status

The JLTV program is currently in the Engineering and Manufacturing Development (EMD) phase. On August 22, 2012, Program Management (PM) JLTV awarded three EMD awards to AM General LLC, Lockheed Martin Corporation, and Oshkosh Corporation. These EMD contracts require each company to deliver 22 full-up prototypes beginning 12 months after contract award, and also specify contractor support to a comprehensive 14-month Government test program, which will include blast testing, automotive testing, and user evaluation.

The Marine Corps plans to acquire 5,500 JLTVs with Full Operational Capability by the end of FY 21.

## JLTV'S Top Three Program Technology Issues:

### 1. Weight/Armor

The JLTV must be transportable by rotary and fixed wing aircraft, as well as aboard amphibious shipping and Maritime Prepositioning Ships. Any additional weight could hinder the vehicle's ability to be transported. Force protection needs will require higher levels of armor protection while still meeting the JLTV's transportability requirement. Therefore, technologies that offer increased protection while maintaining or reducing vehicle weight are critical to the success of the JLTV program.

### 2. Reliability, Availability, Maintainability, Modeling and Simulation

Modeling the reliability of the vehicle is critical to determine if there are maintainability issues.

Therefore, modeling and simulation tools are needed that fully integrate systems engineering principles in the prediction of vehicle reliability that can dramatically reduce the Total Ownership Costs and provide design trade-offs that are traceable, transparent, and consistent.

### 3. Corrosion Resistance

JLTV will be stored and maintained for long durations in prepositioned stock ashore and at sea, outdoor motor pools, and other areas where it will be exposed to salt air, rain, snow, heat, cold, and other corrosive environments, which must be mitigated in the vehicle design. Damage from corrosion can cause significant maintenance requirements. The U.S. Military is experiencing a decrease of readiness through corrosion of tactical ground and ground support equipment. Corrosion degrades operational and structural capabilities and affects the safety of our operating forces. Therefore, corrosion resistance technologies will reduce Total Ownership Costs and provide a significant increase in equipment readiness.

# Joint Light Tactical Vehicle (JLTV)



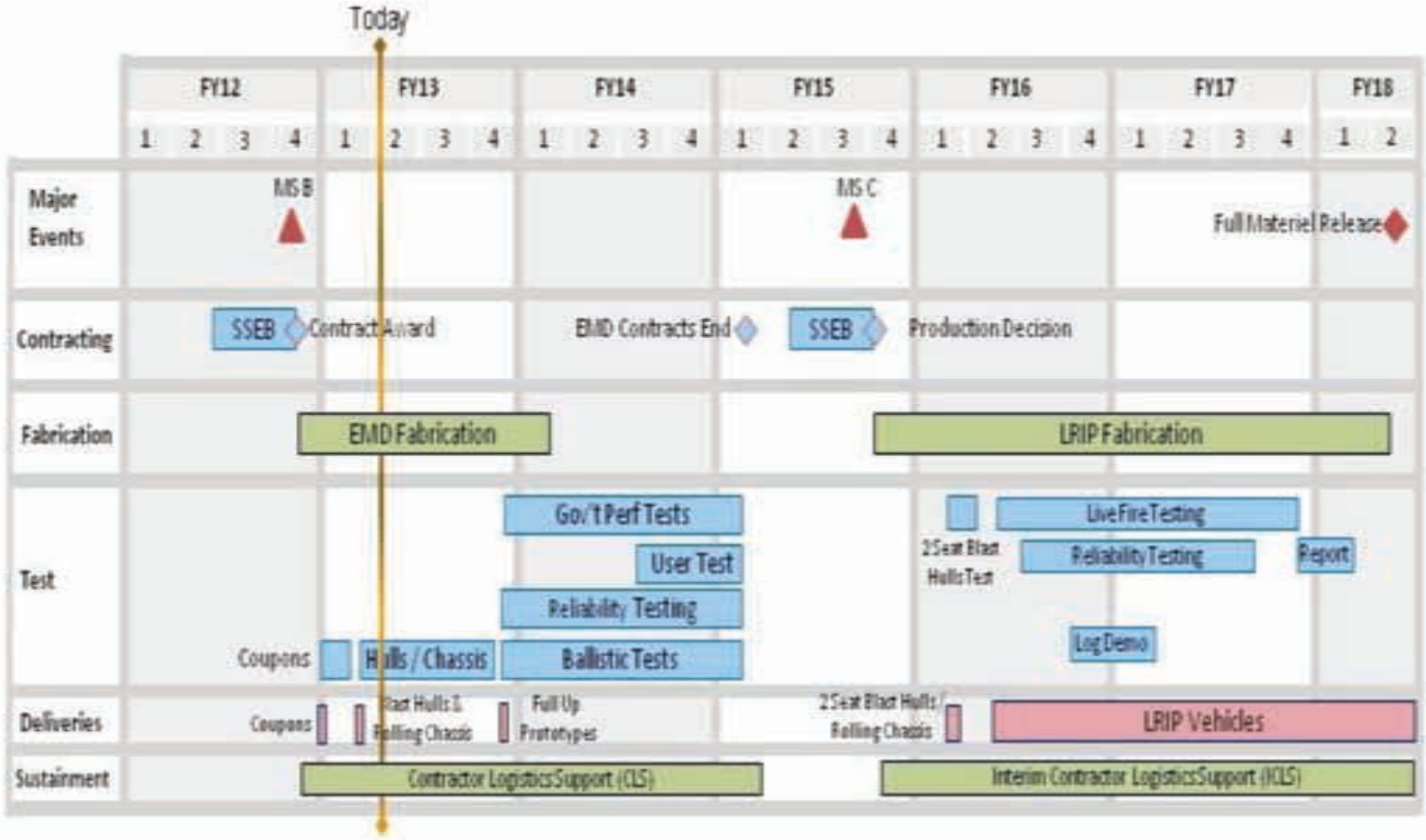

## Program Description

- Mission: The Joint Light Tactical Vehicle (JLTV) Family of Vehicles (FoV) is a Joint Army and Marine Corps program that provides vehicles and companion trailers capable of performing multiple mission roles while providing *protected*, *sustained*, and *networked mobility* for personnel and payloads.
- Description: Marine Corps participation in JLTV focuses on procuring the JLTV for combat mission roles, providing increased survivability, mobility, payload and reliability over the current family of HMMWVs. The initial production of JLTVs will support the operating forces with tactical wheeled vehicles providing a high level of scalable protection, improved sustainment, and net-ready maneuver platforms that are strategically and operationally transportable and tactically mobile across all terrain.

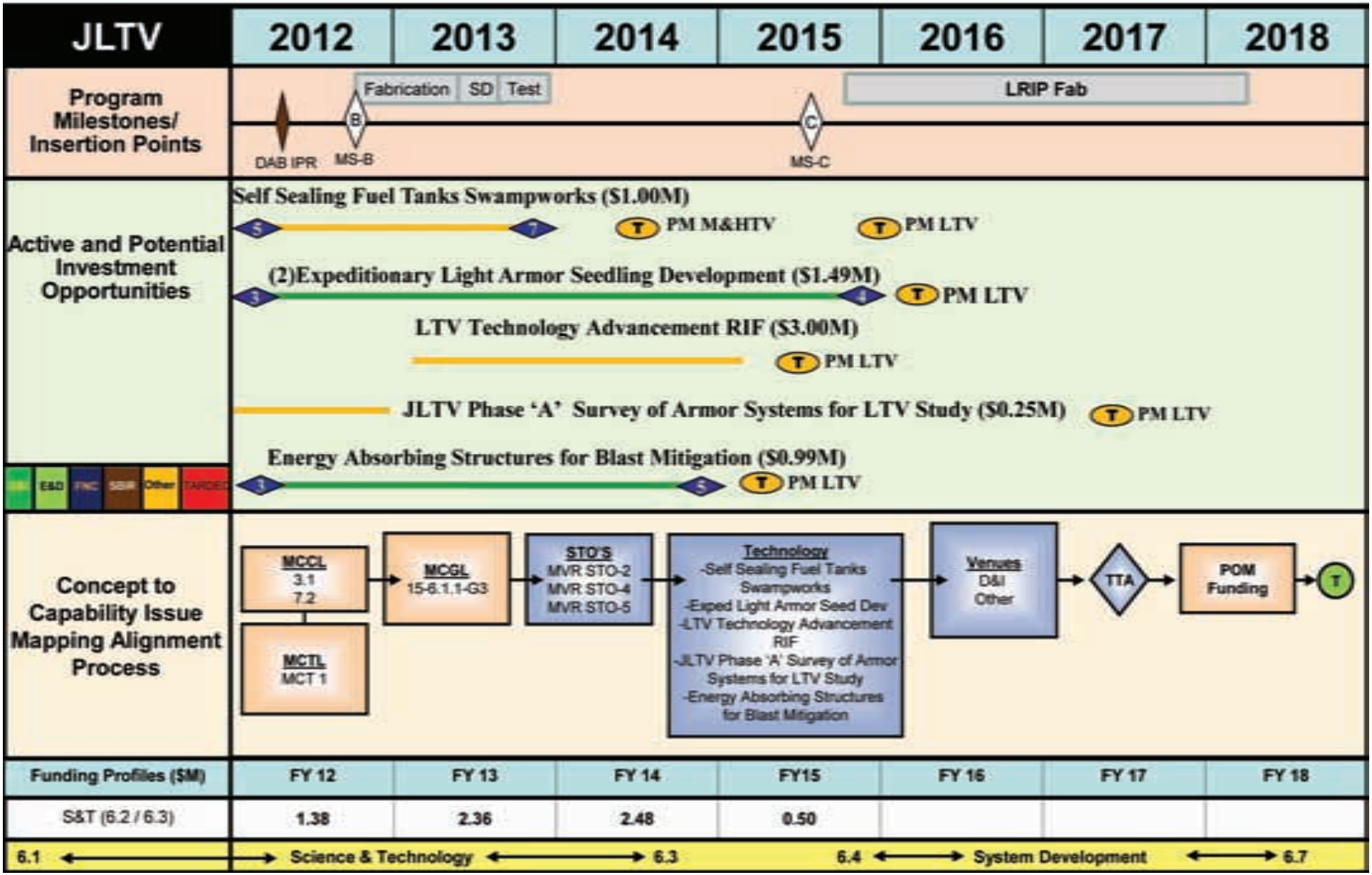
## Program Status

- ACAT: ID
- MS B: August 2012
- Next Key Acquisition Event MS C: June 2015
- Contract Type & Approach: FFP
- Government / Industry Performers: Lockheed, Oshkosh, AM Gen
- Next Demonstration / Test Events: Ballistic hull testing scheduled to begin 1 March 2013. EMD Phase testing will start in September 2013
- AAO: 5,500 (Increment I)
- Service Life: 20 Years
- Envisioned Disposal Date: 2038

# Joint Light Tactical Vehicle (JLTV)



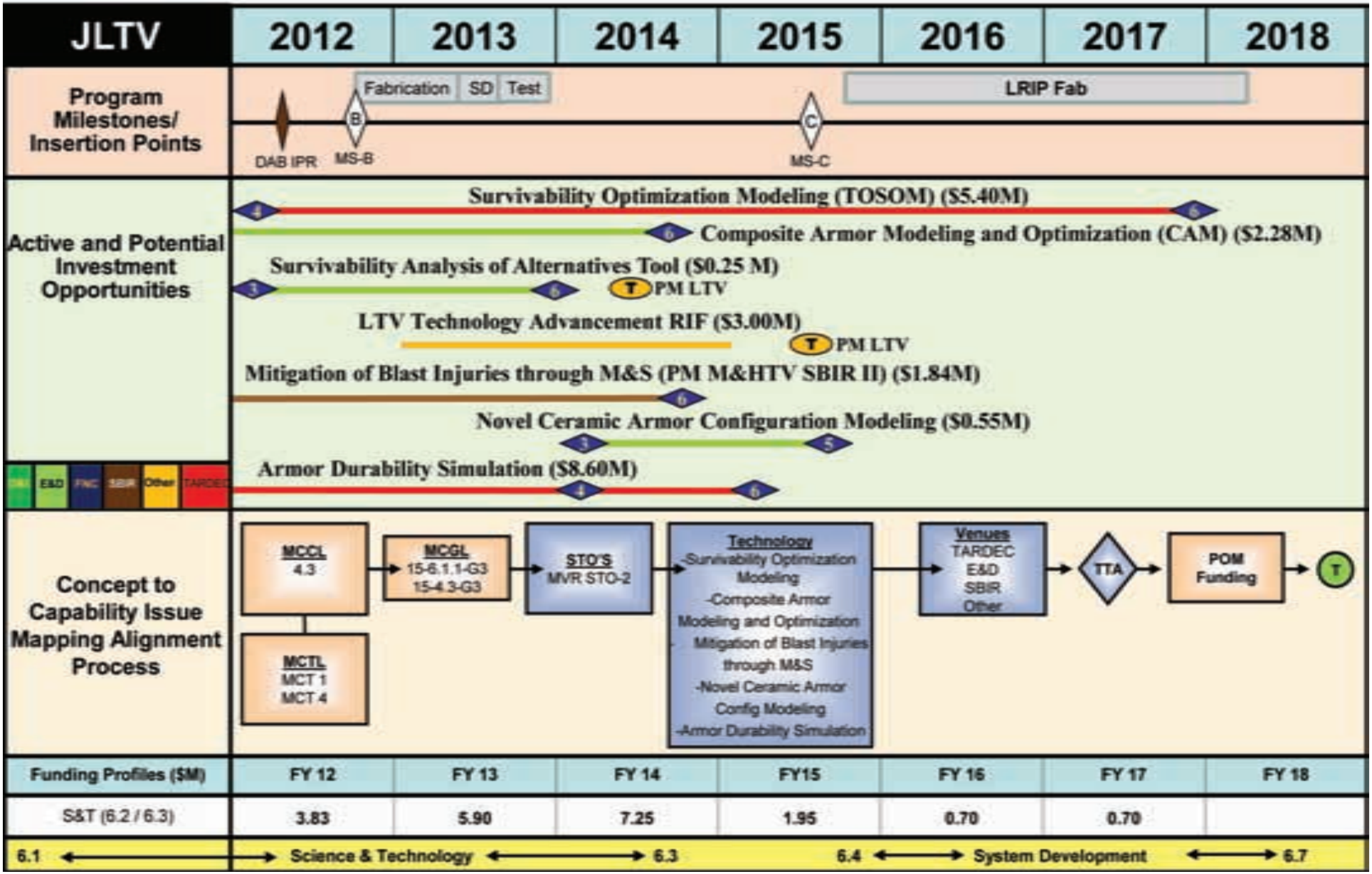
# JLTV Technical Issue #1 Weight/Armor




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.38 | 2.36 | 2.48 | 0.50 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

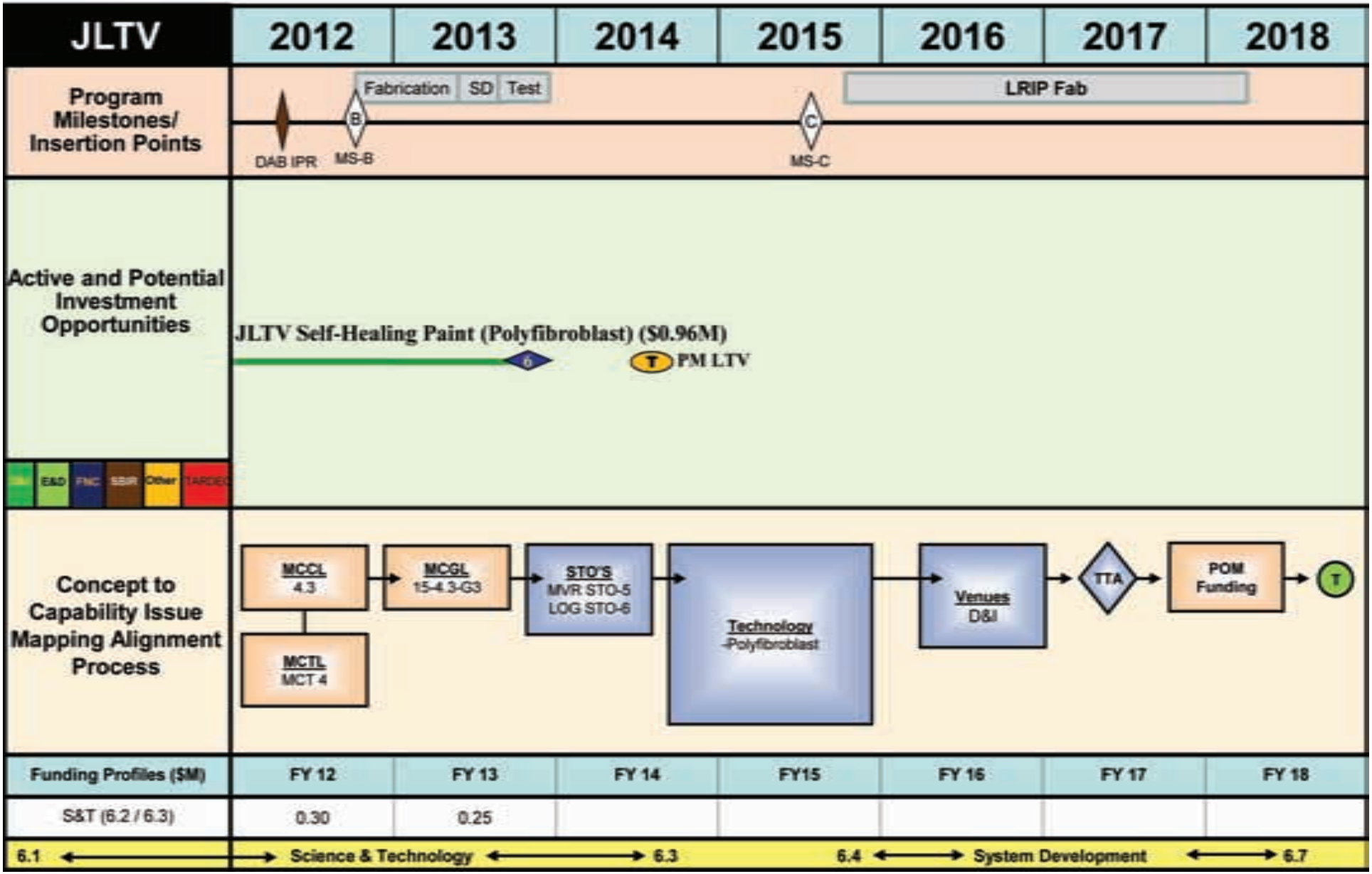
# JLTV Technical Issue #2 Reliability/Affordability/ Maintainability (RAM) Modeling and Simulation (M&S)




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 3.83 | 5.90 | 7.25 | 1.95 | 0.70 | 0.70 | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# JLTV Technical Issue #3 Corrosion Resistance



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# HIGH MOBILITY MULTIPURPOSE WHEELED VEHICLE (HMMWV)

## Program Description

The HMMWV, commonly known as the Humvee, is a four-wheel drive military automobile produced by AM General. The Marine Corps' most recent variant of the HMMWV is the ECV, which is the 4th generation design of the HMMWV. The Marine Corps has procured, fielded and supported large numbers of HMMWVs for many years; there is now a plan to reduce the Marine Corps HMMWV fleet from 24,000 vehicles to approximately 18,500, with 5,500 of those vehicles subsequently replaced by JLTV. The remaining Marine Corps HMMWV fleet of approximately 13,000 vehicles will require sustainment through 2030. The Sustainment Modification Initiative proposes to leverage mature and production ready designs/technologies that will help restore the existing expanded capacity variant of the HMMWV to pre-armoring levels in terms of safety, performance and reliability.

## Program Status

Efforts are under way at the Nevada Automotive Test Center (NATC) to explore technical possibilities surrounding HMMWV fleet sustainment and upgrades. NATC has been exploring different concept developments and evaluations based on what was established as four distinct models that are bound by certain capabilities and cost constraints. There are costs and performance trade-offs associated with each concept, and the results will be used to inform and shape the requirements. Ultimately, this information will be competed in full and open competition to industry, with reliability and operational assessment scheduled for FY13, RFP for 4QFY13 and Limited User Evaluation FY14.

## HMMWV'S Top Three Program Technology Issues:

### 1. Performance

As a result of the armoring levels required to meet the demands of Operation Iraqi Freedom and Operation Enduring Freedom (OEF) the HMMWV fleet's performance has been significantly degraded. Technologies are needed that increase payload, maximize survivability and restore performance.

### 2. Survivability

The Marine Corps HMMWV Program office is currently exploring technologies and methods to improve the underbody survivability of the HMMWV platform, specifically the ECV platform, in combination with ongoing efforts to extend the service life to meet the Light Tactical Vehicle need of the Marine Corps.

### 3. Reliability/Durability

Technologies are needed that increase the reliability and durability of the HMMWV across the spectrum of its mission profiles.

# High Mobility Multipurpose Wheeled Vehicle (HMMWV)


Not Applicable

## Program Description

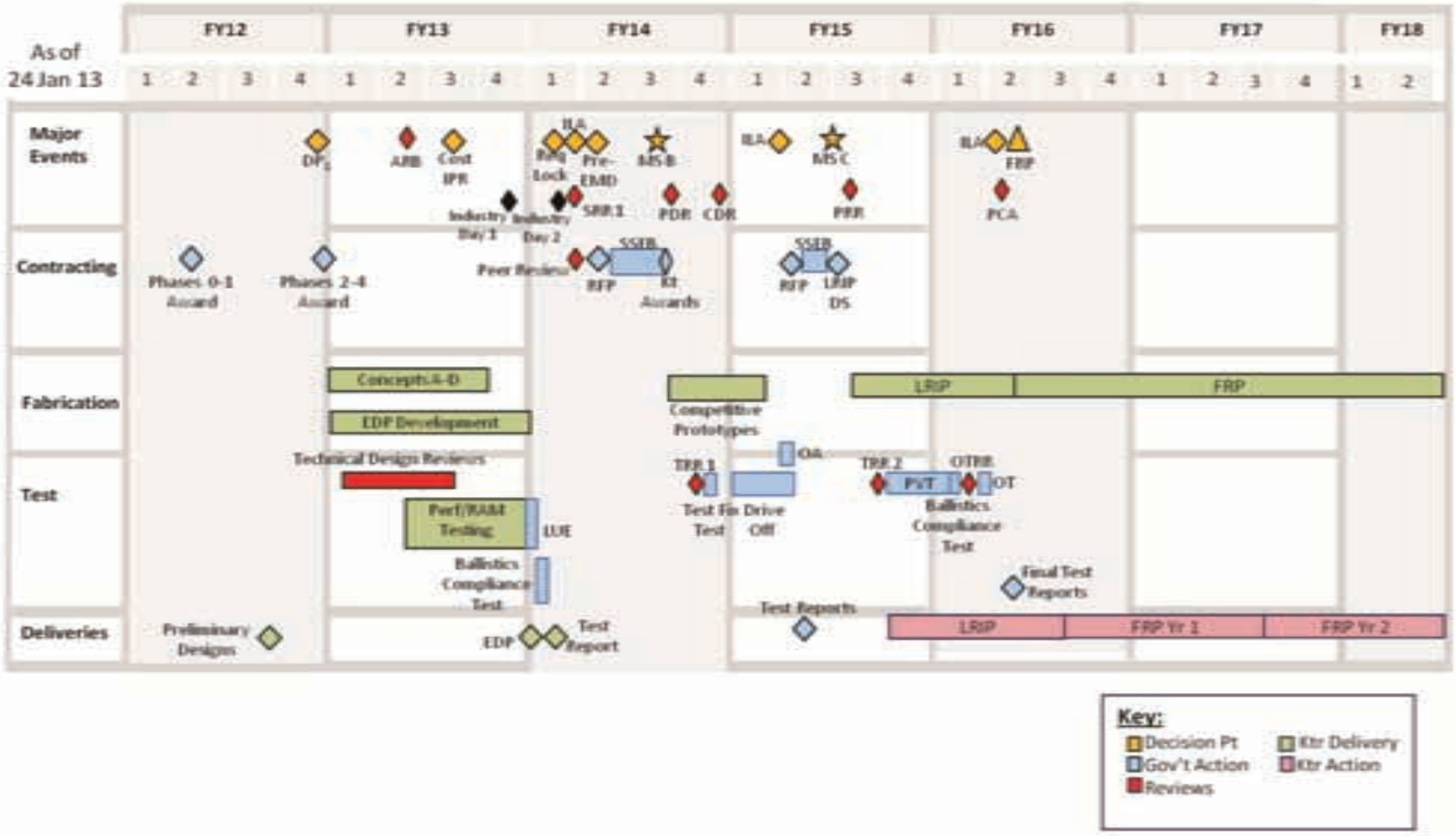
- The HMMWV FoV serves as the primary light tactical ground transport platform for command and control, troop transport, light cargo transport, shelter carriers, towed weapons prime movers, and weapons platforms throughout all areas of the battlefield or mission area. Currently, approximately 70 other component systems are associated to the HMMWV for employment.
- The High Mobility Multipurpose Wheeled Vehicle Expanded Capacity Vehicle (HMMWV ECV) is the 4th generation design of the HMMWV. The HMMWV fleet includes a mix of A2 and ECV variants.
- ECV upgrades include: 6.5L turbo engine; microprocessor-controlled engine electrical start system; more powerful EPA compliant engine; increased payload (500lbs); improved corrosion prevention; and access panels to facilitate maintenance.

## Program Status

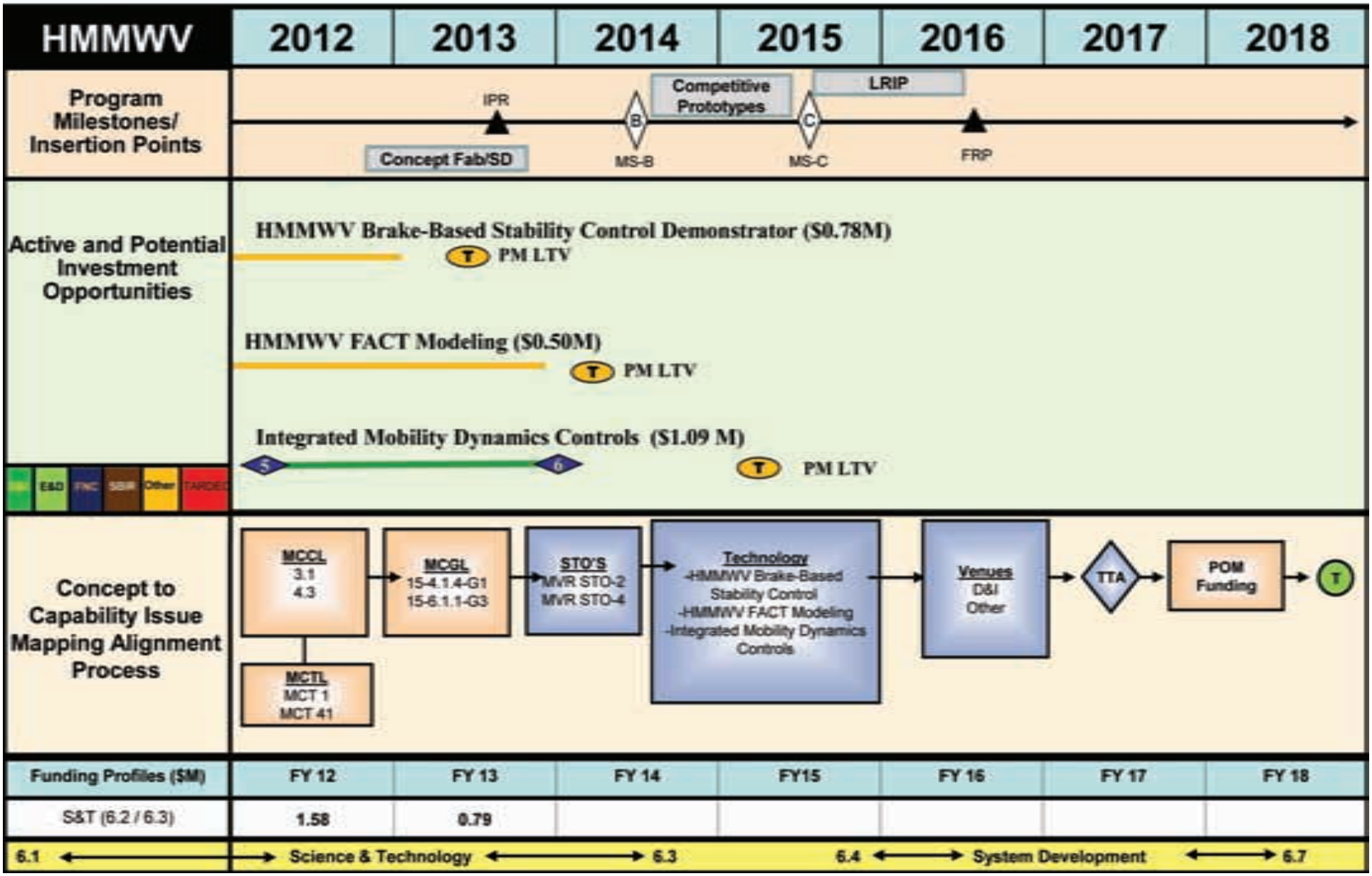
- ACAT: IC
- Full Rate Production Decision – mid 1980s
- Fielding beginning: 1984 4th Qtr
- IOC: 1986 1st Qtr
- FOC: HMMWV is fully fielded, per MCCDC CD&I decision, PMO is no longer authorized to procure HMMWVs
- AAO: 22,424
- Contract Type: Requirements based multi-year U.S. Army contract expired Dec 2012
- Prime Contractor: AM General
- Award Date: 1984
- Fleet consists of A2 and ECV variants

# High Mobility Multipurpose Wheeled Vehicle (HMMWV)

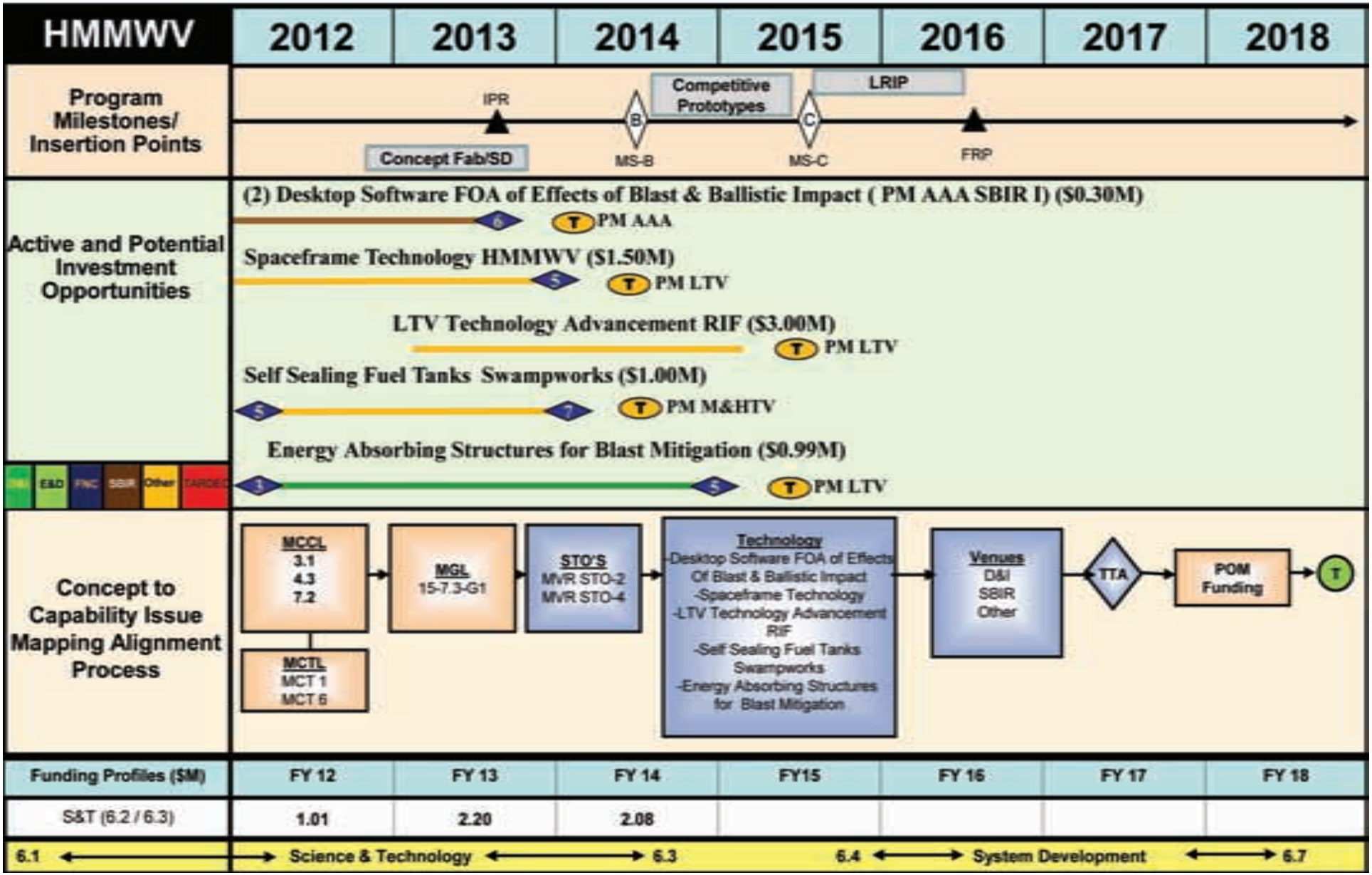
## SMI PROGRAM SCHEDULE



# HMMWV Technical Issue #1 Performance



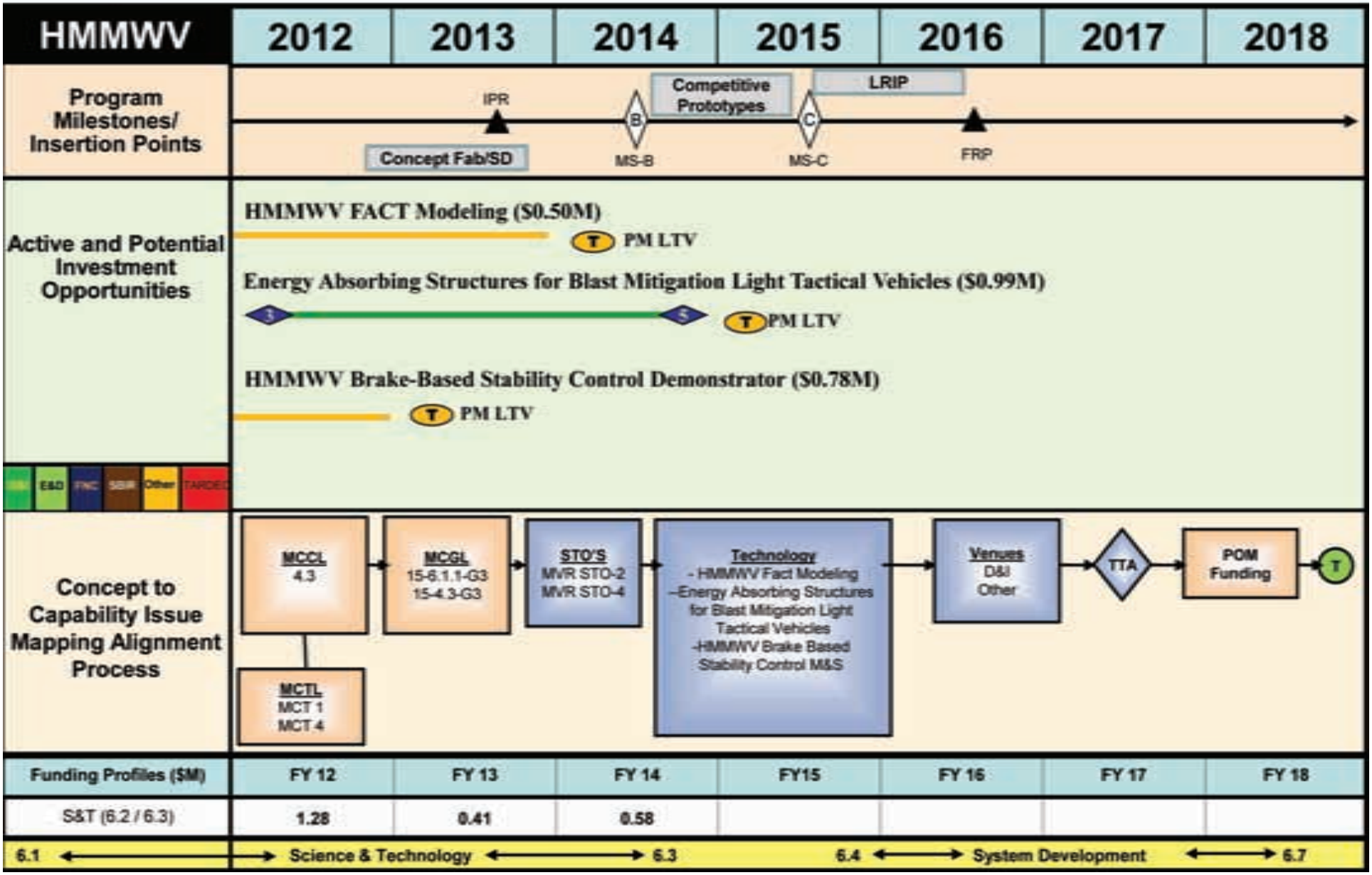
# HMMWV Technical Issue #2 Survivability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.01 | 2.20 | 2.08 | | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

# HMMWV Technical Issue # 3 Reliability/Durability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.28 | 0.41 | 0.58 | | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

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# INTERNALLY TRANSPORTABLE VEHICLE (ITV)

## Program Description

The ITV program has been developed to field a family of light attack vehicles in support of expeditionary forces. The ITV-LSV will replace the Interim Fast Attack Vehicle (IFAV) as well as fill the tactical void created by the disposal of all M151 Jeep variants. The ITV is designed to be internally transportable within both the MV-22 tilt-rotor aircraft and CH53D/E rotary wing aircraft. ITV has been fielded as a system of systems. Light Strike Vehicle supports Infantry, Recon, and SOF while Prime Mover tows Expeditionary Fire Support System mortars and ammunition trailers.

## Program Status

Production and fielding completed in December 2012. Support will transition from Contracting Logistics Support to organic support in FY14. The ITV Improvement Initiative (I3) is under way to identify safety and reliability issues. Reliability and performance testing is being conducted at Aberdeen Test Center along with engineering and design analysis to improve system deficiencies. Efforts outside of the Program Office are exploring operational concepts to aid in lightening the MAGTF, including the Autonomous resupply mission.

## ITV'S Top Three Program Technology Issues:

**1. Stability/Braking**

The ITV was designed with a narrow wheel base driven by the requirement to fit in the MV-22. Due to the unconventional vehicle wheel base the front brake proportioning valve has been adjusted to compensate for system design. This design has led to stability and breaking issues. System performance could be greatly improved with the addition of an Anti Lock Braking System.

**2. Reliability/Durability**

Primary vehicle areas that lack adequate reliability include the following: drive shaft, half shafts, and rear steer system. These issue areas are being addressed through the I3 effort.

**3. Corrosion**

Improper Chemical Agent Resistant Coating painting procedures during ITV production and lack of operator preventive maintenance, checks, and services has led to significant corrosion issues for the ITV fleet. The Program Office is currently working with the CPAC team to address the corrosion issues encountered in the ITV fleet.

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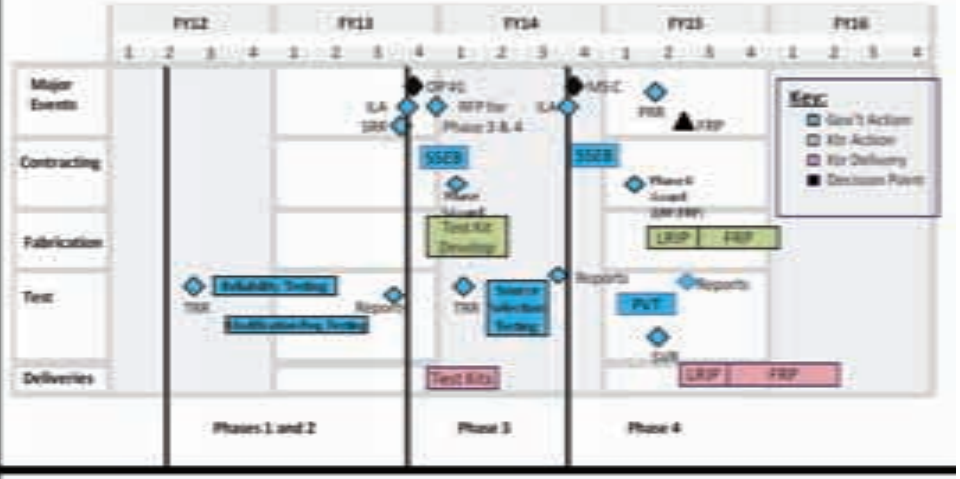
# Internally Transportable Vehicle (ITV)

## Proposed ITV Improvement Initiative Schedule



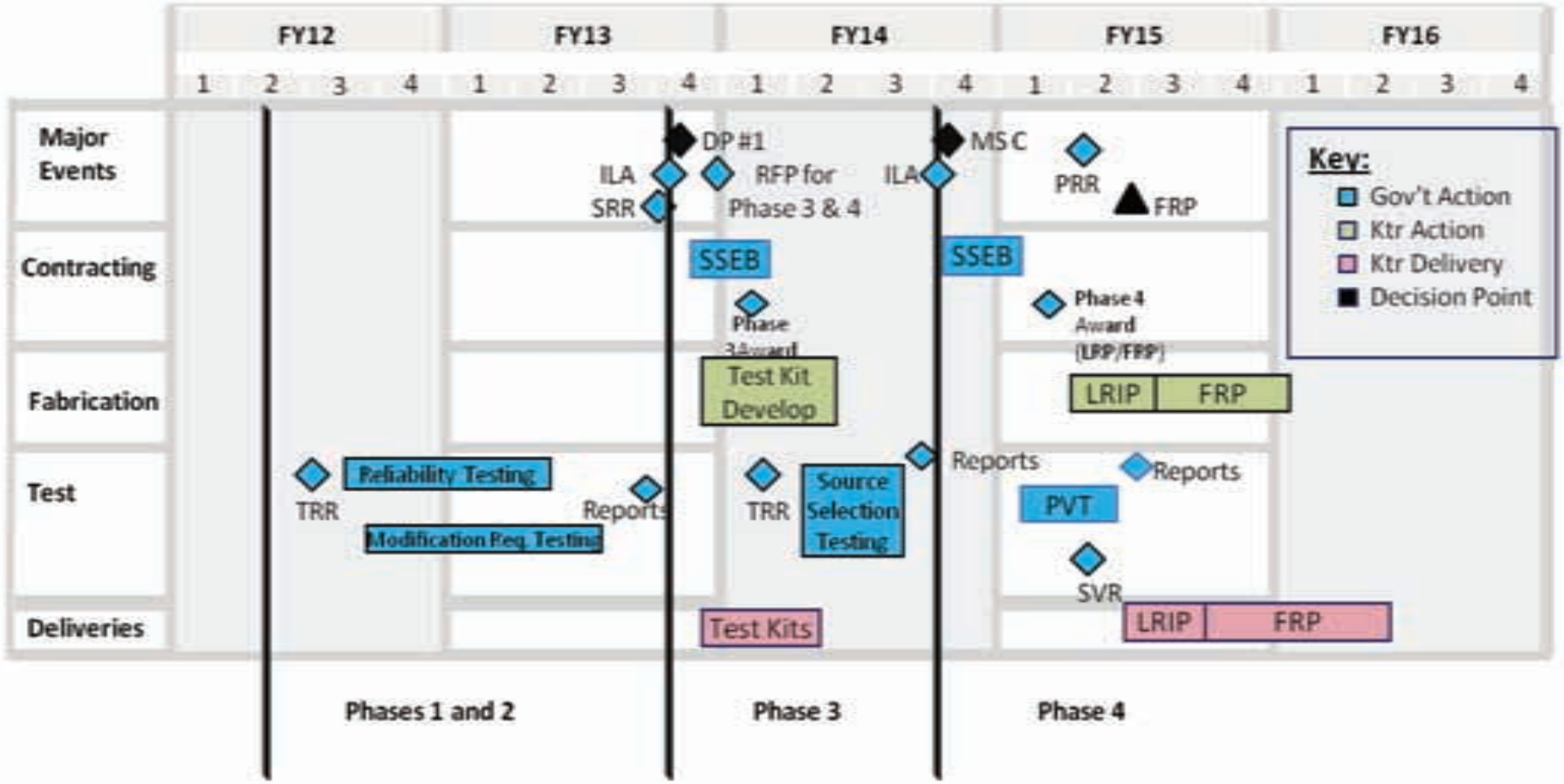

## Program Description

- Capability Provided: The ITV provides the Marine Air Ground Task Force (MAGTF) with a vehicle internally transportable in the MV-22, CH-53F/G and the MH-47. The ITV serves primarily as a high mobility weapons capable platform that supports a variety of operations and provides ground units with equal or greater mobility than the MAGTF maneuver elements they support.
- System Description: The ITV is a narrow width, lightweight high mobility vehicle capable of carrying up to 2000 lbs of cargo, 4 Marines, and a crew served weapon.
- Integration / Interdependencies: The ITV Family of Vehicles supports and sustains the Prime Mover (PM) and ammo trailer for the Expeditionary Fire Support System (EFSS), as well as the Light Strike Variant (LSV).

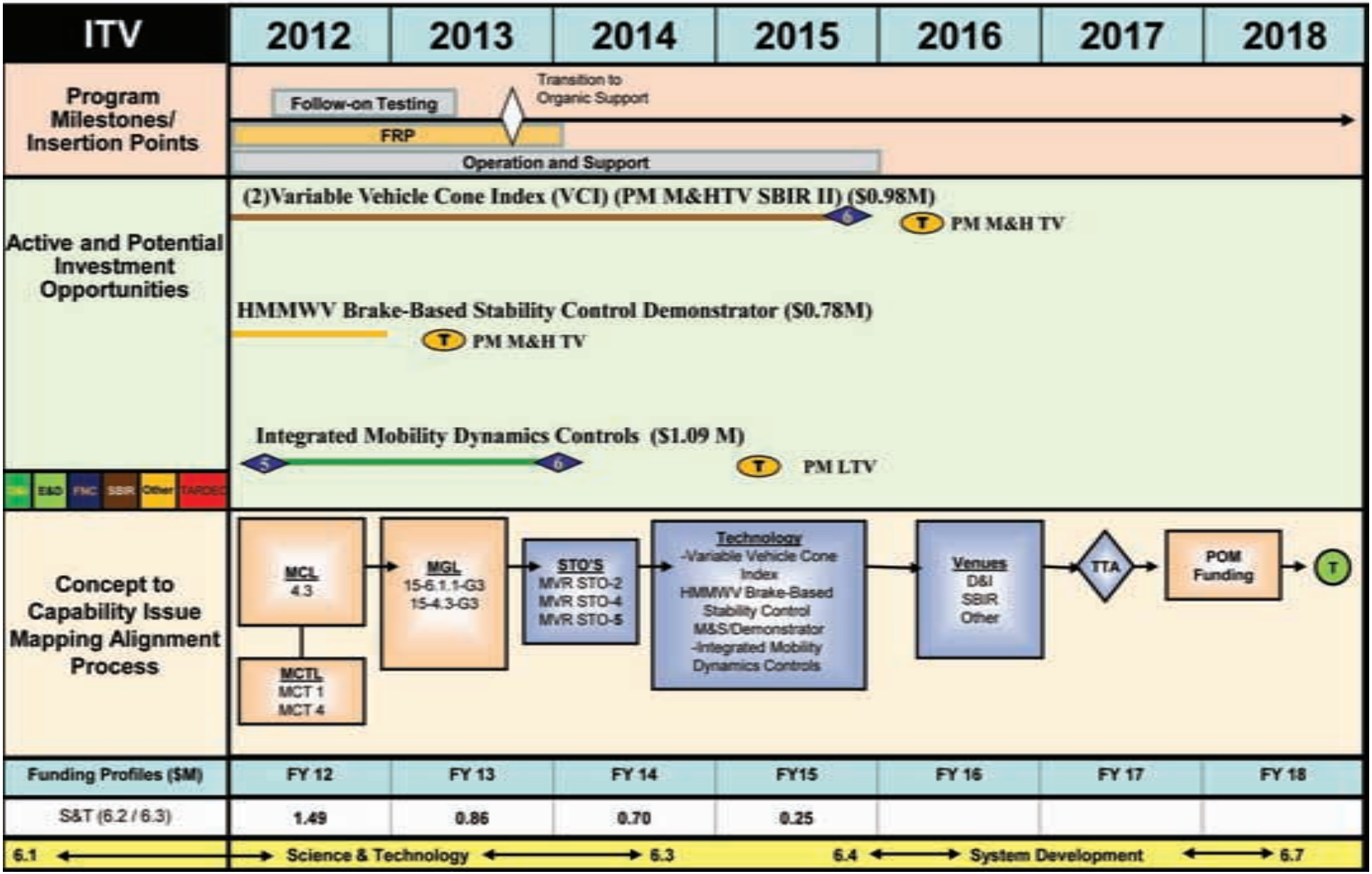
## Program Status

- ACAT: III
- Original contract award date: 10 November 2004
- Contract Type: Cost Plus Firm Fixed Price
- Prime Contractor: General Dynamics Ordnance & Tactical Systems
- Current AAO: LSV 266 / PM 144
- IOC: June 2009
- Production contract ended November 2011, all units received
- Reports from the field identified post-production reliability and safety issues.
  - PM initiated post-production baseline testing at Aberdeen to identify areas to improve safety and reliability.
  - CD&I addressing PMC funding requirements in POM 15
- Currently no funding available due to CRA

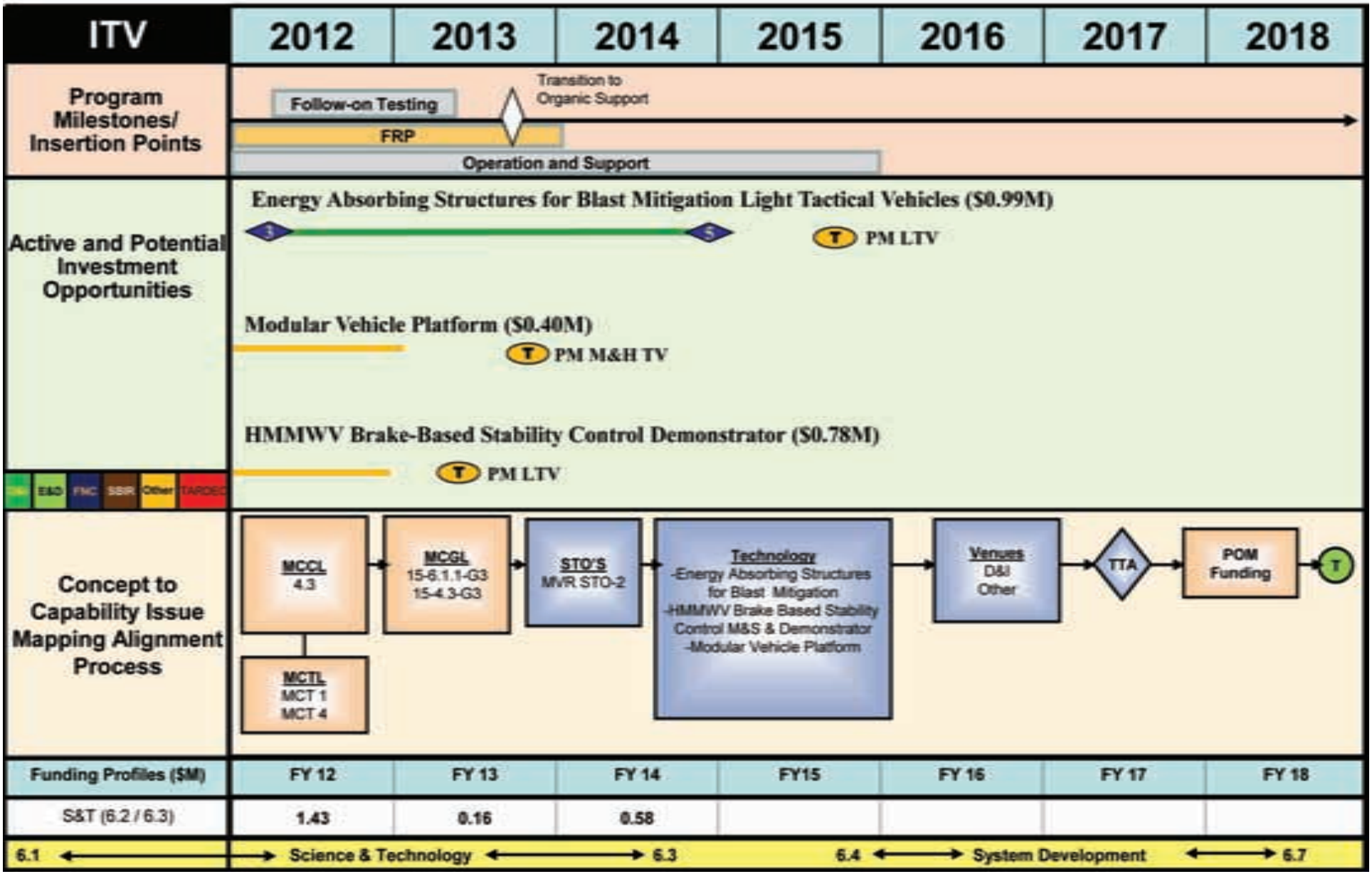
# Internally Transportable Vehicle (ITV)



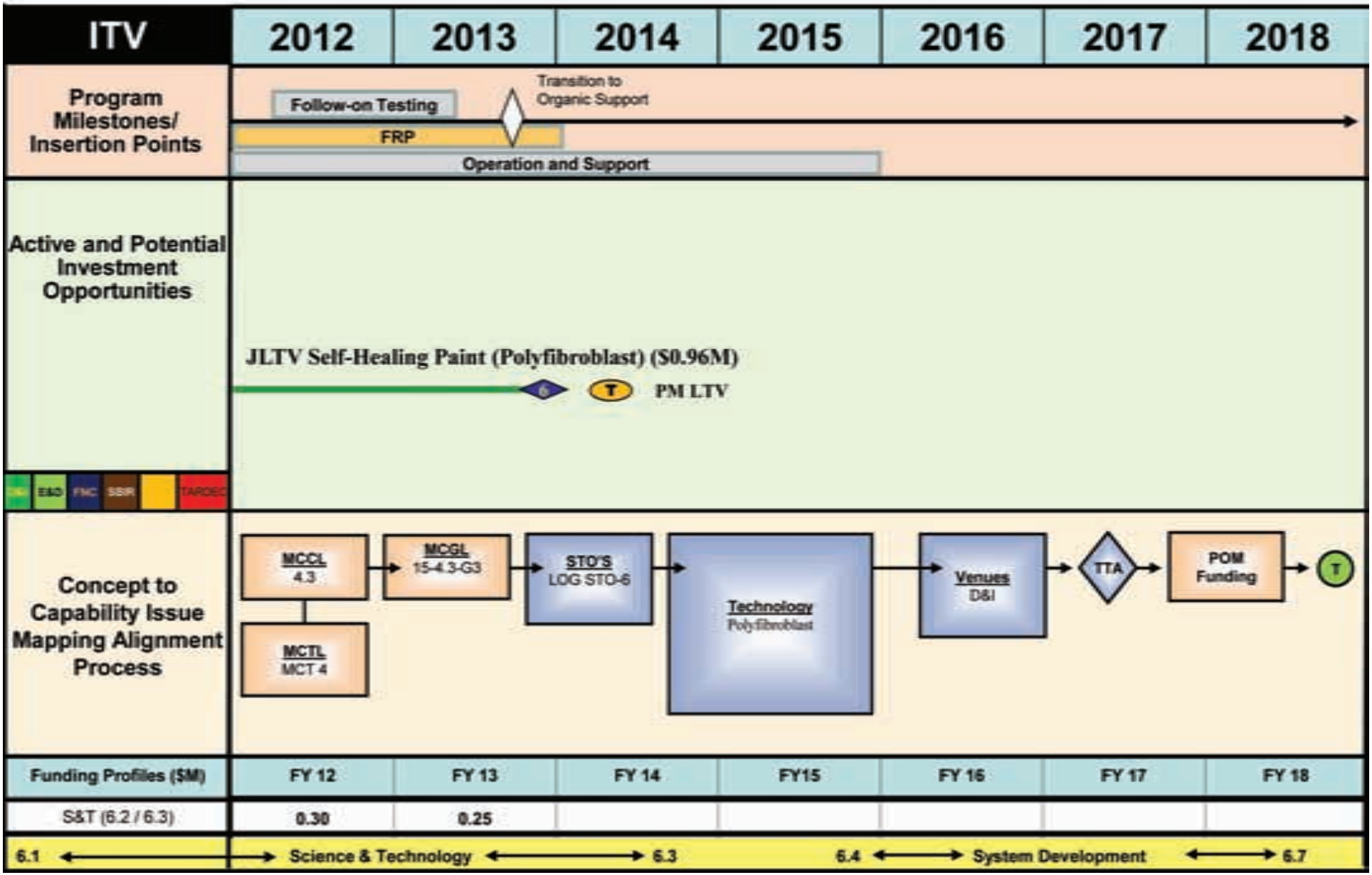
# ITV Technical Issue #1 Stability/Braking



# ITV Technical Issue #2 Reliability/Durability



# ITV Technical Issue #3 Corrosion



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# MEDIUM TACTICAL VEHICLE REPLACEMENT (MTVR)

## Program Description

The MTVR six-wheel, 7-ton, all-terrain multi-purpose vehicle has replaced the service's aging 5-ton trucks. Manufactured by Oshkosh Defense, the vehicles were first fielded in 2001 as replacements for the obsolete M813 series, M923 series and M925 series vehicles. The platforms have an on-road cruising range of 300 miles (483 kilometers) and the ability to ford five feet (1.5 meters) of water, and they can traverse a 60 percent gradient and 30 percent side slope with the maximum cross-country load. Operational performance is further enhanced by advanced technologies like the Oshkosh TAK-4® independent suspension system and Command Zone™ integrated control and diagnostics system. MTVR variants include: Standard Cargo and Extended Wheel Base Cargo Trucks; dump trucks; tractors; wreckers; and High Mobility Artillery Rocket System Resupply Trucks. Approximately half of the vehicles are armored and some possess a reducible height capability.

More than 8,900 MTVRs are in service with the Marine Corps. The Marine Corps' Ground Combat Tactical Vehicle Strategy reduced the MTVR AAO to 8,750 vehicles. The Navy SeaBees also possess over 1,800 MTVRs that are used in riverine and combat engineering missions. More than 800 USMC MTVRs have been in service in Afghanistan.

To improve the vehicle's level of protection against mines and improvised explosive devices, the MTVR Armor System was designed as a permanent modification to the vehicle. It provides complete 360-degree protection as well as overhead and underbody protection for the cab occupants.

The MTVR was built with a 22-year service life and currently there is no service life extension program or modernization upgrade scheduled.

## Program Status

The MTVR has been in service since 2001. More than 2,000 MTVRs have seen service in Iraq and/or Afghanistan. With its 70 percent off-road mission profile and highly survivable armor package; the MTVR has been heavily used in theater for logistics missions as well as for "other missions as assigned."

## MTVR's Top Three Program Technology Issues:

**1. Fuel Economy**

At 3.8 miles per gallon, coupled with the fully burdened cost of fuel, moderate increases in fuel efficiency of the MTVR have the potential to save millions of dollars. Therefore, technologies that improve MTVR Fuel Efficiency will have a dramatic effect across the Marine Air-Ground Task

Force. These include: engine mounted fuel efficiency technologies, regenerative braking, accessory electrification, hybrid, and electric drive.

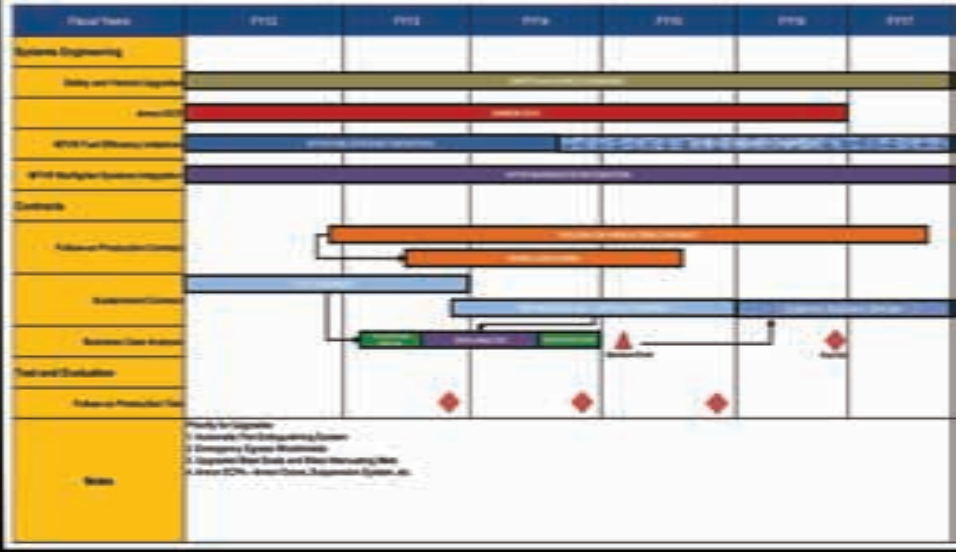
**2. Increased Survivability**

Technologies are needed that maintain or increase survivability of the vehicle and occupants from emerging threats. This includes increasing armor protection while maintaining or reducing current weight, improvements in blast resistant seats, crew egress systems, and advanced fire suppression systems.

**3. Safety**

Technologies are needed that increase vehicle stability and mitigate vehicle rollover while maintaining the ability of the MTVR to achieve its 70% off-road/30% on-road mission profile.

# Medium Tactical Vehicle Replacement (MTVR)



## Program Description

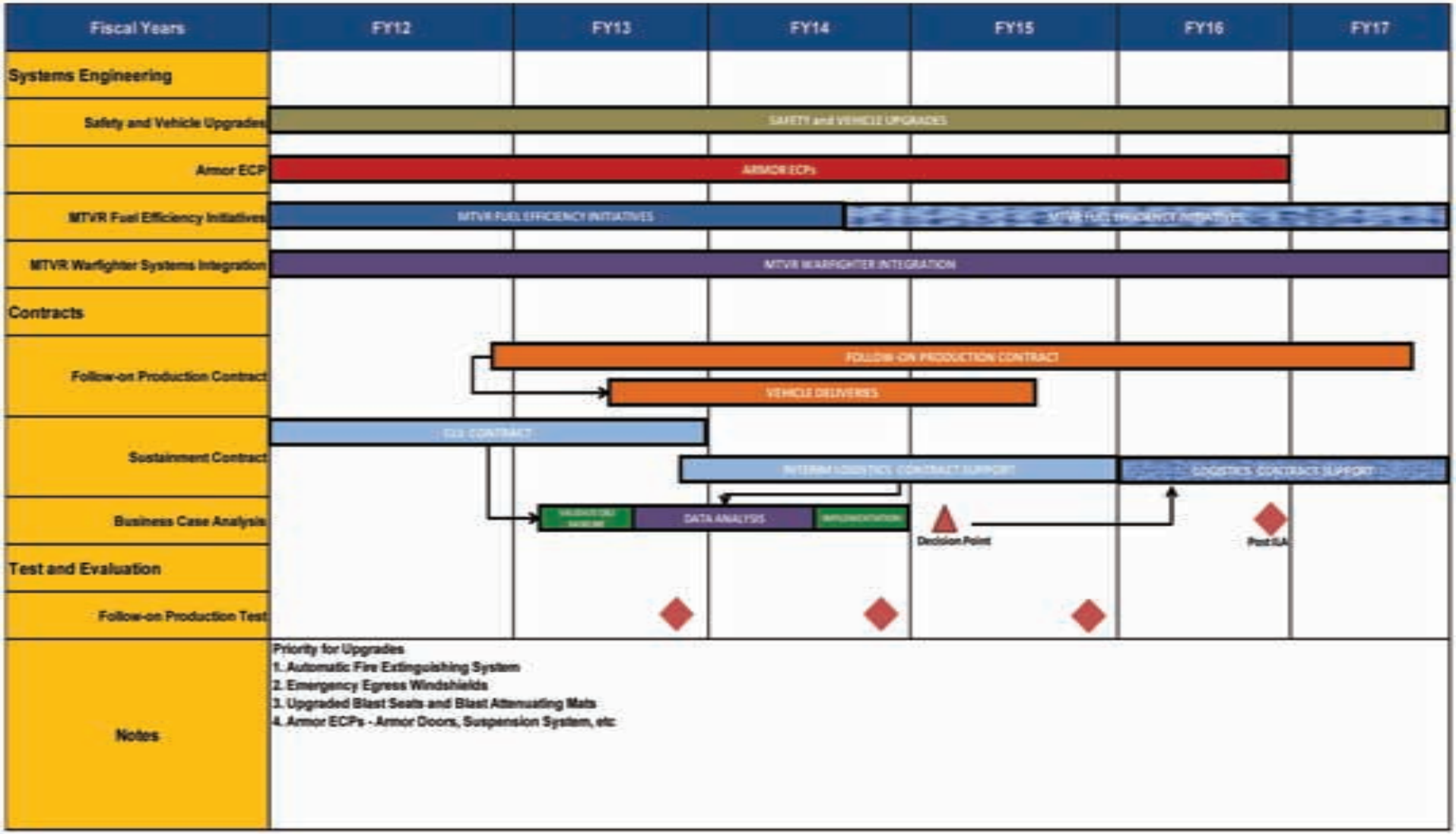
- The MTVR replaced the aging M809/M939 series 5-ton trucks with state-of-the-art commercial automotive technology beginning in 2001. The MTVR Cargo truck has a 7.1-ton off road and 15-ton on road payload and a 22-year service life. MTVR variants include the Cargo, Dump, Wrecker, Tractor (5th Wheel) and High Mobility Artillery Rocket System (HIMARS) Re-Supply Vehicle. There is a high level of commonality across the family of vehicles.
- The MTVR Armor System (MAS) provides complete 360-degree protection as well as overhead and underbody protection for the crew compartment. The MAS is a permanent modification to the vehicle and includes an upgraded front suspension and cab rebuild. The kit includes a removable personnel carrier (with ballistic glass), air conditioning system, and machine gun mount. All vehicles in theater include MAS armor.

## Program Status

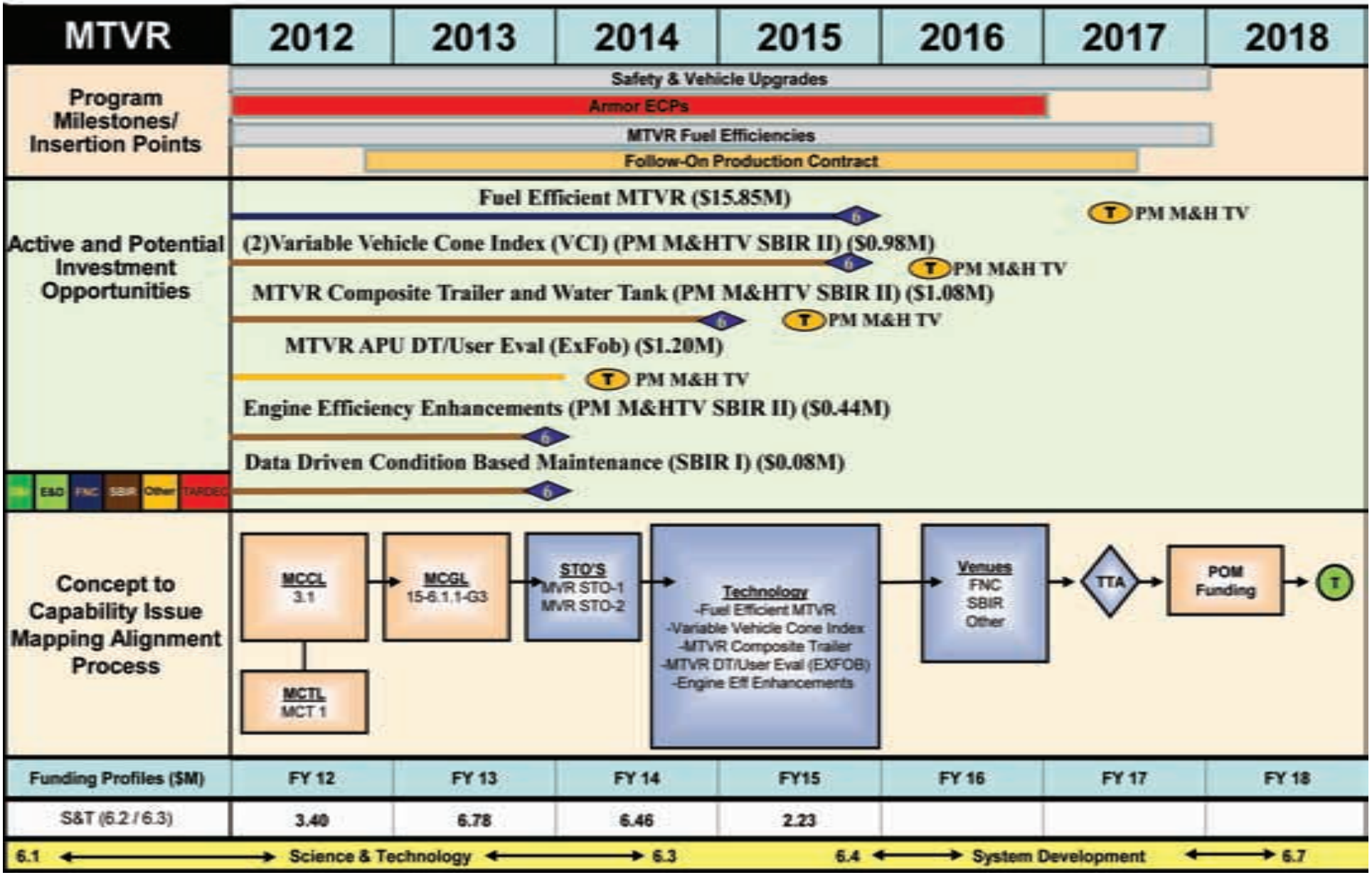
Significant events:

- Follow-on production contract award planned 4th Qtr FY12
- PBI/CLS sustainment contract (award 4th Qtr FY13)
- MTVR Program Initiatives
  1. Safety & Crew protection upgrades (Blast Seats/ Mounts , Brake-based Stability, Roll Bar)
  2. Energy Efficiencies
  3. Intra-Service vehicle & engine exchange

# Medium Tactical Vehicle Replacement (MTVR)



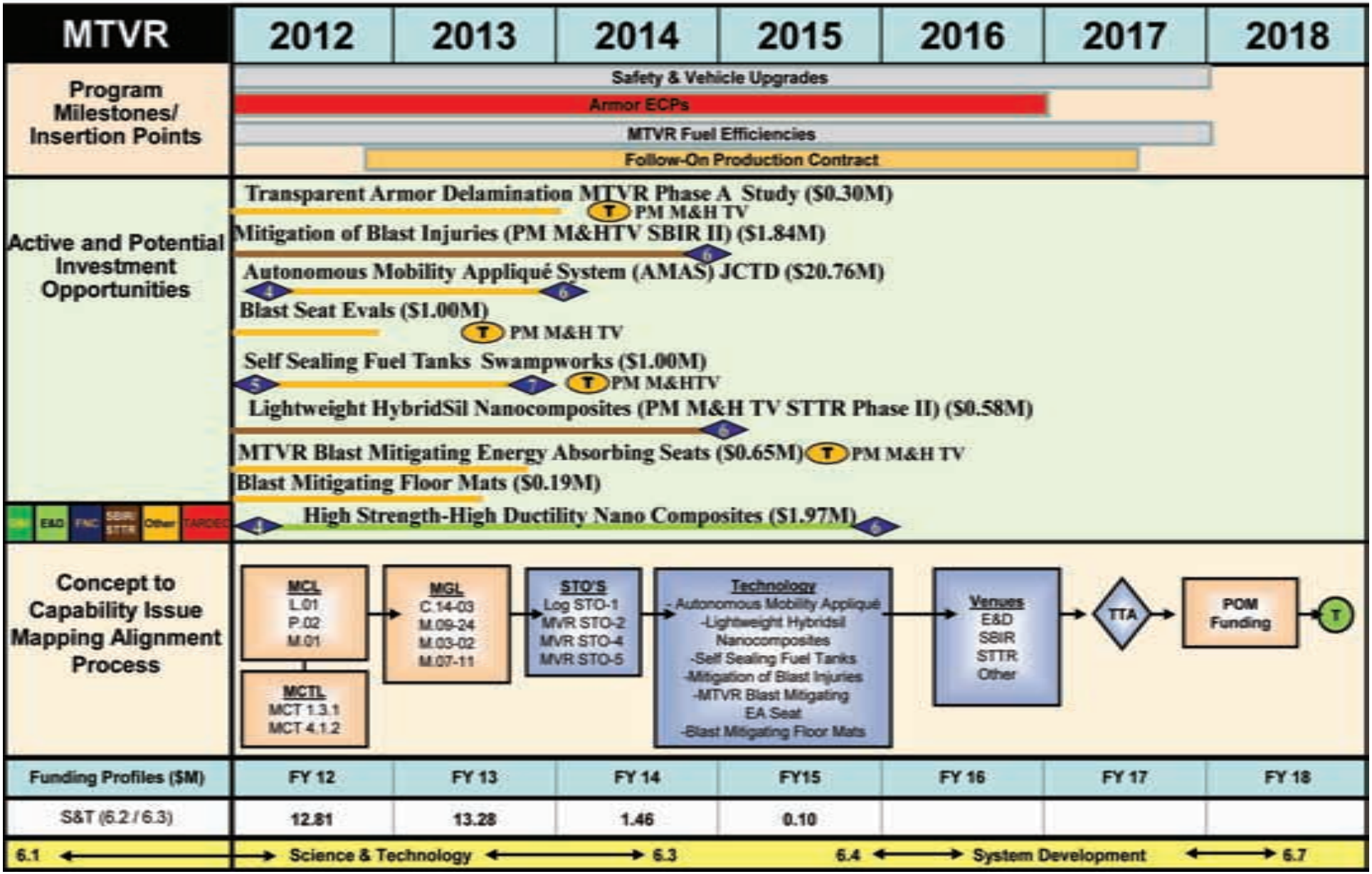
# MTVR Technical Issue #1 Fuel Economy




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 3.40 | 6.78 | 6.46 | 2.23 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

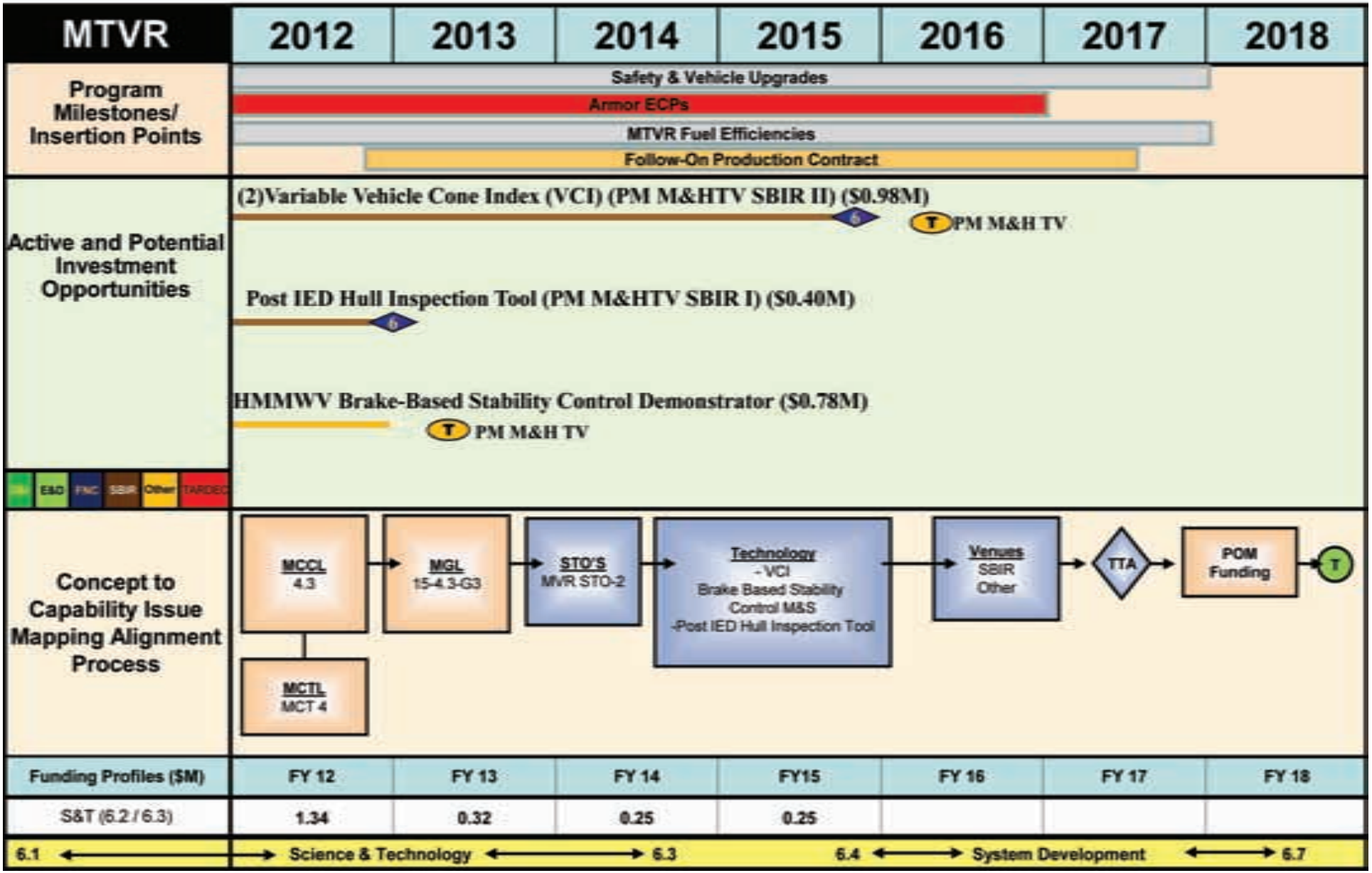
# MTVR Technical Issue #2 Increased Survivability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 12.81 | 13.28 | 1.46 | 0.10 | | | |

6.1 ⟷ Science & Technology ⟷ 6.3 6.4 ⟷ System Development ⟷ 6.7

# MTVR Technical Issue #3 Safety




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.34 | 0.32 | 0.25 | 0.25 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

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# LOGISTICS VEHICLE SYSTEM REPLACEMENT (LVSR)

## Program Description

The LVSR system serves as the Marine Corps' "heavy logistics" vehicle. The LVSR replaces the Marine Corps' aging Logistics Vehicle System (LVS) and incorporates the MK 48/MK 48A1 front power unit with associated Rear Body Units to transport large quantities of supplies across the battlefield. The LVSR is deployed in the Marine Logistics Group, Marine Divisions, and Marine Aircraft Wings.

The LVSR includes three variants: MKR 18 Cargo, MKR 16 Tractor, and MKR 15 Wrecker. The vehicle has a 22.5-ton (20,412 kilograms) on-road/16.5-ton (14,969 kilograms) off-road payload, 600 horsepower diesel engine, Command Zone™ integrated control and diagnostics, and factory-installed armor integrated into the initial vehicle design.

The LVSR can travel up to 65 miles per hour on paved surfaces and ford 5 feet of water, and it has a cruising range of 300 miles. Built by Oshkosh Corporation, the new tactical-distribution heavy hauler carries fuel, water, ammunition, standardized containers, palletized cargo, and heavy equipment. The earlier-vintage LVS, also built by Oshkosh, consisted of a two-piece truck-trailer, with a four-wheel-drive front power unit and five categories of trailer rear-body units. In contrast, the all-wheel-drive LVSR has a straight body design supporting its three variants.

The LVSR, with a standard two-person cab (and a third position for an optional machine gunner position), uses Oshkosh's TAK-4 independent suspension system for improved mobility and off-road maneuverability. There is an Acquisition Objective of 2246 with Full Operational Capability scheduled for 3QFY14 for all variants.

## Program Status

The LVSR Cargo variant achieved Initial Operating Capability in September 2009 and the first LVSRs deployed to OEF in support of the Mobile Trauma Bay that same September. The LVSR is helping address one of the Marine Corps biggest challenges in Afghanistan, which is to get supplies, equipment, and logistics into the remote areas in which Marines routinely operate.

## LVSR's Top Three Program Technology Issues:

### 1. Fuel Economy

At 2.0 miles per gallon, coupled with the fully burdened cost of fuel, a moderate increase in fuel efficiency of the LVSR has the potential to save millions of dollars. Technologies are required to increase fuel efficiency of the LVSR. Potential technologies include engine mounted fuel efficiency technologies and regenerative braking.

### 2. Increased Survivability

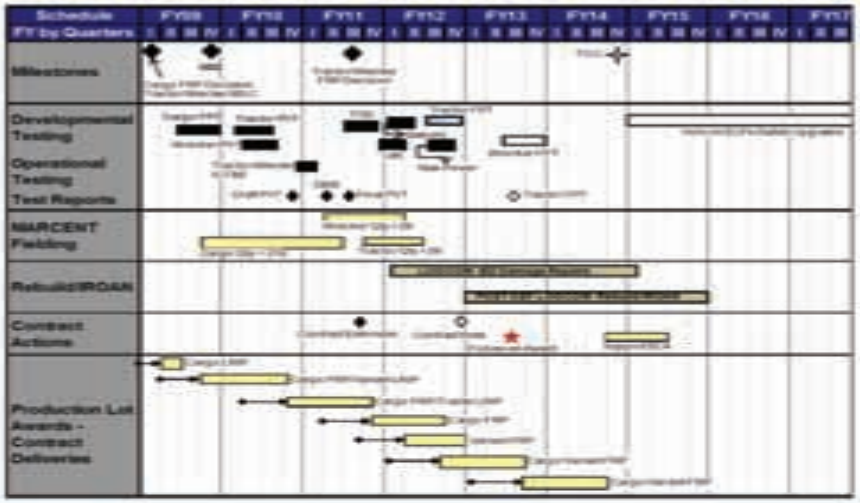
Technologies are needed that maintain or increase survivability of the vehicle and occupants from emerging threats. This includes increasing armor protection while maintaining or reducing current weight, improvements in blast resistant seats, crew egress systems, and advanced fire suppression systems.

### 3. Safety

Technologies are needed that increase vehicle stability and mitigate vehicle rollover while maintaining the ability of the LVSR to achieve its 70% off-road/30% on-road mission profile.

**Line of Logistics Vehicle Systems**

# Logistics Vehicle System Replacement (LVSR)




## Program Description

The Logistics Vehicle System Replacement (LVSR) will replace the current Marine Corps heavy-tactical wheeled vehicle, the Logistics Vehicle System (LVS). As the Marine Corps' heavy-tactical distribution system, the LVSR Cargo variant will transport bulk liquids (fuel and water); ammunition; standardized containers; bulk, break-bulk, palletized cargo, and bridging equipment. The LVSR Wrecker variant will perform heavy wrecker/recovery missions, while the LVSR Tractor variant will tow heavy engineer equipment and combat vehicles with the M870A2 40 ton Medium Heavy Equipment Trailer (MHET).

IOC: 3QFY09 FOC: FY14 AAO: 2000

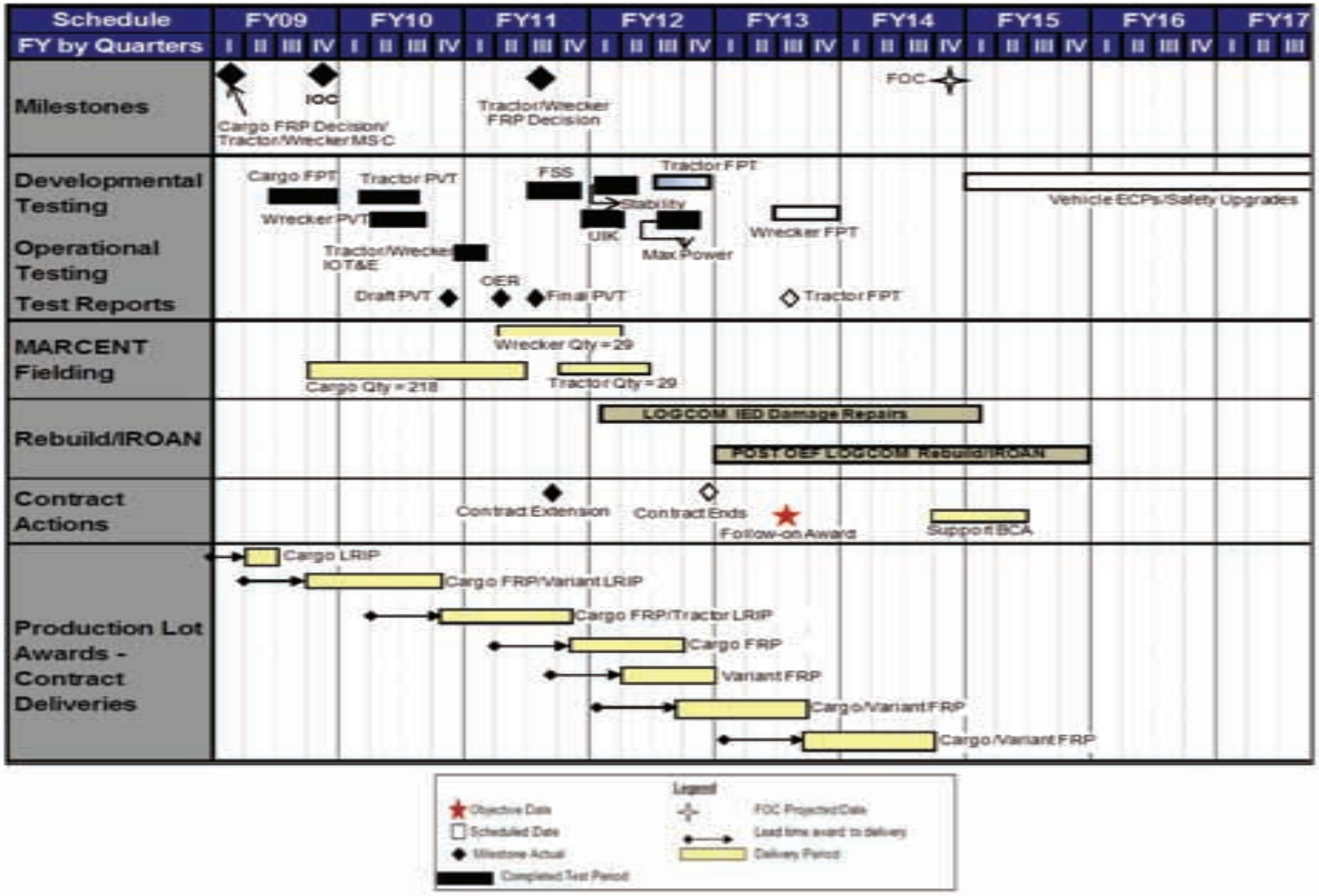
## Program Status

- AAO 2000 Includes (1489 Cargo, 349 Tractors, & 162 Wreckers)
- Prime Contractor: Oshkosh Corporation
- Significant events
  - All variants in process of fielding
  - MARCENT Fielding
    - 218 Cargos
    - 29 Wreckers
    - 29 Tractors

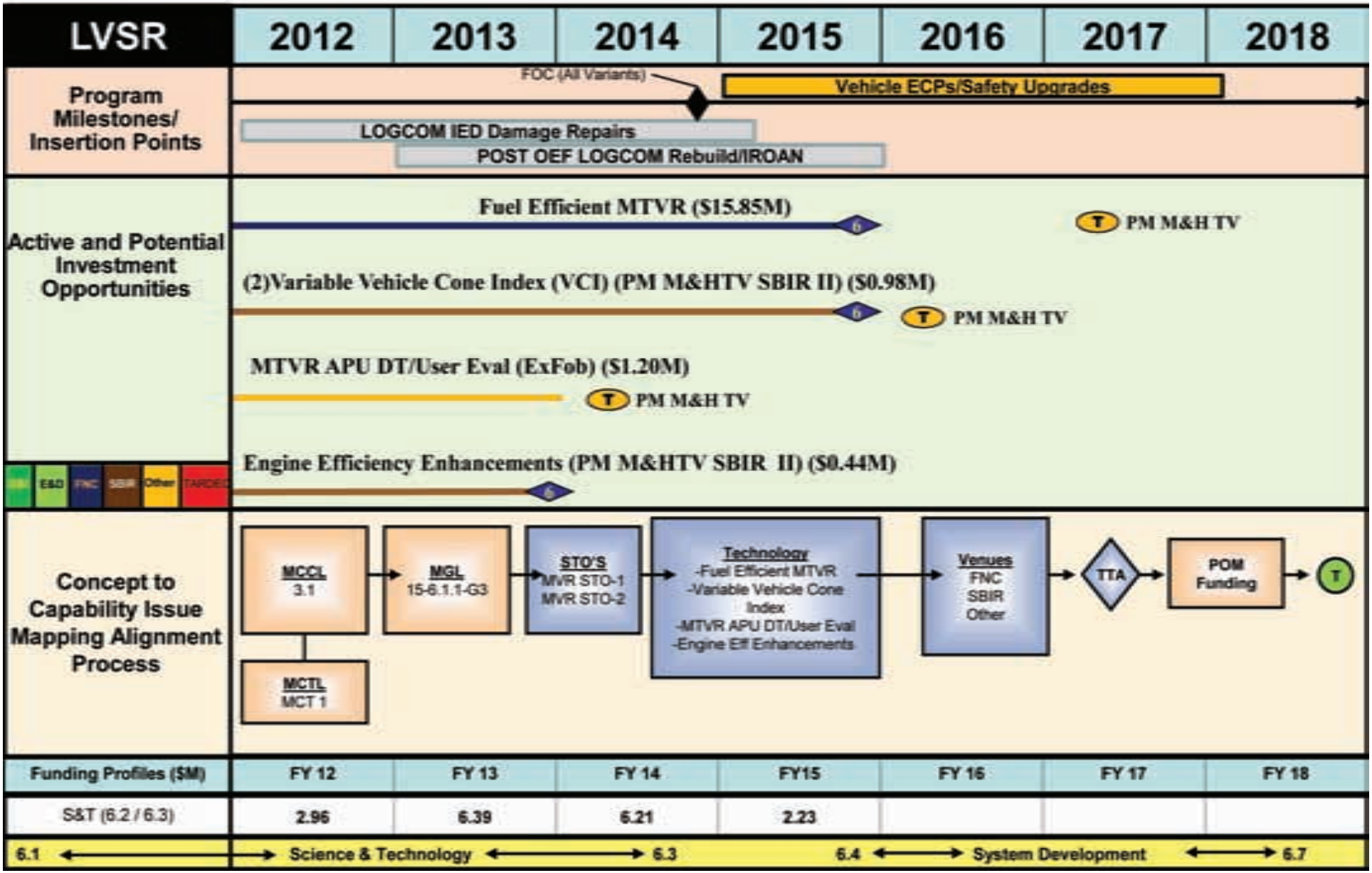
**Issues**

- FOC requires definition based on OEF and Reset/Recon distribution on vehicles
- Follow-On contract anticipated award 3QFY13

# Logistics Vehicle System Replacement (LVSR)



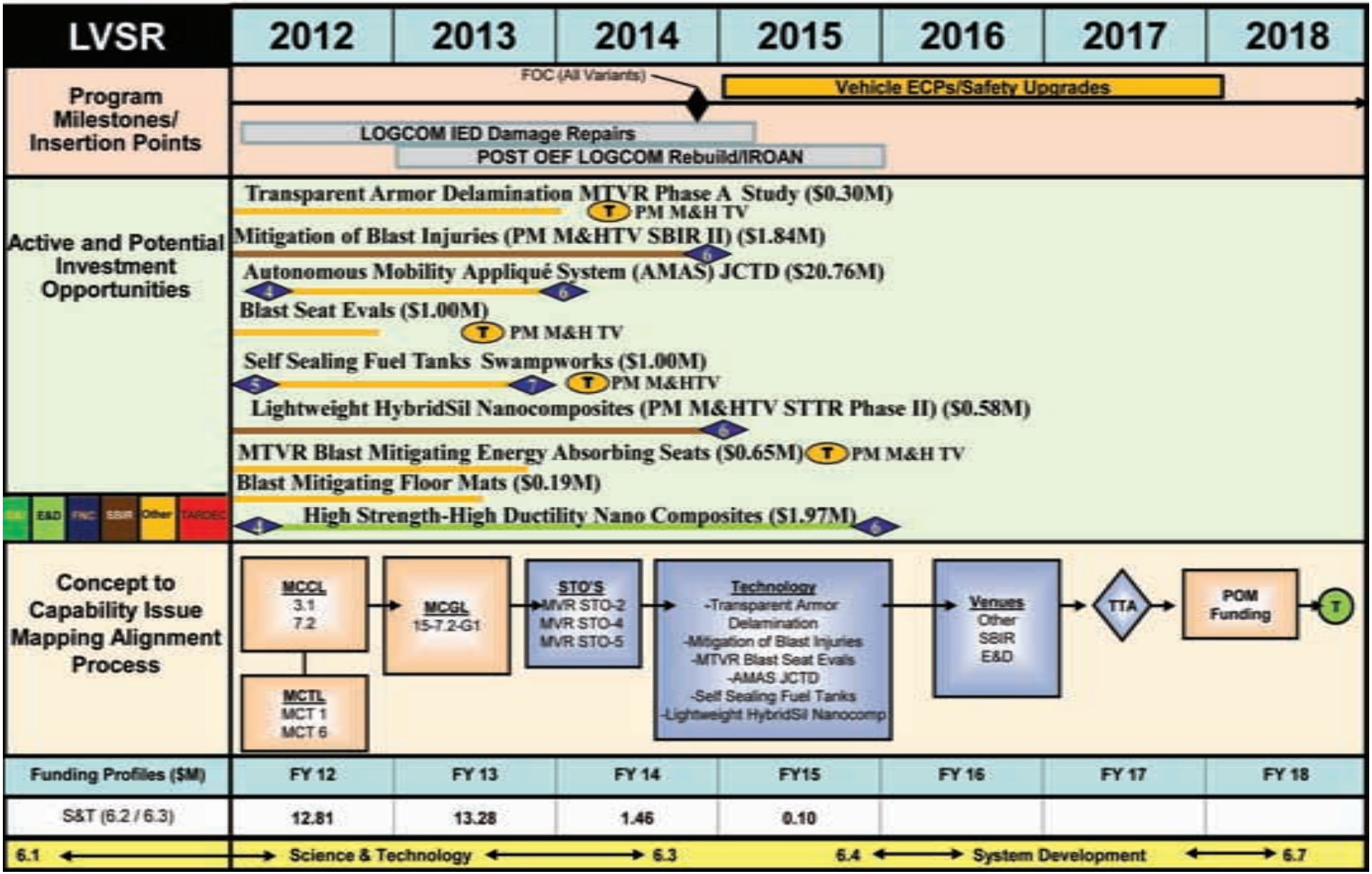
# LVSR Technical Issue #1 Fuel Economy




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 2.96 | 6.39 | 6.21 | 2.23 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

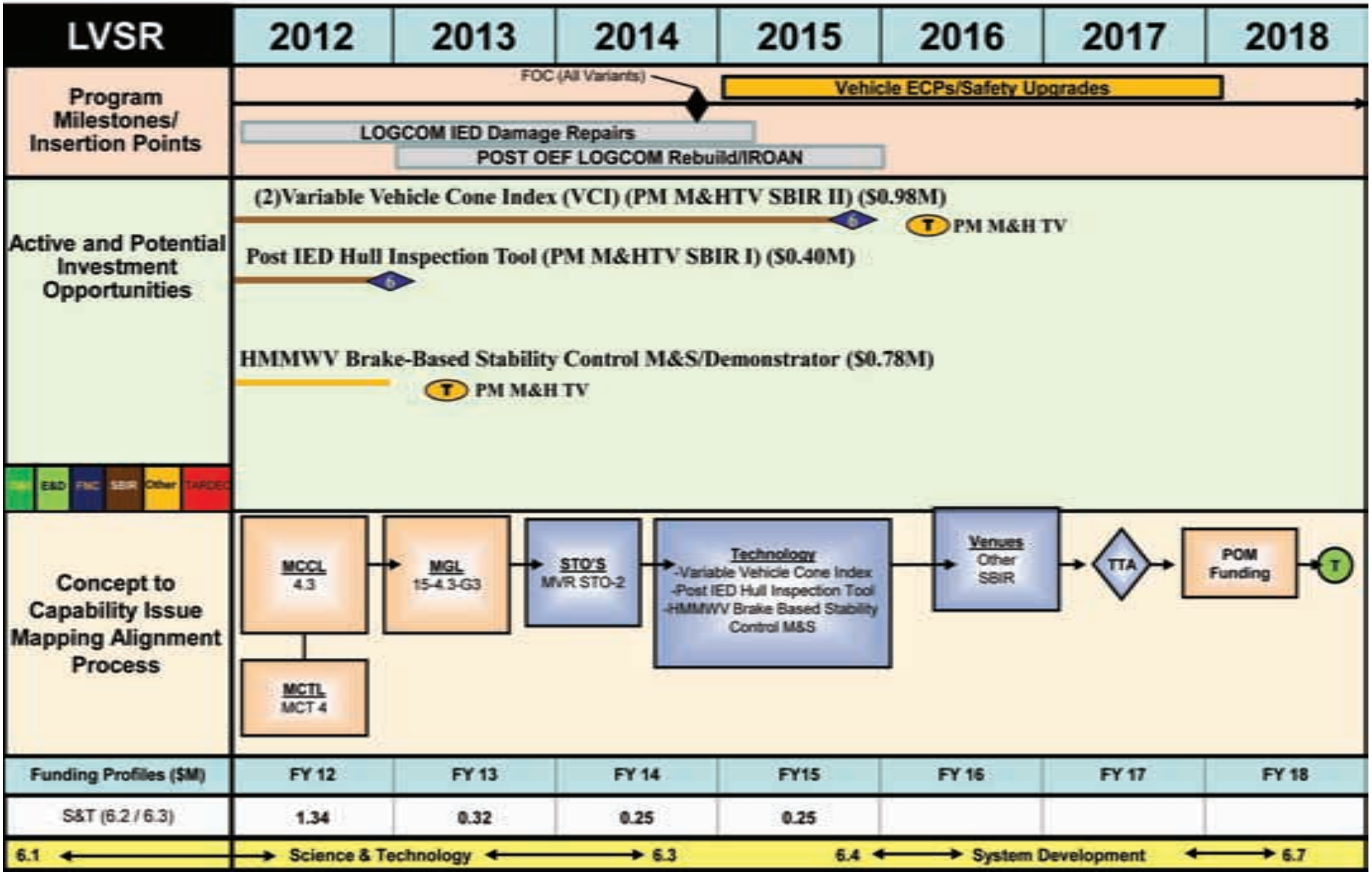
# LVSR Technical Issue #2 Increased Survivability




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 12.81 | 13.28 | 1.46 | 0.10 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

# LVSR Technical Issue #3 Safety




| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | 1.34 | 0.32 | 0.25 | 0.25 | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

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# LIGHTWEIGHT 155MM HOWITZER (LW 155)

## Program Description

A cornerstone of the PM Towed Artillery Systems (PM TAS) portfolio is the "Triple Seven," or the M777A2 Lightweight 155 mm Howitzer. Produced by BAE Systems in the United Kingdom, the Lightweight 155 is a Marine Corps led Joint program with the Army. The M777A2 replaces the Marine Corps' aged M198 155 mm weapons.

The M777A2 is capable of firing standard (unassisted) projectiles to a range of 15 miles (24 kilometers), assisted projectiles to 19 miles (30.5 kilometers), and the Excalibur munitions to ranges in excess of 25 miles (40 kilometers).

The world's first artillery weapon to make widespread use of titanium and aluminum alloys, the lightweight M777A2 can be air-lifted into remote high-altitude locations inaccessible by ground transportation and is capable of being transported by the Marine Corps' V-22 Osprey as well as medium and heavy-lift helicopters.

## Program Status

There are currently 1,071 M777 howitzers on contract: 511 for the Marine Corps and 488 for the Army, with the remaining targeted for foreign military sales. To date over 925 of these systems have been fielded. Full Operational Capability for the USMC was achieved in June 2011.

The M777 Program plans to "refresh" the system's digitized fire control system. Described as a leap-ahead, towed artillery technology, the digital fire control has transformed how Marines employ artillery.

## LW155's Top Three Program Technology Issues:

### 1. Modular Artillery Charge Systems (MACS) Compatibility with the M777A2 Howitzer

The Joint PM-TAS has pursued a dual path to address compatibility issues with the M232A1 propelling charge. The primary path was to have Benet Labs redesign the breech and Primer Feed Mechanism (PFM) components to survive MACS loading. The secondary path was to pursue a laser ignition system, which will be designed to handle the MACS load. PM-TAS has down selected and recently qualified the redesigned breech and PFM. Retrofit of these components will commence in 2013.

### 2. Power Upgrades

The power system of the digital fire control is inadequate to support the type of operations required in Afghanistan. The full combat potential of a digitized M777A2 is not being realized because of the current limitations associated with the power system. PM-TAS is currently qualifying an Improved Power Condition and Control Module, which will be retrofited to all howitzers, which will resolve the majority of these issues. PM-TAS is also working to identify a replacement for the current lead acid batteries. This Enhanced Power Pack will replace lead acid batteries, further enhancing the power system.

### 3. Thermal Warning Device Reliability

The current mercury thermal warning device used to measure the outside diameter temperature of the gun tube has accuracy and durability issues. After a critical field failure at Ft. Bragg, PM-TAS began looking into replacing the mechanical device with an electronic thermal warning device. PM-TAS and Benet Laboratories have developed an electronic replacement that is currently finishing qualification. Retrofit of all M777A2 howitzers will commence in 2013. A planned improvement will integrate the electronic version with the howitzer's Digital Fire Control System.

# Lightweight 155 Howitzer

## Mission:

Provide direct, reinforcing, and general support fires to maneuver forces. Direct support artillery for the Stryker Brigade Combat Teams. Replaces the M198 howitzer as the general support artillery for light forces in the Army. Replaces all howitzers in all missions in the USMC.

## Capability / Improvements:

Improved lethality & strategic deployment

Increased tactical mobility & reliability

Improved Survivability (decreased emplace/displace time -- shoot and scoot tactics with digital fire control)

Digitizes Army and USMC towed artillery

First artillery platform with Excalibur capability fully embedded

## Requirements:

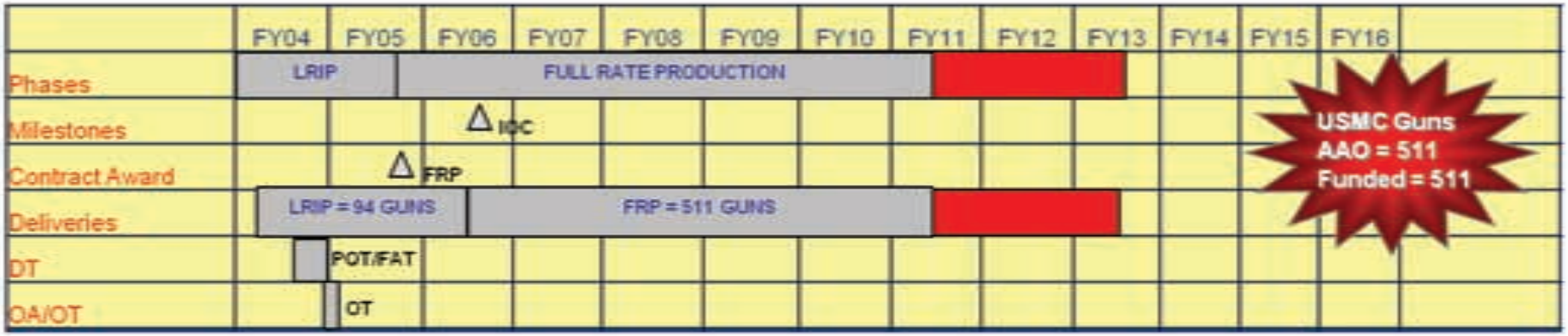
| | |
|---|---|
| Weight | 10,000 pounds or less |
| Emplace, Displace | <3 min, 2-3 min |
| Maximum Range | 30 km (assisted) |
| Rate-of-Fire | 4/min max, 2/min sustained |
| Prime Mover | Current 5T truck, FMTV, MTVR |
| Air Mobility | MV22, CH53D/E, CH47D |
| Fire Control | Digital & Optical |
| Precision Fire | Excalibur Capable & PGK Capable |

## Program Status:

- Nov 04 JORD – All KPP's Met
- Joint USMC/Army Program in Full Rate Production
- >700 Weapons Fielded to USMC and Army
- All Weapons M777A2 (Excalibur Capable)
- Used Very Effectively in OEF & OIF
- FMS Case with Canada & Australia; India FMS Case Expected FY12

| | IOC | FOC | AAO | AAO Funded | AAO Unfunded |
|---|---|---|---|---|---|
| USMC | Dec 05 | Jun 11 | 511 | 511 | 0 |
| Army | Oct 06 | Jun 14 | 542 | 488 | 54 |

# Lightweight 155 Howitzer



# LW 155 Technical Issue #1
# Modular Artillery Charge (MACS) Compatibility

| LW155 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Program Milestones/ Insertion Points | FRP → | | | | | | |
| Active and Potential Investment Opportunities | The JPMO is pursuing an initiative to address Modular Artillery Charge (MACS) Compatibility. | | | | | | |
| Concept to Capability Issue Mapping Alignment Process | MCCL 4.3 → MCGL 15-3.2-G17 → STO'S Fires STO-1 → Technology N/A → Venues → TTA → POM Funding → T<br>MCTL MCT 3 | | | | | | |

| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | | | | | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

# LW 155 Technical Issue #2 Power Upgrades

| LW155 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Program Milestones/ Insertion Points | FRP → | | | | | | |
| Active and Potential Investment Opportunities | The JPMO is pursuing an initiative to replace the power distribution system and the batteries with advanced components that would eliminate this problem. | | | | | | |
| Concept to Capability Issue Mapping Alignment Process | MCL F.02 M.01 → MCGL 15-3.2-G17 → STO'S Fires STO-1 → Technology - N/A → Venues N/A → TTA → POM Funding → T; MCTL MCT 3 | | | | | | |

| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | | | | | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

# LW 155 Technical Issue #3
# Thermal Warning Device Reliability

| LW155 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Program Milestones/ Insertion Points | FRP → | | | | | | |
| Active and Potential Investment Opportunities | The JPMO is pursuing an initiative to address Thermal Warning Device Reliability. | | | | | | |
| Concept to Capability Issue Mapping Alignment Process | MCCL 4.3 → MCGL 15-3.2-G17 → STO'S Fires STO-1 → Technology N/A → Venues N/A → TTA → POM Funding → T; MCCL 4.3 → MCTL MCT 3 | | | | | | |

| Funding Profiles ($M) | FY 12 | FY 13 | FY 14 | FY15 | FY 16 | FY 17 | FY 18 |
|---|---|---|---|---|---|---|---|
| S&T (6.2 / 6.3) | | | | | | | |

6.1 ← → Science & Technology ← → 6.3 6.4 ← → System Development ← → 6.7

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# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Aviation Technology Program (ATP) | Basic and Applied Research Program to support Navy and Marine Corps need for many fixed wing, rotary wing, and vertical take off and landing (VTOL) aircraft to perform missions across the spectrum: SEAD / strike, close air support, assault support, logistics, and anti-air, anti-surface and anti-submarine warfare. | ONR | Dependent on technology need and research opportunity. | 0-3yrs | $100K-$500K Three Years | Coordination with (by announcement): • the Army's Vertical Lift Research Center of Excellence (VLRCOE) • Rotorcraft Technology Center (NRTC) • Defense Advanced Research Projects Agency's Mission Adaptive Rotor Program | Respond to Broad Agency Announcement (BAA) | 2 to 5 | **John Kinzer** ONR, Code 35 Aerospace Research 703-696-7917 john.kinzer@navy.mil | http://www.onr.navy.mil/en/Science-Technology/Departments/Code-35/All-Programs/aerospace-research-351/Aircraft-Aviation.aspx |
| Advanced Technology Program (ATP) | To accelerate the development of innovative technologies for broad national benefit through partnerships with the private sector. | National Institute of Standards and Technology | On-going call for proposals via the Federal Register | – | – | – | Submit a Proposal to ATP in response to a solicitation /request for proposals published by ATP. | – | **Send questions to: InfoCoord.ATP@nist.gov** | http://www.atp.nist.gov/atp/charter.htm |
| Advanced Technology Support Program (ATSP) | Gives government organizations access to state-of-the-art technologies and engineering capability through leading defense industry resources and the engineering expertise of Defense Microelectronics Activity (DMEA). Tasks include: • Systems engineering, trade studies, technology assessment • Software design, analysis, coding, testing and verification • Hardware design, fabrication, assembly, testing, integration, prototyping and limited production | OSD | Ongoing by defined requirements and scope issues | – | There are three pricing arrangements available: • cost plus fixed fee • firm fixed price • time and materials. The proper price arrangement is determined on a task-by-task basis | Federal Agencies along with Prime and pre-qualified contractors. | Contact DMEA with a funded task requirement that is within the ATSP contract scope. ATSP contracts are managed by DMEA. | – | **ATSP Program Office at DMEA** (916) 231-1555, greg.davis@dmea.osd.mil or (916) 231-1575, alan.hinton@dmea.osd.mil | http://www.dmea.osd.mil/atsp.html |
| Combatant Commander Command and control Initiatives Program (C2IP) | Funds emerging or unforeseen C2 system requirements that can immediately increase mission readiness and improve combat capabilities | CJCSI 7401.02D | On-going | – | YOE O&M, DW | – | A. 1 June J-6 proposal request; 1 August Submission Deadline (anticipated)<br><br>B. Out of Cycle Calls Possible<br><br>C. May submit emergency request at any time.<br><br>D. Final approval by J6. | 6 to 8 | – | www.dtic.mil/cjcs_directives/cdata/unlimit/7401_02.pdf |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Coalition Warfare Program (CWP) | Provides competitively selected DoD projects with dedicated funds to conduct collaborative research and development with committed foreign government partners to:<br>• accelerate delivery of high-quality solutions for the warfighter<br>• improve U.S. interoperability with coalition partners<br>• strengthen global partnerships | OSD | Yearly Call August | 0-2yrs | 0-$2M<br><$1M per year Two Years | DoD Agencies<br>OSD Staff<br>Cannot accept directly from industry/foreign organizations | Projects are selected for the following fiscal year.<br>Deadlines for drafts and final proposals are found on the website.<br>Check affiliated Agency for Service-specific deadlines. | 3 to 6 | Deputy Director **Coalition Warfare Program** coalition.warfare@osd.mil | http://www.acq.osd.mil/ic/cwp.html |
| Cooperative Research and Development Agreements (CRADA) | Allows collaboration R&D between the Federal government and non-Federal partners to speed the commercialization of federally developed technology. | – | – | 0-5yrs | A formal written agreement (not a procurement contract or grant) between one or more federal laboratories and one or more nonfederal parties. The Federal laboratory provides personnel, facilities, equipment, or other resources without reimbursement (no funds) to the nonfederal party. The nonfederal party may supply the same resources, as well as funds, to Federal Labotory under the agreement. This Agreement provides the means to offer intellectual property rights and other fedral resources that would otherwise not be available to a non-federal partner in a manner consistent with the laboratory's mission. | – | – | 1 to 10 | – | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transfer-T2/Partnership-Options.aspx<br>http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transfer-T2/Partnership-Options/CRADA-handbook.aspx |
| CRADA Agreement with: US Industry Universities/Academia Non-Profit Organization State or Local Government Foreign Industry | Rapid-response S&T solutions to immediate Fleet/Force needs identified by Sailors and Marines; addresses:<br>• New applications of emerging/existing technologies<br>• Well-bounded problems with S&T solutions<br>• Impact to the individual warfighter | ONR | Accepts on-going requests | 0-1yrs | 0-$1M<br>Average project ~ 750K<br>Maximum 12 months to complete<br>Goal: prototype demo within 15 to 18 months of request | US Navy and Personnel only<br>Solution developed by Naval Research Enterprise (NRE) or National LabsCommercial &/or academic partners are common | Request submitted by E4 - O4 Sailor/Marine or ONR Science Advisor to the ONR TechSolutions office | 1 to 6 | **ONR, Office of Innovation** (703) 696-6774 techsolutions@onr.navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/office-innovation/tech-solutions-innovation.aspx |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| CRADA Agreement with: US Industry Universities/ Academia Non-Profit Organization State or Local Government Foreign Industry | CRADA agreement allowing Non-Federal parties to collaborate with the Navy individually or together on: • research • development • engineering, or other tasks | OSD | A Federal Laboratory and a Non-federal party share a mutual research interest. | 0-3yrs | 0-$3M <$1M per year, more funding may be allowed with appropriate review. Duration up to three years, may be extended by amendment with appropriate review. | Navy with: US Industry Universities/Academia Non-Profit Organization State or Local Government Foreign Industry. Not authorized to do CRADAs with Foreign Governments. | Title 15 U.S.C. 3710a NAVAIRWARCENACDIVINST 5700.1, CRADA PROCESS Contact the NAWCAD Business & Partnership Office | 3 to 6 | **Navy POC: Dorothy Vincent** ONR 03T Technology Transfer Program Manager (703) 696-4792 dorothy.vincent@navy.mil **OSD POC: Cynthia Gonsalves** Acting Director, Office of Technology (703) 607-5315 cynthia.gonsalves@osd.mil | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transfer-T2/Partnership-Options.aspx |
| Defense Exchange Agreement (DEA) | Government-to-government subordinate agreement that provides a mechanism for the exchange of Research and Development information to: • create closer alliances • marshall U.S. and friendly foreign nations' technological capabilities • enhance the security of the free world • improve interoperability and standardization and identify cooperative opportunities | NIPO | Anytime, it usually takes about 12 months to establish a DEA | – | Any amount provided during any fiscal year in relationship to other funding Agreements. Valid for a period of five years Eligible to Renew Data exchange is: • "generic", not platform specific • subject to disclosure guidelines (case-by-case) basis | Navy, US Government Agencies and Foreign Governments | Technologists in US and partner country develop specific list of mutual interests according to Navy International Program Office (NIPO guidelines). NAVAIR recommends a Technical Program Officer for NIPO following the DEA Annex guidelines which specify: • the scope • classification • authorities • channels of correspondence • establishments | 2 to 4 | **Michael Locke** NIPO (202) 443-6032 michael.locke@navy.mil | http://www.nipo.navy.mil/faqs#2 |
| Discovery & Invention (D&I) | Fund Research to: • Develop Naval-relevant fundamental Knowledge • Provide the basis for future Navy and Marine Corps systems and • Maintain the health of the Defense Scientist and Engineer workforce | ONR | Yearly | 0-2yrs | Estimated $200K Estimated 2 years BA1 or 2 Amount and period of performance of each selected proposal may vary depending on research area and the technical approach | Varies Depending on Source | ONR Departments issue planning letters soliciting white papers via a Broad Agency Announcement (BAA) or yearly calls for: • University Research Initiatives (URI) • In-House Laboratory Independent Research (ILIR/IAR) • Defense Research Science (DRS) | 1 to 4 | **Dr. Michael Kassner** Director of Research, ONR (703)696-6769 Michael.kassner@navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/office-research-discovery-invention.aspx |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Environmental Security Technology Certification Program (ESTCP) | Fund research and demonstration projects that respond to DoD's high-priority environmental requirements. Projects demonstrate and validate promising innovative technologies and methodologies. | Fund research and demonstration projects that respond to DoD's high-priority environmental requirements. Projects demonstrate and validate promising innovative technologies and methodologies. | Annual | 1-3yrs | $100K-$1M<br><br>Projects are led by researchers from industry, academia, and government labs. Annual solicitations are released in the forms of Broad Agency Announcements (BAA) for private sector organizations and Calls for Proposals for Federal organizations. | – | – | 5 to 7 | – | http://www.serdp.org/About-SERDP-and-ESTCP/About-ESTCP |
| ESTCP Federal | Demonstrate and validate the most promising innovative environmental research and technologies that target DoD's most urgent environmental needs and are projected to pay back the investment through cost savings, improved efficiencies or improved outcomes. | OSD | Yearly Oct Call | 2-5yrs | $100K-$1M<br><br>Cost and environmental performance data will be collected during the demonstration(s) to allow realistic estimates to be derived for full scale implementation of the technology at the demonstration site and other DoD sites. Projects are typically 2-5 years in length and funding level varies depending on scope of effort. | Researchers from DOD Agency labs | All proposals must respond to a Topic Area associated with the solicitation.<br><br>Awardees are selected through a multi-stage review process, including a brief, pre-proposal, full proposal, oral presentation (based upon the pre-proposal evaluation) ESTCP reserves the right to select for award, any, all, or none of proposals received. | 0 to 9 | SERDP and ESTP Office<br>**Executive Director**<br>Phone: (703) 696-2120<br>**Deputy Director**<br>Phone: (703) 696-3826 | http://www.serdp.org/Funding-Opportunities/ESTCP-Solicitations/DoD-Proposal-Instructions |
| ESTCP Non-DoD Federal Agencies | Demonstrate and validate the most promising innovative environmental technologies from other Federal Agencies that target DoD's most urgent environmental needs and are projected to pay back the investment through cost savings, improved efficiencies or improved outcomes. | OSD | A DoD Laboratory and a Non-DoD Federal party share a mutual research interest. | 2-5yrs | $100K-$1M<br><br>Cost and environmental performance data will be collected during the demonstration(s) to allow realistic estimates to be derived for full scale implementation of the technology at the demonstration site and other DoD sites | Researchers from Non-DOD Agency labs | A Broad Agency Announcement (BAA) is released for Private Sector organizations. | 0 to 9 | SERDP and ESTP Office<br>**Executive Director**<br>Phone: (571) 372-6378<br>**Deputy Director**<br>Phone: (571) 372-6379 | http://www.serdp.org/Funding-Opportunities/ESTCP-Solicitations/Non-DoD-Federal-Proposal-Instructions |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| ESTCP Non-Federal | Enable promising research and technologies to receive regulatory acceptance and be fielded and commercialized more rapidly by creating partnerships between private sector experts, responsible DoD organizations, and the regulatory community. | OSD | A DoD Laboratory and a Non-Federal party share a mutual research interest. | 2-5yrs | $100K-$1M<br><br>Cost and environmental performance data will be collected during the demonstration(s) to allow realistic estimates to be derived for full scale implementation of the technology at the demonstration site and other DoD sites | Researchers from industry and academia | A Broad Agency Announcement (BAA) is released for Private Sector organizations. | 0 to 9 | SERDP and ESTP Office<br>**Executive Director**<br>Phone: (571) 372-6378<br>**Deputy Director**<br>Phone: (571) 372-6379 | http://www.serdp.org/Funding-Opportunities/ESTCP-Solicitations/Non-DoD-Federal-Proposal-Instructions |
| Federally Funded R&D Centers (FFRDC) | Studies/Trade-offs of broad Naval operation and composition | CAN, APL, etc. | On-going | _ | _ | _ | Case by case negotiation | Varies | _ | http://www.nsf.gov/statistics/ffrdclist/ |
| Fleet Experimentation Program (FLEX) Formerly Sea Power 21 Government Initiatives | Fleet enabler element to test-drive new capabilities. Temporarily deploys advanced capabilities on platforms to collect real-world performance data and feedback from fleet users during an underway experimentation period. Insights gained throughout the experiment will be provided to U.S. Navy decision makers as recommendations regarding future capability investments for the fleet. | U.S. Fleet Forces Command | Annual Call Down select late April/early May | _ | FLEX funding (~$1M) of the experiment planning, design, data collection and analysis comes from appropriated Navy experimentation funds. The funding for the development and testing of the individual technologies comes from the individual technology sponsors. | DoD and other government Agencies | The process begins with the release of the Request for Initiatives (RFI) message that provides the focus areas and military problems that will serve as the foundation for respective TW experiment. Government initiative down selection usually occurs late April to early May. Notification of selection can be expected soon thereafter. | 4 to 6 | **CDR Mike Frantz, USFF FLEX**<br>(757) 443-9637<br>michael.frantz@navy.mil<br><br>**NWDC POC:**<br>Jeremy Tyler, British liaison,<br>(757) 443-9617<br><br>Dean Oyler,<br>(757) 443-9619<br><br>USFF only has oversight responsibilities<br><br>NWDC has more specific responsibilities. | http://www.public.navy.mil/usff/tridentwarrior/Pages/default.aspx |
| Fleet Experimentation Program (FLEX) Formerly Sea Power 21 Industry Initiatives | Fleet enabler element to test-drive new capabilities. Temporarily deploys advanced capabilities on platforms to collect real-world performance data and feedback from fleet users during an underway experimentation period. Insights gained throughout the experiment will be provided to U.S. Navy decision makers as recommendations regarding future capability investments for the fleet. | U.S. Fleet Forces Command | Annual Call (Jan – March) for Industry First quarter of calendar year | _ | FLEX funding (~$1M) of the experiment planning, design, data collection and analysis comes from appropriated Navy experimentation funds. The funding for the development and testing of the individual technologies comes from the individual technology sponsors. | Industry | Industry proposals for are solicited via a commercial area announcement (CAA). The CAA is generally issued during the first quarter of each calendar year (January – March). Industry responses to the CAA will be accepted up until the deadline published in the released document. After this deadline has passed, no further commercial submissions will be accepted. The format of responses and the requested information from each commercial firm will be identified within the CAA. The CAA contains a specific point of contact to notify in any case there are technical difficulties encountered in submitting responses via the site itself. This point of contact must be used in order to ensure technical issues are addressed appropriately. Submissions received through other government representatives will not be accepted. | 4 to 6 | **CDR Mike Frantz, USFF FLEX**<br>(757) 443-9637<br>michael.frantz@navy.mil<br><br>**NWDC POC:**<br>Jeremy Tyler, British liaison,<br>(757) 443-9617<br><br>Dean Oyler,<br>(757) 443-9619<br><br>USFF only has oversight responsibilities<br><br>FLEX. NWDC has more specific responsibilities. | http://www.public.navy.mil/usff/tridentwarrior/Pages/default.aspx |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Foreign Comparative Test (FCT) | Supports the warfighter by leveraging mature equipment and technologies from allied and coalition partner nations to satisfy U.S. defense requirements by:<br>• Rapidly fielding quality military equipment<br>• Eliminating unnecessary duplication of research, development, test, and evaluation<br>• Reducing life cycle or procurement costs<br>• Enhancing standardization and interoperability<br>• Promoting competition by qualifying alternative sources<br>• Improving the U.S. military industrial base | OSD/AT&L | OSD yearly call November | 1-2yrs | $200K-2M<br><br>Varies; total program is ~$32.8M 12 to 18 months | Government-to-Foreign Industry | ONR issues the call to each major Navy/Marine Corps Systems Command (SYSCOM);<br>NAVSEA<br>NAVAIR<br>SPAWAR<br>Marine Corps<br>OSD creates a prioritized list in early June | 7 to 9 | **ONR FCT Program Manager**<br>DoN_FCT_Contact @onr.navy.mil<br><br>**OSD**<br>(571) 372-6803<br>FCT@osd.mil | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transition-Initiatives-03TTX/Foreign-Comparative-Testing-FCT.aspx<br><br>http://www.acq.osd.mil/cto<br><br>http://www.acq.osd.mil/cto/FCT_Overview_Mar2012.pdf |
| Future Naval Capabilities (FNC) | Provides the best technology solutions to stated OPNAV requirements by bundling discrete but interrelated S & T products that deliver a distinctly measurable improvement to align with the pillars of the Chief of Naval Operation's and the Commandant of the Marine Corps' vision for the future-Naval Power 21-and to focus on providing Enabling Capabilities (ECs) to close warfighting gaps. | ONR | ONR yearly call April/May | 3-5yrs | 0-$30M<br><br>Each product ~$4.25M<br><br>Each program ~$20-$30M | Each major Navy/Marine Corps Systems Command | A three-star Navy and Marine Corps Board of Directors, the Technical Oversight Group, approves the FNCs based on their contribution to closing S&T capability gaps. | 3 to 6 | **Mr. Steve Smolinski**<br>ONRA<br>(703) 696-0000<br>Steven.smolinski@navy.mil | http://www.onr.navy.mil/en/Science-Technology/Directorates/Transition/Future-Naval-Capabilities-FNC.aspx |
| High Energy Laser Joint Technology Office (HEL-JTO) | Advocate and execute a High Energy Laser technology investment strategy for the Department of Defense. Funds:<br>• theoretical, computational, and experimental investigation<br>• modeling and simulation | HEL-JTO/AFOSR | Annual call Mar/April | 2-4yrs | 0-$1M per year Military-unique BA 1-3 | Government University and Industry laboratories | Issued by Broad Agency Announcement (BAA) JTO developed integrated business process that includes strategy development, review, and validation by higher authorities within DoD. JTO integrates and coordinates an investment strategy for the Technology Area Working Groups to develop and prioritize in response to requirements and opportunities (i.e., technology assets). | 2 to 6 | **Ms. Nancy Wilson**<br>nancy.wilson@jto.hpc.mil<br>(505) 248-8200 | http://www.grants.gov/search/search.do?mode=VIEW&oppId=52008 |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Independent Applied Research (IAR) | Mechanism to fund applied (BA 2) in-house defense:<br>• applied laboratory research<br>• developing and maintaining scientific workforce | ONR/NAVAIR | Annual Call May | 0-3yrs | $100k-$300K<br>NTE $110k per year<br>NTE 3 years<br>(some exceptions considered) | Warfare Center scientists and engineers | Proposals, coordinated with T-Codes, submitted to the naecto@navy.mil mailbox<br>Rated and selected by a review panel comprised of the NAE CTO, S&T IPT, and selected SMEs | 1 to 3 | **Reginald G. Williams, PhD**<br>ONR, Code 03R<br>Director, N-STAR<br>(703) 696-0611<br>reginald.g.williams@navy.mil | - |
| In-House Laboratory Independent Research (ILIR) | Mechanism to fund basic applied (BA 1) in-house defense:<br>• basic laboratory research<br>• developing and maintaining scientific workforce | ONR/NAVAIR | Annual Call May | 0-3yrs | $100k-$300K<br>NTE $110k per year<br>NTE 3 years<br>(some exceptions considered) | Warfare Center scientists and engineers | Proposals, coordinated with T-Codes, submitted to the naecto@navy.mil mailbox<br>Rated and selected by a review panel comprised of the NAE CTO, S&T IPT, and selected SMEs | 3 to 4 | **Reginald G. Williams, PhD**<br>ONR, Code 03R<br>Director, N-STAR<br>(703) 696-0611<br>reginald.g.williams@navy.mil | - |
| Innovative Naval Prototype (INP) | To design, build, and demonstrate prototypes of innovative (high BA 2 or BA 3) technology. Focus on high-risk/high-payoff opportunities emerging from the D&I portfolio that can significantly impact Naval capabilities if technology can mature. | ONR | Yearly Call October | 4-8yrs | $150-$200M<br>4-8 years | Anyone can propose an INP. | Approved and overseen by the Naval S&T Corporate Board (Assistant Secretary of the Navy for Research, Development and Acquisition (RD&A), Assistant Commandant of the Marine Corps and Vice Chief of Naval Operations) Go-No Go Reviews based on defined technical goals at 2 to 3 year intervals. | 5 to 7 | **Dr. Larry Schuette**<br>Director of Innovation, ONR<br>(703) 696-7118<br>larry.schuette@navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/office-innovation/innovative-naval-prototypes.aspx |
| International Program Agreement (PA) | Collaborative allied technology agreement designed for cost-shared demonstrations | NIPO/NAVAIR | Depending on complexity this takes from 9-12 months. | 2-3yrs | 0-$10M<br>Time period is case-by-case, usually 2-3 years although broad subjects can be longer. Besides funding exchange, can include personnel exchange, training, and loan of equipment. | PAs are established on a government-to-government basis. Approval is granted based on an acceptable Summary Statement of Intentions (SSOI). | Proposed Program Arrangements are developed at the Competency or PMA level and discussed with ASR-1.4. A Program Officer (PO) is recommended. NIPO negotiates and approves the agreement. | 5 to 7 | **Michael Locke**<br>NIPO<br>(202) 433-6032<br>michael.locke@navy.mil | http://www.nipo.navy.mil |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
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| Joint Aircraft Survivability Program (JASP) | Fund projects that complement Service survivability programs to develop and test survivability technology and assessment methodology. Research interests are organized into three subgroups: • Susceptibility Reduction • Vulnerability Reduction • Survivability Assessment (Modeling & Simulation). | OSD | Yearly Call September Proposals due: December | 0-3yrs | 0-$1.5M <$500K per year <3 years | Joint and Service staffs, Other Government Agencies Industry | After submission to the Joint Aircraft Survivability Office (JASPO). Proposals will be reviewed by the appropriate JASP subgroup and committee | 1 to 6 | **Darnell Marbury** Business Analyst Joint Aircraft Survivability Program Office (703)604.0817 darnell.marbury@navy.mil | https://jaspo.wpafb.af.mil |
| Joint Concept Technology Demo (JCTD) | The goal of the JCTD Program is to match Combatant Commander (COCOM) needs with S&T innovation and rapidly demonstrate and transition capabilities. | OSD | Yearly Call Submit proposals NLT March 29, 2013 for participation in May 2013 CNB briefing. | Aim to be completed within two years, although longer duration projects will be considered. | 0-$10M ~$10M of S&T funding plus in-kind funding from sponsors | Federal Service programs. Proposals must have a COCOM as the primary sponsor and support joint, coalition, or inter-agency capabilities. | All JCTD information: • White Papers • updates • briefs • quads submitted to the Knowledge and Information Management System (KIMS) | 6 to 9 | **Dan Petonito** (703) 697-4038 daniel.petonito.ctr@osd.mil | http://www.acq.osd.mil/rfd/DOCS/Call_for_FY14_JCTD_Proposals.pdf |
| Joint Insensitive Munitions Technology Program (JIMTP) | Funds applied research associated with improving the: • lethality • reliability • safety and survivability of munitions and weapon systems; and develop joint enabling technologies | OSD | Annual call in late Spring. | 1-5yrs | $100k-$2.5M 6.2 & 6.3 PE's. Within Navy, transitions possible to 6.4 JMAD and JMITP. | Under the JIMTP, investments are focused on specific munition areas that have been identified by the S&T community and validated by the technology needs identified in the JN Strategic Plans submitted by the Program Executive Officers (PEOs). These five munitions areas are: 1) high performance rocket propulsion, 2) minimum smoke rocket propulsion, 3) large caliber gun propulsion, 4) anti-armor warheads, and 5) blast and fragmentation warheads. | JIMTP Program Manager promulgates JN needs received from NAVAIR Program Managers and solicits solution demos from government & industrial sources | 4 to 7 | **David Olson, OSD** (703) 693-9041 david.olson@osd.mil **Bill Rupert, Army** (410) 278-3441 | A government sponsor must provide/grant access to the DEFENSE SYSTEMS AND TECHNOLOGIES KNOWLEGE ONLINE (DTSTK) website |
| Marine Corps Technology Division | To identify and evaluate promising technologies that support warfighter Needs. | MCCDC Marine Corps Warfighting Lab | On-Going | _ | _ | _ | _ | _ | mcwlpao@usmc.mil | http://www.marines.mil/unit/mcwl/Pages/Introduction.aspx/ |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
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| Memorandum of Understanding or Memorandum of Agreement (MOU/MOA) | Allows collaboration R&D between the Federal government and other Federal Agencies (i.e. DARPA) to collaborate with the Navy individually or together on:<br>• research<br>• development<br>• engineering, or other tasks | – | A Federal Laboratory and other Federal Agency share a mutual research interest. | 0-5yrs | An agreement between Navy and other Federal Agencies (i.e. DARPA) to establish the organizational links in technology transfer efforts. | – | – | 1 to 10 | – | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transfer-T2/Partnership-Options/CRADA-handbook.aspx |
| Memorandum of Understanding or Memorandum of Agreement (MOU/MOA)) with other Federal Agency Agreement | MOU/MOA agreement allowing other Federal Agencies (i.e. DARPA) to collaborate with the Navy individually or together on:<br>• research<br>• development<br>• engineering, or other tasks | DoD/Partner | – | 0-3yrs | 0-$3M Max<br>< $1M per year for up to three years; may be extended up to another two years by amendment with appropriate review | Navy with other Federal Agency | Contact the NAWCAD Business & Partnership Office | 3 to 6 | – | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transfer-T2/Partnership-Options/CRADA-handbook.aspx |
| National Labs (Draper, Sarnoff, ORNL, etc.) | Partnering (MOU), collaboration, in-kind support | Vaious | On-going | Case by case | Case by case | Case by case | – | Varies | – | Http://www.dmoz.org/Regional/North_America/United_States/Government/Executive_Branch/Department_of_Energy/DOE_National_Laboratories/ |
| Navy International Cooperative Program (NICOP) | A mechanism to encourage international S&T cooperation in areas of interest to the Naval Research Enterprise (NRE) by providing seed funding when ONR Headquarters or other organizations within the NRE commit to out-year program funding. | ONR/NAVAIR | Applications are accepted on a continuous basis. | 1-2yrs | 0-$100K Max<br>From ONR to:<br>• promote collaboration<br>• new ideas<br>• new funding<br>• new participants. | Scientists and engineers within the NRE | Two-stage process including both white papers and full proposals (downloaded from ONR website) submitted electronically to:<br>• ONRG grant administrator<br>• copy to ONR Global associate director | 2 to 6 | ONR Global grant administrator : ONRG.GrantProposals@mail.mil | http://www.onr.navy.mil/Science-Technology/ONR-Global/funding-opportunities/NICOP.aspx |
| NESDI | Invest in innovative and cost-effective technologies, processes, materials, and knowledge that enhance Fleet readiness and weapons system acquisition programs and: Support Fleet readiness by minimizing operational risk, constraints, and costs while ensuring shore-based environmental stewardship and regulatory compliance. | CNO N45<br>NAVFAC | Annually Solicitation Announcment issued by mid-October | – | Scope and focus of NESDI-sponsored projects are broad and diverse. Average total funding: $200K to $300K Typical Duration: 2 to 3 years | Limited to personnel at naval facilities to retain in-house capabilities and subject matter expertise. (specialized or unique skills are obtained by reaching out to academic and contractor communities on a project-by-project basis) | Proposals must address high priority needs typically funneled by representatives from the Navy's Functional Working groups (FWG). A guide for submitting and evaluating need is provided on the website. The NESDI website is the main access point for submittal of environmental needs, pre-proposals and full proposals | 6 | Leslie A. Karr, P.E.<br>NAVFAC<br>805-982-1618<br>leslie.karr@navy.mil | http://www.nesdi.navy.mil/ |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
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| Navy Manufacturing Technologies (ManTech) | Provides for the development of enabling manufacturing technology and the transition of this technology for the production and sustainment of Navy weapon systems to support the Fleet | ONR | Annually | 0-3yrs | 0-$3M<br>Two years | • defense contractors<br>• the Naval Research Enterprise<br>• Navy acquisition Program Offices<br>• academia | https://www.onr.navy.mil/Sci-ence-Technology/Directorates/Transition/Manufacturing-ManTech.aspx | 5 to 7 | **DoD**<br>dodmantech@drc.com<br>**John Carney**<br>ONR Office of Transition ManTech<br>(703) 696-0352<br>john.a.carney@navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Manufacturing-ManTech.aspx |
| Navy Manufacturing Technologies (ManTech) Centers of excellence | The Navy ManTech Program executes its projects primarily through its Centers of Excellence. The Centers of Excellence were established as focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia and the Naval Research Enterprise | – | – | 1-3yrs | $500K-$2M<br>The Centers of Excellence:<br>• Execute projects; manage project teams<br>• Serve as corporate expertise in technological areas<br>• Collaborate with acquisition program offices / industry to identify and initiate manufacturing needs<br>• Develop and demonstrate manufacturing technology solutions for identified Navy requirements<br>• Provide consulting services to Naval industrial activities and industry<br>• Facilitate transfer of developed technologies<br>The Navy Program currently has nine centers of excellence. | – | The Navy ManTech Program is part of the Department of Defense (DoD) ManTech Program, managed by the Office of the Deputy Under Secretary for Defense, Advanced Systems & Concepts, which has oversight of the ManTech programs of the Services and the Defense Logistics Agency (DLA). These organizations, together with the Missile Defense Agency (MDA), coordinate their programs through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP) consisting of the ManTech directors of the Services, DLA, and MDA with advisory representation from the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies. | 5 to 7 | – | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Manufacturing-ManTech/Center-Excellence.aspx |
| NIPO Pre-International Compliance Division (ICAD) Funding | To support exploratory efforts to determine if DON should enter into a new international cooperative project | NIPO/ONR | Anytime | 0-1yr | $5K-$50K for cost of researching and developing a Summary Statement of Intentions (SSOI)--including travel. | SYSCOMS and Program Offices | Program Office (or SYSCOM) completes funding request and forwards with flag endorsement to NIPO. NIPO forwards to OPNAV (N8F) to verify support and funding. NIPO directs ONR to issue funding to requester. NIPO assigns a negotiator to assist with international agreement process (assists in drafting SSOI) | 2 to 6 | **Carmen Farro**<br>Navy IPO<br>(202) 433-5908<br>carmen.farro@navy.mil | – |
| NISE Work Force Development (WFD) | Fund in-house workforce development that improves the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise.<br>Proposal categories include Higher Education, Strategic Rotations, Training Opportunities, and Strategic Growth/ Capability Development | ONR/NAVAIR | Bi Annual Call Oct and March | 1-3yrs | Total $500,000<br><br>Varies based on scope/ type of project | Warfare Center scientists and engineers | Proposals, coordinated with the T-Codes, submitted to the naecto@navy.mil mailbox. Rated and selected by a review panel comprised of the NAE CTO and senior government leaders | 2 to 7 | **Reginald G. Williams, PhD**<br>ONR, Code 03R<br>Director, N-STAR<br>703-696-0611<br>reginald.g.williams@navy.mil | – |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/DSD POC | WEBSITE |
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| NSE Basic and Applied Research (BAR) | Fund in-house innovative basic (BA 1) and applied (BA 2) research conducted at the defense laboratory that supports military missions | ONR/NAVAIR | Annual Call: May | 0-3yrs | Total $150K-$750K<br>$50 - $250k per year<br>NTE 3 years (some exceptions considered) | Warfare Center scientists and engineers | Proposals, coordinated with T-Codes, submitted to the navsbir@navy.mil mailbox. Rated and selected by a review panel comprised of the NAE CTO, S&T IPT, and selected SMEs. | 1 to 3 | **Reginald G. Williams, PhD**<br>ONR, Code 03R<br>Director, N-STAR<br>703-696-0611<br>reginald.g.williams@navy.mil | – |
| NSE Transition | Fund in-house programs to support the transition of technologies developed by the defense laboratory into operational use | ONR/NAVAIR | Annual Call: September | 1-3yrs | NTE $500k total project funding<br>1 – 3 years (some exceptions considered) | Warfare Center scientists and engineers | Proposals, coordinated with T-Codes, submitted to the navsbir@navy.mil mailbox. Rated and selected by a review panel comprised of the NAE CTO, S&T IPT, and selected SMEs. | 3 to 5 | **Reginald G. Williams, PhD**<br>ONR, Code 03R<br>Director, N-STAR<br>703-696-0611<br>reginald.g.williams@navy.mil | – |
| Other Government Agencies (NASA/n DARPA, CIA, etc...) | Partnering, collaboration, or direct funding. | Various. See website for complete list. | Varies | Varies | Varies | Varies | Varies | Varies | Varies | http://www.usa.gov/directory/federal/index.shtml |
| Patent License Agreement with NAWCAD | Federal Government's technology transfer policy to promote the utilization and commercialization of inventions that arise from agency-supported research and development through a PLA. | Normally, a PLA will be granted to companies agreeing to manufacture the product(s) substantially in the U.S.A. A PLA can be exclusive, partially exclusive, or non-exclusive. | Anytime | Project Dependent | Project Dependent | N/A | The non-Federal party must satisfy a number of conditions.They include a satisfactory development or marketing plan, as well as information about its ability to implement the plan. The non-Federal party must commercialize the invention within a specified period of time and must continue to make the benefits of the invention reasonably accessible to the public. The company must report its utilization of the patent periodically to the Federal agency holding the patent. The Federal Government always retains an irrevocable royaltyfree right to practice the invention. | – | – | http://www.navair.navy.mil/nawcad/index.cfm?fuseaction=home.content_detail&key=8A8456C4-FCF3-46C5-893F-B27038E85032 |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Quick Reaction Fund (QRF) | Focus is on shorter cycle time Conventional Forces and responding to emergent needs during the execution years that take advantage of breakthroughs in rapidly evolving technologies | OSD | Proposals may be submitted any time during the year as opportunities and need arise | 0-1yr | $100K- $1M Max | [illegible] | QRF takes advantage of technology breakthroughs in rapidly evolving technologies. It provides Components, Combatant Commanders and Force Providers an opportunity to capitalize on emergent technology and to rapidly field-test promising new technology prototypes that can immediately have an impact on military operations.Criteria QRF initiatives are limited to those that will deliver a military prototype application within 6-12 months of being funded. Projects funded thus far are generally in the dollar range from several hundred thousand to several million dollars. | 7 to 9 | **Glenn Fogg** Director, Rapid Reaction Technology Office 703-746-1343 glenn.fogg@osd.mil http://www.acq.osd.mil/rrto/rrto.html Also, can email QRF_Contact@onr.navy.mil | http://www.onr.navy.mil/en/Science-Technology/Directorates/Transition/Technology-Transition-Initiatives-03TTX/Quick-Reaction-Fund-QRF.aspx |
| Rapid Deployment Capability Program (RDC) | For new or emerging threats (or potential threats) or safety issues. Allows fielding without acquisition or requirements document. Must identify the threat or safety issues, requirements, logistics, reasons, etc. RDC number simply allows bypassing normal acquisition process; however, if intent is to modify or upgrade system, then must become an ACAT program. | See SECNAVINST 5000.2C | — | — | No Funding - 3502S not required once approved => funding must be identified. | — | A. Program Sponsor or Requirements Division applies to OPNAV N8/CMC.<br><br>B. N8/CMC validates and forwards to ASN(RD&A)<br><br>C. ASN/RDA then approves and signs RDC number. | 6 to 8 | — | http://acquisition.navy.mil/home/policy_and_guidance/secnavinst_5000 |
| Rapid Development and Deployment (RDD) | To provide an environment and process for rapid development and fielding of prototype solutions to meet urgent needs in the Global War on Terrorism (GWOT). | OSD | — | 0-1yr | $100K-$500K<br><br>Capability can be fielded within 270 days | — | The appropriate requirements organization (i.e., DONO [N8] or OS, PEODC) will submit RDD proposals to the Technology Oversight Group's (TOG) sub-committee, the Rapid Development and Deployment Committee (RDDC). The NaSL then identifies and evaluates alternative solutions, and provides recommendations to the RDDC for decision. For approved projects, the NaSL will select appropriate technologies, and develop, integrate, test, and deliver fieldable prototypes with the essential logistics for use by the warfighter within 270 days. End users will be involved throughout the process as part of the virtual team. | 7 to 9 | CDM&A/SERSYSCOM<br><br>**Executive Agent for the NaSL** RDD_contact@onr.navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transition-Initiatives-03TTX/Rapid-Development-Deployment-RDD.aspx |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/DSD POC | WEBSITE |
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| Rapid Innovation Fund (RIF) | The Rapid Innovation Fund (RIF) is designed to transition innovative technologies, primarily from small businesses, that resolve Department of Defense operational challenges. | OSD | Annual BAA Issued early September | 24 months Max | $3M Max | Industry and Academia Navy laboratories may team with other responsible sources from academia and industry but are not eligible to receive awards. | A total of four Broad Agency Announcements (BAA), including one from each Military Department and one from the Office of Small Business Programs (OSBP), will be used to solicit white papers and technical proposals for RIF funding. Upon release, each of these BAAs will remain open for a minimum of 60 days. | 5 to 7 | **Bob Smith** (703) 696-7954 robertbsmith@navy.mil | ONR 'BAA list': http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx<br><br>RIF Submission Website: http://www.dodsbir.net/rif/SignIn.asp |
| Rapid Reaction Fund (RRF) | Focus is on emerging technologies addressing irregular warfare capabilities with the goal of leveraging the DoD science and technology base, other federal departments, academia and industry to accelerate fielding of affordable, sustainable capabilities and concepts to counter emerging threats | OSD | Proposals may be submitted any time during the year as opportunities and need arise | 6 to 18 months Capabilities are developed and fielded through a supporting spiral approach | Varies | Varies | Varies | 7 to 9 | **Glenn Fogg** Director Rapid Reaction Technology Office 703 746-1343 glenn.fogg@osd.mil | http://www.dtic.mil/dtic/stresources/researchinprogress/rrto_desc.html |
| Reduction in Total Ownership Costs (RTOC) | To achieve readiness improvements in weapon systems and to reduce operations and support costs. | OSD | Annual Call October | 0-3yrs | $5M Max<br><$3M any fiscal year<br><3 years | Partnerships involving Program Managers:<br>• programming, budgeting and requirements communities<br>• basic and applied technology base developers<br>• test and evaluation communities | The Deputy Secretary of the Navy Acquisition and Logistics Management memorandum promulgates to the SYSCOMs, PEOs and DASNs the Director of Defense Research and Engineering Call for R-TOC Projects | 7 to 7 | — | https://acquisition.navy.mil/rda/home/acquisition_one_source/reduction_of_total_ownership_cost |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| SBIR Phase I Start up | Feasibility study to evaluate the scientific and technical merit of an idea | ONR | Tri Annual Solicitation<br>November<br>April<br>July | 0- 5yr | $150K Max<br>$80K with $70K option<br>6 months<br>Competitive Solicitation | Small Businesses | Eligibility<br>Determine topic feasibility and scientific or technical merit in 3 phases.<br>Method<br>Topics:<br>• endorsed by PMAs<br>• reviewed by T-Codes<br>• selected by PEOs,<br>• contracts created & monitored by SBIR Office | 1 to 5 | **John Williams**<br>ONR Director, Navy SBIR Programs<br>(703) 696-0342<br>john.williams6@navy.mil | http://www.navysbir.com/ |
| SBIR Phase II | Expand on the results of and further pursue the development of Phase I. | ONR | At completion of Phase I | 0-2yrs | $750K Max<br>24 months<br>Government Selected | Small business that has successfully completed Phase I | – | 2 to 5 | **John Williams**<br>ONR Director, Navy SBIR Programs<br>(703) 696-0342<br>john.williams6@navy.mil | http://www.navysbir.com/ |
| SBIR Phase III | Commercialization of the results of Phase II | ONR | As Phase III funds are identified | 1-3yrs | $3M Max<br>$3Unlimited Unlimited time<br>Funding can come from the Government or Private Sector | Any SBIR company that has identified non-SBIR source of funds | – | 6 to 10 | **John Williams**<br>ONR Director, Navy SBIR Programs<br>(703) 696-0342<br>john.williams6@navy.mil | http://www.navysbir.com/ |
| SEED Federal | Designed to investigate innovative approaches that entail high technical risk or require supporting data to provide proof of concept | OSD | Call issued in October<br>Proposals due in March | 0-1yr | $150K Max<br>One year duration | Federal organizations, including Government-Owned Contractor-Operated (GO-CO) research laboratories | Proposals submitted to the SERDP Office in response to a BAA and Statement of need (SON) | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | www.serdpestcp.org/Funding-Opportunities/SERDP-Solicitations/Federal-SEED-Proposal-Instructions |
| SEED Non-Federal | Designed to investigate innovative approaches that entail high technical risk or require supporting data to provide proof of concept | OSD | Call issued in October<br>Proposals due in January | 0-2yrs | $150K Max<br>One year duration | Private Sector Organizations<br>DoD organizations<br>Other federal agencies | Proposals submitted to the SERDP Office in response to a BAA and Statement of need (SON) | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | http://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations/Non-Federal-SEED-Proposal-Instructions |
| SERDP Core Solicitation | Seeks proposals for basic and applied research and advanced technology development | OSD | Annual | 0-3yrs | $150K-$1M Max<br>Vary in cost and duration | – | – | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | – |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| SERDP Core Solicitation Federal | Seeks proposals for basic and applied research and advanced technology development | OSD | Call issued in October Proposals due in March | 0-3yrs | $150K-$1M Max<br>Vary in cost and duration | Federal organizations, including Government-Owned Contractor-Operated (GO-CO) research laboratories | Proposals submitted to the SERDP Office in response to a call for Statement of need (SON) | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | http://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations/Federal-Core-Proposal-Instructions |
| SERDP Core Solicitation Non-Federal | Seeks proposals for basic and applied research and advanced technology development | OSD | Call issued in October Proposals due in January | 0-3yrs | $150K-$1M Max<br>Vary in cost and duration | Private Sector Organizations<br>DoD organizations<br>Other federal agencies | Proposals submitted to the SERDP Office in response to a BAA and Statement of need (SON) | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | http://www.serdp-estcp.org/Funding-Opportunities/SERDP-Solicitations/Non-Federal-Core-Proposal-Instructions |
| SERDP Exploratory Development SEED | Designed to investigate innovative approaches that entail high technical risk or require supporting data to provide proof of concept | OSD | Annual | 0-1yr | $150K Max<br>One year duration | – | Proposals submitted to the SERDP Office in response to a call for Statement of need (SON) | 1 to 4 | SERDP and ESTP Office<br>**Executive Director**<br>(571) 372-6378<br>**Deputy Director**<br>(571) 372-6379 | – |
| Small Business Innovation Research (SBIR) | Funds the critical startup and development stages and encourages the commercialization of technology, product or service from a Small Business (NTE 500 employees) | – | Tri Annual Call<br>March<br>July<br>October | – | Determine topic feasibility and scientific or technical merit in 3 phases. | Determine topic feasibility and scientific or technical merit in 3 phases. | Topics:<br>• endorsed by PMAs<br>• reviewed by T-Codes<br>• selected by PEOs,<br>• contracts created & monitored by SBIR Office | 2 to 4 | **John Williams**<br>ONR Director, Navy SBIR Programs<br>(703) 696-0342<br>john.williams6@navy.mil | http://www.navysbir.com/ |
| Small Business Technology Transfer (STTR) | Foster the innovation necessary to meet the nation's scientific and technological challenges.<br>Provides:<br>• Funding opportunities in the federal innovation research and development arena<br>• Expansion of public/private sector partnership to include the joint venture opportunities for small business and the nation's premier nonprofit research | OSD/ONR/NAVAIR | Annual Call<br>June | – | Determine topic feasibility and scientific or technical merit in 3 phases. | Small Businesses partnered with Research Academia and nonprofit research institutions | Topics:<br>• submitted by technical community<br>• selected and approved by NAE CTO and S&T IPT team<br>• require PMA statement of interest<br>• no ITAR-restricted or classified topic areas<br>• contracts created & monitored by SBIR Office | 2 to 4 | **Steven Sullivan**<br>ONR STTR Program Manager<br>(703) 696-7830<br>steven.sullivan@navy.mil | http://www.navysbir.com/index.html |
| STTR Phase I Start up | Feasibility study to evaluate the scientific and technical merit of an idea | ONR | Annual Topic Call<br>June | 0-0.6yr | $150K Max<br>$80K with $70K option<br>7 months<br>Competitive Solicitation | STTR Partnerships: Small Businesses partnered with eligible Research Institutions | – | 1 to 5 | **Steven Sullivan**<br>ONR STTR Program Manager<br>(703) 696-7830<br>steven.sullivan@navy.mil | http://www.navysbir.com/index.html |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | SERVICE/OSD POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| STTR Phase II | Expand on the results of Phase I and develop a prototype product or process. | ONR | At completion of Phase I | 0-1.1Syrs | $750K Max<br><br>$500K with $250K option<br>18 months with 9 month option<br>Government Selected | STTR Partnerships with successful phase I completion | -- | 2 to 5 | **Steven Sullivan**<br>ONR STTR Program Manager<br>(703) 696-7830<br><br>steven.sullivan@navy.mil | http://www.navysbir.com/index.html |
| STTR Phase III | Commercialization of the results of Phase II. | ONR | As Phase III funds are identified | 1-3yrs | $3M Max<br><br>$0/Unlimited<br>Unlimited time<br>Funding can come from the Government or Private Sector | Any STTR company that has identified non-STTR source of funds; No research institution partnership required | -- | 6 to 10 | **Steven Sullivan**<br>ONR STTR Program Manager<br>(703) 696-7830<br><br>steven.sullivan@navy.mil | http://www.navysbir.com/index.html |
| Swamp Works | Explores innovative, high-risk and disruptive technologies and concepts | ONR | Leverages short exploratory studies to examine the maturation of a proposed technology before making substantial investments. Insertion within 1 to 3 years | 1-3yrs | $100K-$1M Max<br><br>Leverages short exploratory studies to examine the maturation of a proposed technology before making substantial investments. Insertion within 1 to 3 years. | Substantial flexibility in planning and execution; The process allows for the shortest possible technology development timeframe; A formal transition agreement is not required; Programs routinely have strong advocacy outside of the ONR either from the acquisition community or the fleet. | Substantial flexibility in planning and execution; The process allows for the shortest possible technology development timeframe; A formal transition agreement is not required; Programs routinely have strong advocacy outside of the ONR either from the acquisition community or the fleet. | 2 to 6 | **ONR, Office of Innovation**<br>(703) 696-5774<br>swampworks@onr.navy.mil<br><br>**Jim Blesse**<br>(703) 696-4037<br>jim.blesse@navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/office-innovation/swampworks-innovation.aspx |
| Technology Insertion Program for Savings (TIPS) | To increase the rate that new cutting edge technologies are inserted into DoN Acquisition programs in order to significantly reduce operations and maintenance support costs. Structured to rapidly transition applicable commercial off-the-shelf solutions and late-stage development technologies from any source to meet an immediate need. | ONR | NAE CTO call: September<br>Proposals due: October<br>ONR call: November<br>Proposals due from SYSCOMs: 1 Feb | 0-2yrs | $2M Max<br><24 months | Program Office military/civilian (can collaborate with Navy contractors)<br>Requires:<br>Program Office Acquisition Sponsorship<br>OPNAV Resource Sponsorship (responsible for out-year funding) | ONR issues a proposal quota for each SYSCOM. The final NAE CTO selections package is sent to ONR. ONR Transition Office staff review all submitted proposals against the required criteria. Those deemed appropriate for source selection get subjected to a technical review panel. Final selections are made by the Executive Review Group (ERG) | 6 to 6 | ONR Office of Transition (Code 03T)<br>**Transition Initiative Program**<br>03TTX_Contact@onr.navy.mil<br>**TIPS program office**<br>TIPS_Contact@onr.navy.mil | http://www.onr.navy.mil/Science-Technology/Directorates/Transition/Technology-Transition-Initiatives-03TTX/Technology-Insertion-Program-Savings-TIPS.aspx |

# 6.0 S&T VENUE LIST

| VENUE | PURPOSE | WHO | WHEN | DURATION | FUNDING | ELIGIBILITY | METHODOLOGY | TRL | [illegible] POC | WEBSITE |
|---|---|---|---|---|---|---|---|---|---|---|
| Technology Solutions | Hot line for meeting current fleet needs<br>Rapid-response S&T solutions to immediate Fleet/Force needs identified by Sailors and Marines; addresses:<br>• New applications of emerging/existing technologies<br>• Well-bounded problems with S&T solutions<br>• Impact to the individual warfighter | ONR | Accepts on-going requests | Maximum 12 months to complete Goal: prototype demo within 15 to 18 months of request | Average project ~ 750K | US Navy and Personnel only Solution developed by Naval Research Enterprise (NRE) or National LabsCommercial &/or academic partners are common | Request submitted by E4 -O4 Sailor/Marine or ONR Science Advisor to the ONR TechSolutions office | 6+ at end | 703-696-0616 techsolutions@onr.navy,mil | www.onrglobal.navy.mil/techsolutions |
| [illegible] | [illegible] | [illegible] | — | [illegible] | [illegible] | [illegible] | — | [illegible] | [illegible] | http://www.onr.navy.mil/Science-Technology/Directorates/office-research-discovery-invention/Sponsored-Research/University-Research-Initiatives.aspx |

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# Program Executive Officer Land Systems

# Focus the Future Faster

## ATIP 2013 - Volume 4


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