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.

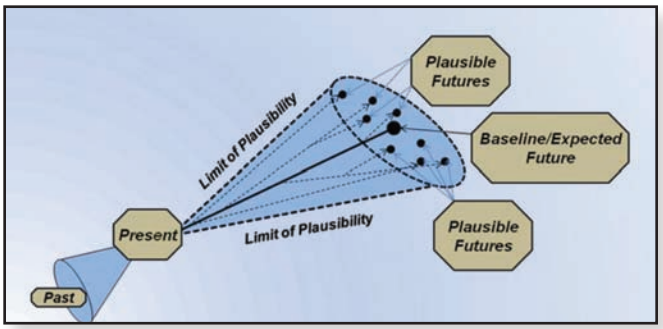
For PEO LS, this required activity centers squarely on the U.S. defense establishment. The strategic methodology utilized in the "Concept to Capability" process informs our advanced technology investment plan and provides context to our understanding of the "expected" future state of the world. This 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.

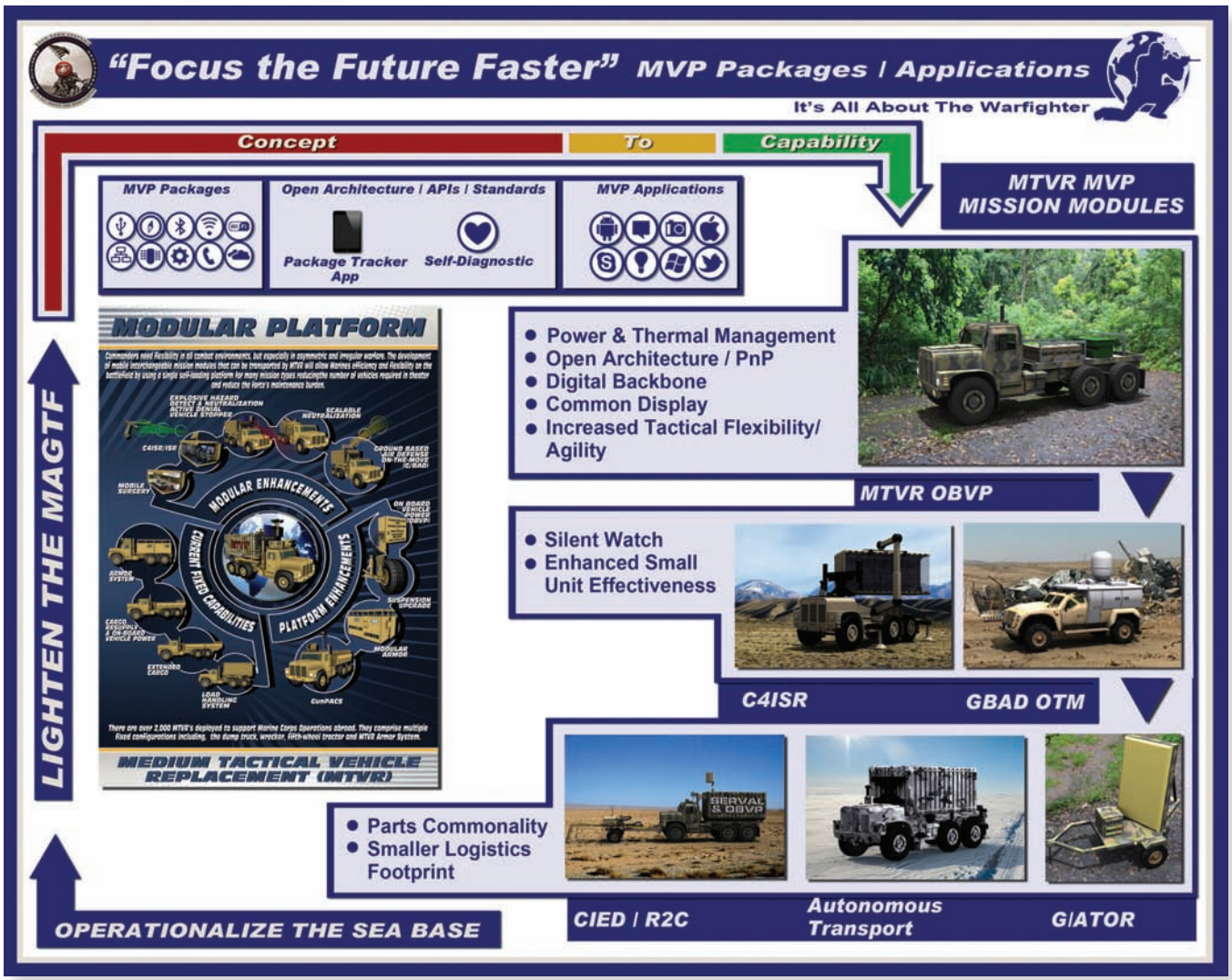
A key approach to developing a lighter, more fiscally responsible capability is Holistic Modularity, a design philosophy that incorporates a multi-disciplinary design approach, optimized for requirements. In order to effectively operate from the Sea Base in remote areas of the Asia Pacific

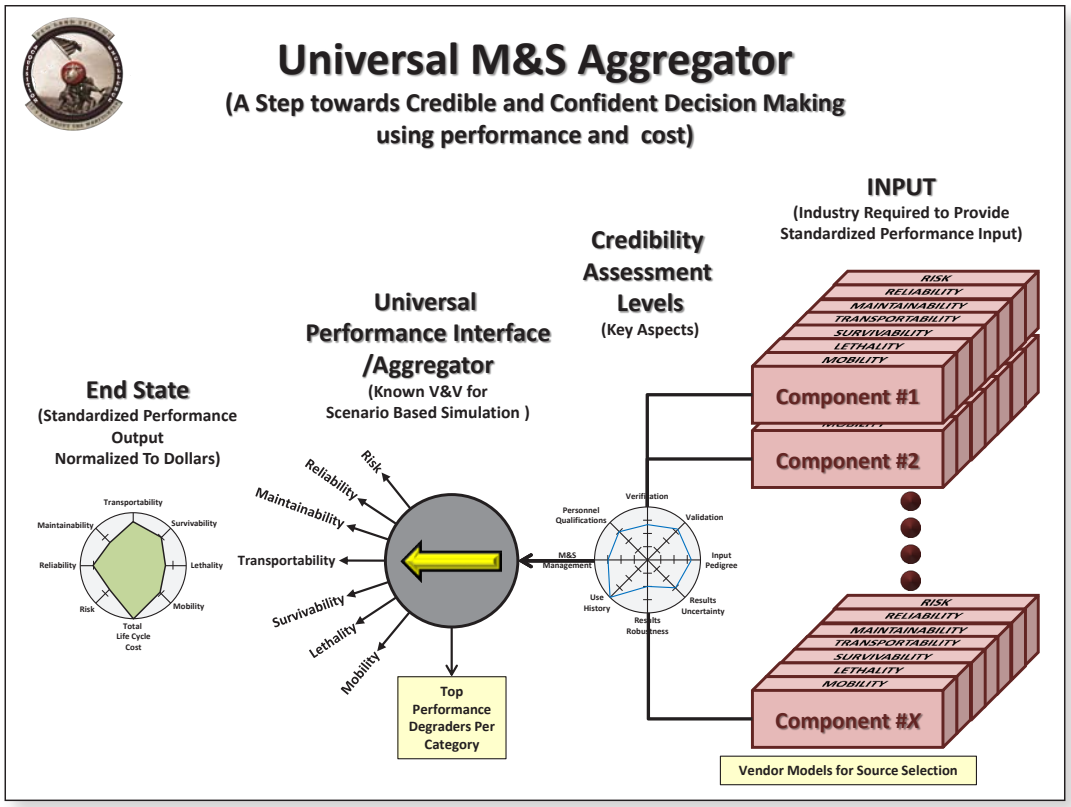
theater, Marines must embrace a "Lighten the Load" mentality for all associated acquisition programs. While the design, development and implementation of this holistic modularity presents significant 2nd and 3rd order effect technical challenges, it will ultimately provide an enabling framework to lighten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

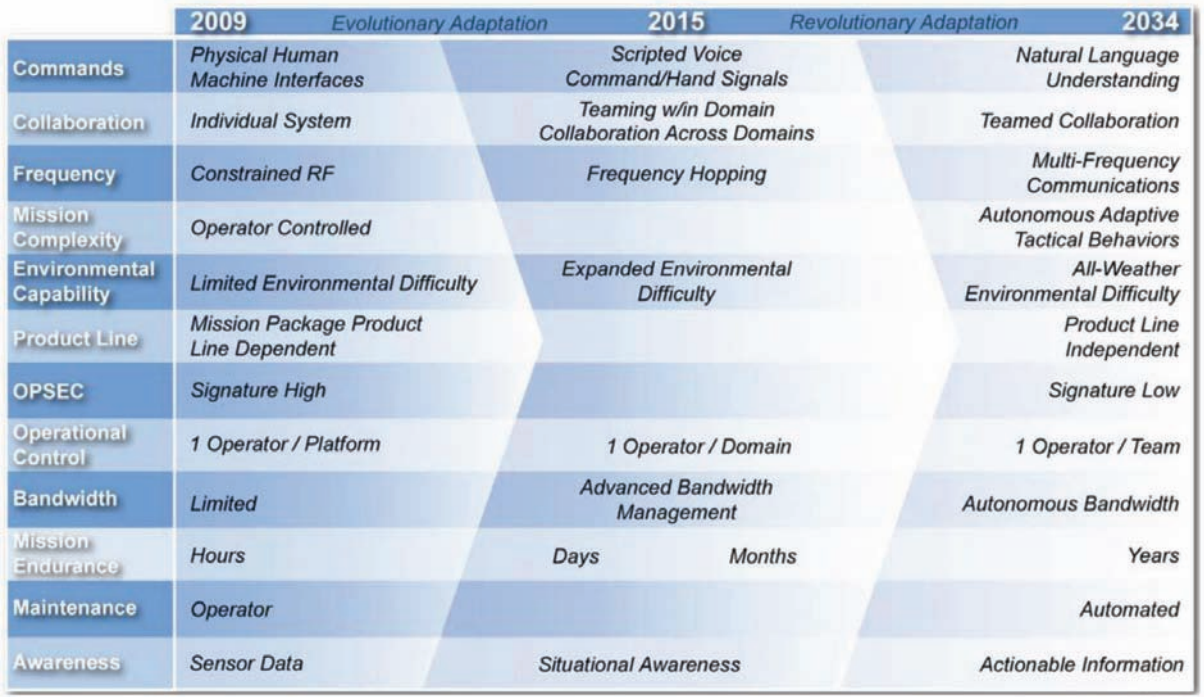
As the Marine Corps reduces, standardizes, and modernizes its equipment and vehicle fleet to

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.