U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND

Mission Engineering and Prototype Warfare: Operationalizing Technology Faster to Stay Ahead of the Threat

Matthew Horning
Systems Engineer
TARDEC, Systems Engineering

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“Success no longer goes to the country that develops a new fighting technology first, but rather to the one that better integrates it and adapts its way of fighting.”

To achieve an optimal solution, less flexibility is required closer to event horizon.

**TIME / FLEXIBILITY PARADOX**

Increasing scenario clarity

- Wargaming of Potential Scenarios
  - Pre-Engineered Solution Portfolio & CONOPS

- Modularize
  - Wargaming can help define what must be modular versus inherent.

- Rapid Production / Customization S&T
  - Conflict-Tailored Solutions

- Adaptable/ Flexible
  - Technology Overmatch Despite Parity
MISSION ENGINEERING

System-of-Systems engineering approach where individual system requirements are optimized to achieve maximum mission performance given operational (METT-TC) and acquisition (Cost, Schedule, Performance) constraints

METT-TC: mission, enemy, terrain, troops available, time, and civilians
WHAT IS MISSION ENGINEERING?

Mission Engineering is the deliberate planning, analyzing, organizing, and integrating of current and emerging operational and system capabilities to achieve desired warfighting mission effects.

- Mission engineering treats the end-to-end mission as the ‘system’
- Individual systems are components of the larger mission ‘system’
- Systems engineering is applied to the systems of systems supporting operational mission outcomes
- Mission engineering goes beyond data exchange among systems to address cross-cutting functions, end-to-end control and trades across systems
- Technical trades exist at multiple levels; not just within individual systems or components
- Well-engineered composable mission architectures foster resilience, adaptability and rapid insertion of new technologies
Examples

National Strategies, Strategic Goals, Global Environment

CONPLANs, Operational Concepts, Theater Scenarios

Tactical Scenarios, Convoys, Force on Force

Aircraft, Vehicles, Equipment, Soldiers, Weapon Systems

Fire Control, Sights & Sensors, C4, Powertrain, Suspension, AFES

Circuit cards, engines, drive shafts, rotor blades
INPUTS – DOCTRINAL & TECHNICAL ANALYSIS, USER COMMUNITY FEEDBACK, ETC.

FM, TC, ATP, Other Doctrine

Current Operations + Threats (classified and unclassified)

Future Operations (Multi Domain)

OMS/MP & other High level Analysis

Acquisition Strategies

Technology Study & Review

Interface with User Community, Technology developers, and NATO partners.

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PROTOTYPE WARFARE

Rapid fielding of tailored systems with a focus on specific functions, specific geographic areas, or even specific fights that are inexpensively produced (potentially disposable)
The Prototype Warfare approach enables rapid need-to-solution development times.
3 ENABLING TECHNOLOGY ADVANCES

Early Synthetic Prototyping (ARCIC/RDECOM)

– Physics-based persistent game network that allows Soldiers and engineers to collaborate on exploration of the materiel, force structure, and tactics trade space.

– Over one million of digital battlefield data per year†

Artificial Intelligence needed to derive useful data on tactics and technical performance from the data

Rapid Manufacturing

– Investment in rapid manufacturing techniques

– Understand the trade-offs of custom production versus modularity

Heavily reliant on Digital Engineering with strong M&S capabilities
Core system model exists in a perpetual pre-PDR state
Specific prototype systems proceed to design synthesis

Prototype Warfare Digital Engineering Model
PROTOTYPE WARFARE CHALLENGES

Operation and Maintenance of fielded unique systems
  – Digital manifesting database of replacement parts
  – Use of common components where possible

Operator & Maintainer interfaces
  – Standardize and simplify interfaces
  – Personalized interface based on individual user credentials
FURTHER QUESTIONS AND DISCUSSION

Matthew A Horning
US ARMY TARDEC
Systems Engineering
586.282.5456
matthew.a.horning.civ@mail.mil