



Unified Quest 2013

Deep Future Wargame

2030-2040

Executive Report

15-20 September 2013, U.S. Army War College, Carlisle Barracks, PA



Exploring Conflict from Hilltop 2030



Deep Future Wargame 2030-2040

Key Participants

Joint and Interagency Partners

U.S. Department of State
Defense Advanced Research Projects
Agency (DARPA)
Joint Staff Directorate for Joint Force
Development (J7)
U.S. Special Operations Command
U.S. Transportation Command
U.S. Navy
U.S. Marine Corps
U.S. Air Force
U.S. Coast Guard
U.S. Army Reserve
U.S. Army National Guard

Army Major Commands

Training and Doctrine Command
Army Materiel Command
Medical Command
U.S. Army Special Operations Command
U.S. Army Central Command
U.S. Army Cyber Command
U.S. Army Space and Missile Defense
Command

Other Organizations and Agencies

Institute for Defense Analyses (IDA)
Army Research Laboratory
U.S. Army Tank and Automotive Research, Development, and Engineering Center (TARDEC)
U.S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC)
U.S. Army Natick Soldier Research Development and Engineering Center (NSRDEC)
Defense Language Institute
Asymmetric Warfare Group
U.S. Army Heritage Center
National Geospatial Intelligence Agency (NGA)

International Partners and Organizations

Australia
Canada
France
Germany
Great Britain
Italy
Netherlands
Singapore
Japan
Turkey
NATO Allied Command Transformation

Service Schools and Academia

Army War College
Navy War College
U.S. Military Academy
College of William and Mary



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND
COMMANDING GENERAL
950 JEFFERSON AVENUE
FORT EUSTIS, VIRGINIA 23604-5700

November 20, 2013

As the Army transitions from execution to preparation, studying future challenges is critical to ensuring national leaders possess relevant options to protect the country in coming decades. After 12 years of conflict and a necessary focus on near-term challenges, Training and Doctrine Command is reenergizing future exploration to better understand and describe potential implications to the Army. This report provides a comprehensive depiction of national security challenges the Army, as part of a joint force and interagency team, will face in 2030-2040.

Addressing these challenges and opportunities is the Army Chief of Staff's Title 10 Future Study Plan, Unified Quest, which serves as an essential element of the Army's Campaign of Learning (CoL). Fundamental within Unified Quest was the September 2013 Deep Future Wargame. As described in this report, the wargame demonstrated how the intersection of dangerous trends in 2030-2040 will require the Army to rapidly respond with an operationally decisive force in time to arrest cascading events that threaten national security interests. The insights from the wargame will inform the future Army Operating Concept and subsequently doctrine, organization, training, materiel, leadership and education, personnel, and facilities. To this end, the CoL leverages ideas generated by Unified Quest and thereby guides a process of integration across the campaign and informs emerging concepts, potential policy solutions, and investment options.

I am confident you will find this report informative and thought provoking while we prepare the Army for success in any future conflict. Additionally, this report is a must read for company-grade officers across the force. The challenges and opportunities explored within this report define the operational environment they may face and the capabilities they will require as brigade-level leaders in 2030-2040. Please forward any questions or comments concerning the Deep Future Wargame 2030-2040 to the Chief of the Future Warfare Division, Army Capabilities Integration Center, United States Army Training and Doctrine Command, Fort Eustis, Virginia 23604 for our consideration.

Sincerely,



Robert W. Cone
General, U.S. Army

ARMY



A Soldier's Story

Overlooking the battlefield from Hilltop 2030, I try and shake the ringing from my ears while the smell of destroyed vehicles sears my nostrils. Wiping the sweat from my eyes, I stare at my Command Display projecting in front of me. The company net is buzzing with follow on orders and intelligence reports. New icons indicating known enemy positions display with new coordinates for my platoon to attack. I send movement instructions to my robotic wingman for the platoon to orient from, while I take a minute to reflect.

I survived my first combat insertion, as did my platoon. It didn't go entirely as planned, but we trusted our instincts, understood the purpose, remembered our training and made it happen. As realistic as they seemed at times, all the simulations and graphic-enhanced exercises could not compare to actual combat.

The flight to the objective included virtual rehearsals and back briefs to the battle group commander. Everyone knew their tasks, the mission and commander's intent.

- **Seize an objective containing weapons of mass destruction.**
- **Defeat a hybrid enemy comprised of terrorists and conventional forces with tanks, infantry, and special forces in order to secure the area and prevent proliferation.**
- **Be discriminate but lethal.**

Following the virtual update, the Platoon Sergeant had everyone rest, not knowing when the next chance will be to take a break. My platoon sergeant knows the region and the troops; I will lean on his expertise. We got the ten minute final alert and in what seemed like seconds, I am out the door.

The central ideas of future Joint and Army concepts, given constrained resources, demand the Army operate differently than it does today.

Preface

"A Soldier's Story" describes a platoon leader's perspective and anticipated experiences in the context of a probable conflict involving U.S. Army Forces in the 2030 timeframe. The leader symbolizes the Army's exploration of future conflict while the hypothesized environment—Hilltop 2030-- replicates the strategic and operational trends that served as a foundation for the Army's Unified Quest Deep Future Wargame 2030-2040.

The wargame explored the challenges and opportunities defined by National Intelligence Council documents and the ongoing efforts of the Deputy Chief of Staff for Intelligence, Training and Doctrine Command. The future operational environment will require a globally responsive, regionally engaged Army with an expeditionary mindset and the capability to project operationally decisive forces anywhere in the world.

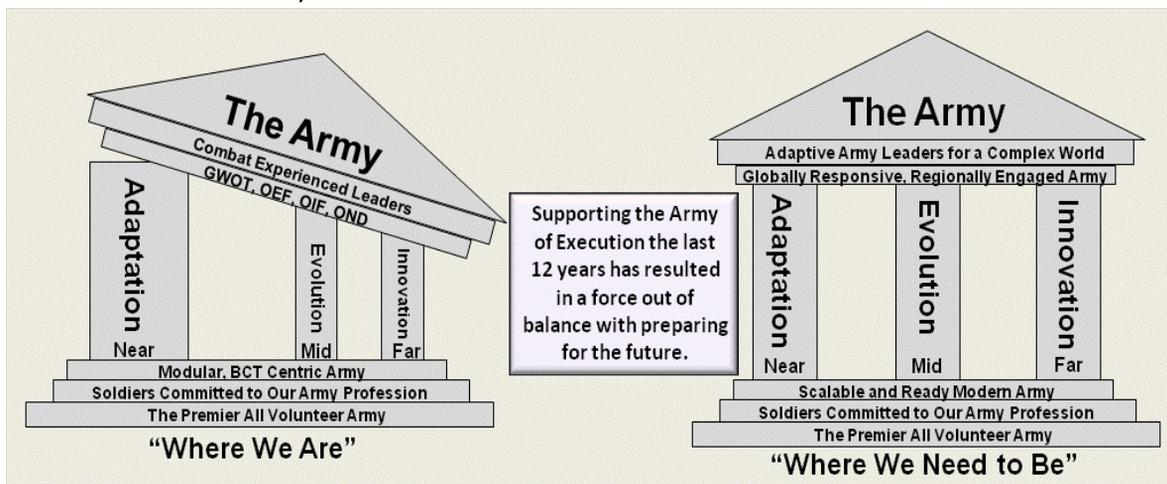
Future battlefields will be inherently different from those Soldiers have faced during the last 12 years. Unit leaders executing a policy of global responsiveness and regional engagement will be more capable, lethal, precise and strategically relevant. However, the leader on Hilltop 2030 also experienced the effects of the enduring characteristic of warfare. Just as today's Soldiers and leaders learned in the mountains of Afghanistan and the streets of Iraq: warfare is a human endeavor. A short video describing the wargame and event summaries can be viewed at www.arcic.army.mil/init-unified-quest.aspx.

Executive Summary

Unified Quest is the Army Chief of Staff's Future Study Plan and recently concluded a yearlong effort investigating emerging tactical, operational and strategic challenges in a plausible future operational environment. As the Army transitions from execution to preparation, events like the Deep Future Wargame will inform emerging operational-level concepts and investment options and identify potential policy implications. Over a series of seminars, workshops, senior leader discussions and planning events, military and civilian participants explored future concepts and capabilities projected to enable the Army to execute Integrated Distributed Operations (IDO) in support of the Joint Operating Concept of Globally Integrated Operations (GIO) in 2030 through 2040.

Key Insights

1. The future operational environment will demand an Army capable of rapidly responding with operationally decisive forces able to arrest future cascading challenges at the speed of human interaction, measured in hours and days versus weeks and months.
2. Expeditionary Maneuver enables rapid response to proliferation, humanitarian crises and atrocities; precludes enemy action and denies opportunity; expands strategic decision space to creates more operational options.
3. Effective, broad and enduring engagement offers an opportunity to expand the "bench" of potential coalition members to aid U.S. forces and current partners in the future.
4. Leader development must adapt in the near term to instill the importance of understanding, shaping and influencing the Operational Environment as a critical element of Strategic Landpower.
5. The Army has a long-term need for critical breakthrough expeditionary capabilities that must be enabled by a rebalance in science and technology investment strategies. Selected areas of investment can create opportunities to develop mobile, protected firepower and lethality projected at speed that matters, and reduce opportunities for strategic miscalculation as well as operational and tactical overmatch by adversaries.



Way Ahead. Army Capabilities Integration Center (ARCIC) will build upon the success of the 2013 Deep Future Wargame in 2014. The next study will explore specific aspects of the 2030 operational environment to further inform excursions and experiments that define future force required capabilities within the Army's Future Operating Concept. The 2014 Deep Future Wargame design will transition from an infusion of key technologies to exploring new unit formations that may be required to protect vital national interests in the 2030 period including the range of military operations in a megacity environment.

Summary Findings

- I. **Wargame Design/Overview:** In a year-long effort, framed by entropy-based models and analytical study plans, professionals from across the national security establishment explored challenges and opportunities in the 2030-2040 time period.
- II. **Speed and Mass that Matter:** The Army must provide the Nation with a force that can maneuver in a way that reduces miscalculation, influences adversary's populations and militaries and expands strategic leadership's decision space
- III. **Expeditionary Maneuver:** The Army must exploit knowledge, access and advantages gained through strategic maneuver to rapidly deploy operationally decisive forces under austere conditions to achieve strategic objectives and restore strategic balance
- IV. **Efficacy of Regional Engagement:** Integrating the effects and knowledge gained through years of Special Operations Forces and Regionally Aligned Forces (RAF) engagement in a region will set conditions for successful unconventional warfare and other regional operations in support of future conflict objectives.
- V. **People, Information and Performance in 2030:** The Army must maximize its number one capital investment, the Soldier, by increasing cognitive capability to rapidly assess complex situations and then act to resolve conflict
- VI. **Rebalancing Science and Technology:** An integrated science and technology strategy is required for the Army to operationalize the desired attributes of an Expeditionary Force. The report explores the following six areas in detail:
 - **Human Performance Optimization.** Maximizing performance of our #1 Capital Investment.
 - **Accelerated Information to Decision.** Leveraging the Full Potential of our People and Systems.
 - **Mobile, Protected Platforms.** Advanced materials can break the direct relationship between protection and material/system weight.
 - **Aviation.** Platforms are reaching the end of their service lives. Merely upgrading current designs will not be enough for the Army to maintain its edge.
 - **Improved Lethality.** Lethality, Mobility and Survivability-balanced formations that overcome terrain, distance and uncertainty.
 - **Optimizing Logistics.** Innovative, efficient and effective solutions to increase tooth and decrease tail.
- VII. **Implications for the Army of 2030 :** Anticipated challenges of the future operational environment demand that the Army operate differently by maneuver, both strategically and operationally, to achieve National security objectives.

Wargame Design

Emerging Strategic Trends

In 2030-2040, U.S. forces will be increasingly challenged the intersecting trends depicted in Figure 1. Human interaction will be more rapid and will involve greater information than ever before. Speed of interaction is intimately connected to:

- Population growth and migration trends that feed into mega-cities on several continents
- A rapidly changing, progressively multi-polar world characterized by the continued rise of regional powers
- De-westernization of the global economy, decreasing state authority and a rise of hyper-empowered actors
- Accessibility to rapidly changing technology and continued proliferation of weapons of mass destruction

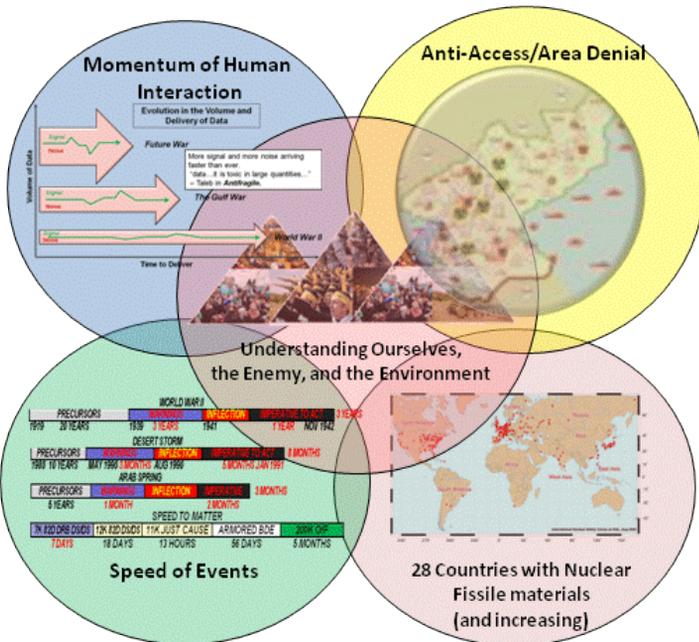


Figure 1: Graphically depicts the intersection of emerging strategic trends and potential threats to national interests.

“Evolution” working group equipped with currently programmed capabilities

“Innovation” working group equipped with potential future game changing capabilities

Two operational working groups (OWG) conducted forced entry operations against a complex mix of state and non-state adversary forces replicated by independent red teams. While adversarial teams employed identical capabilities, the two OWGs employed different force capabilities -- described in Figure 2. This juxtaposition enabled a comprehensive assessment of future challenges, opportunities and gaps resulting in recommendations for the Army and Joint force transitioning beyond 2030.

As the operational planning and wargame simulations commenced, a Strategic Working Group (SWG) focused on the broad challenges of countering weapons of mass destruction and coalition integration; emerging opportunities in science and technology, robotics, and Soldier performance; and implications for the Army Operating Concept.

Operational Working Group 1 “Evolution Force”

- Based on Army Force Modernization Plans to 2035
- Future capabilities in unmanned systems, power projection, and directed energy at TRL 4 to 6 will be fielded
- No potential game changer technology fielded

Operational Working Group 2 “Innovation Force”

- Based on Army Force Modernization Plans to 2035
- Future capabilities in unmanned systems, power projection, and directed energy at TRL 3 to 6 fielded
- Potential game changer technology in directed energy fielded

Figure 2: Specific technology enhancements differed between groups; defined by their technology readiness level (TRL) today. TRL depicts a level of technology development on a 1-9 scale; 9 represents a fielded technology and 1 simply a transition from scientific to applied research.

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Wargame Overview

The Deep Future Wargame featured a fictional 2030 operational environment. Disassociating the military problem from current events and war plans allows an unbridled study of future challenges and opportunities. The scenario represented plausible future threats informed by national and international security agency studies and the UQ13 Strategic Trends Seminar, while being geospatially depicted on Eastern European terrain as seen in Figure 3.



Figure 3: Regional map of the fiction area of instability in the wargame; Matomi.

The date is July 2030 and **the United States had been attacked**. Terrorists and militants based in the collapsing nation of Sasani employed chemical weapons smuggled out of Sasani to attack the United States at home and abroad during humanitarian, refugee-relief operations in the nation of Junapur. The potential for recent nuclear weapons proliferation to follow a similar course threatened U.S. and partner nations' interests. Indications that proliferation was propagated by Takar, the nuclear armed regional hegemon, complicated military intervention and threatened regional security and the global economy. Figure 4 below is a detailed timeline of events for both operational working groups over the course of the wargame. The strategic conditions at the conclusion of the seminar are highlighted in yellow boxes.

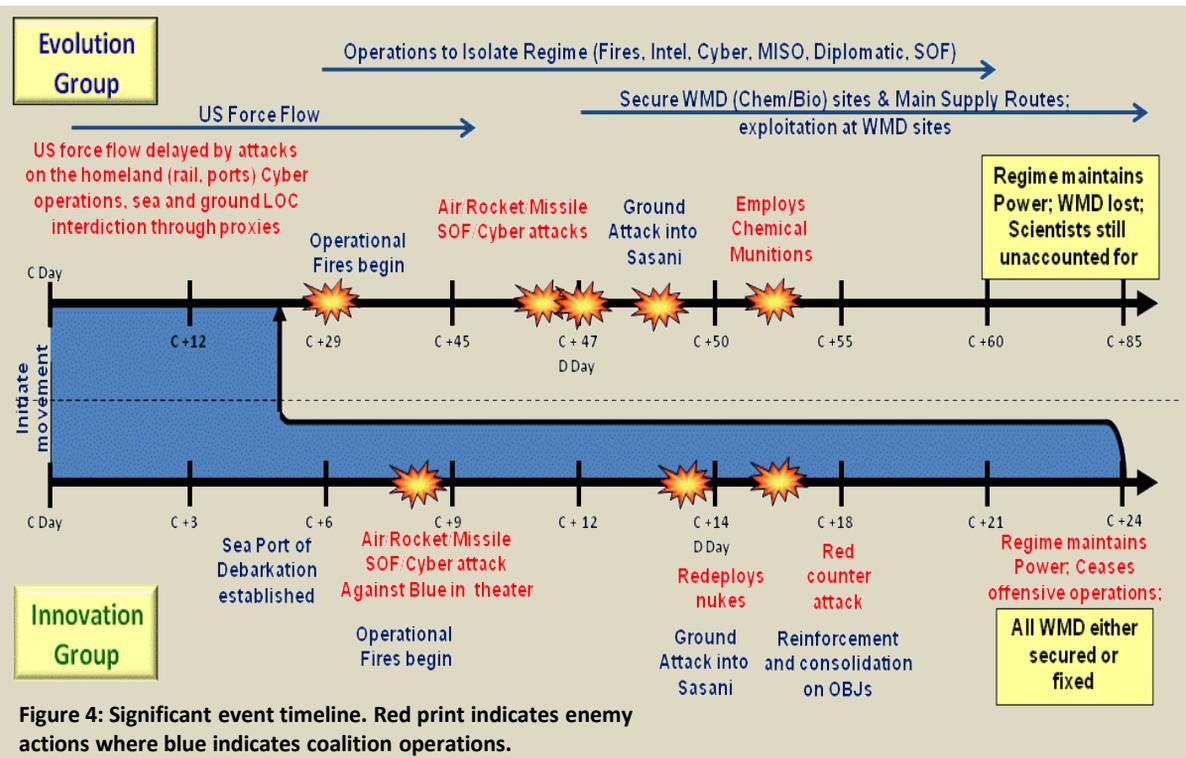


Figure 4: Significant event timeline. Red print indicates enemy actions where blue indicates coalition operations.

Speed and Mass that Matter

Speed and Mass that Matter can create decision space for leaders to employ operationally decisive forces against a threat to vital U.S. interests

The future operational environment will require the Army to rapidly respond with operationally decisive forces to arrest future cascading challenges at the speed of human interaction-measured in hours and days versus weeks and months.

The Army must provide the nation with an operationally decisive force. This is a force that can move and act fast enough to reduce an adversary's miscalculation, influence populations and militaries and expand options for strategic leaders while potentially reducing risk to mission and forces. Figure 4 is a comparison of the operational working groups within the wargame scenario and validated with deployment models.

In 2030-2040, we anticipate potential adversaries, state and non-state, will possess the ability to reduce our strategic freedom of movement from the homeland, through and at regional bases. In the game, their advanced A2AD capabilities complicated operational/tactical freedom of maneuver.

Science and technology investments and capability development must continue to focus on lift systems that improve strategic, operational, and tactical maneuver. Reducing predictability and leveraging force projection across all domains increases employment options and creates multiple dilemmas for the adversary thereby stressing their defense systems.

The joint force must advance the capabilities of seabasing platforms to project, stage and employ forces. However, seabasing alone is not adequate to meet the operational requirements. Seabasing operations require additional joint command structures and protection capabilities to operate in contested areas.

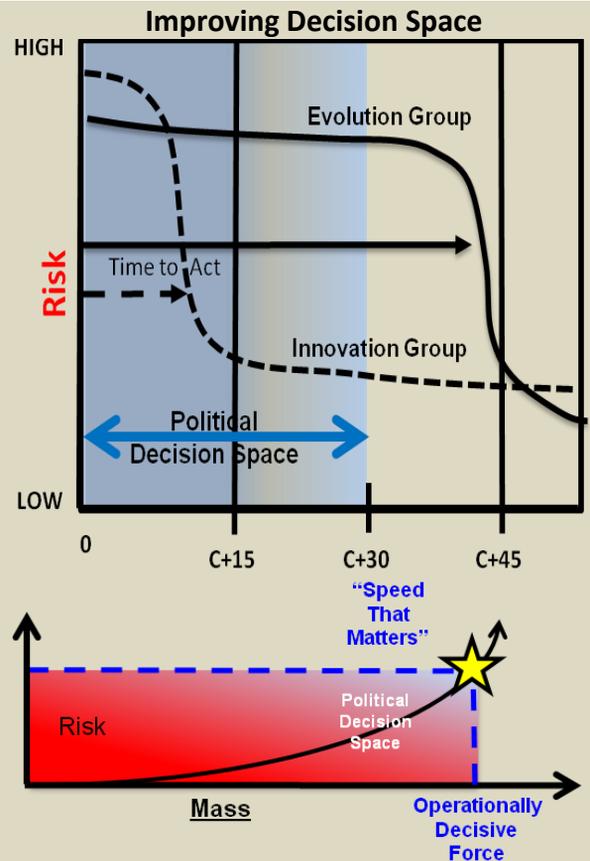


Figure 4: The graph depicts the management of risk over time highlighting decision space and time provided to leaders by each working group.

As an example, without sufficient lift capacity to move, carry and deliver forces and equipment over extended distances, the Evolution working group was forced to rely on expansive and vulnerable ground lines of communication. Their operations required an additional 30 days and significant resources to create the logistical architecture and reduce operational risk.

Given a more Continental United States (CONUS)-based Army, and current joint power projection capabilities, Army S&T rebalance is necessary to drive more expeditionary Strategic Landpower options

Innovation Group: Decreased strategic and operational risk to mission due to speed; increased tactical risk due to our protection and sustainment capability gaps

Operational Risk

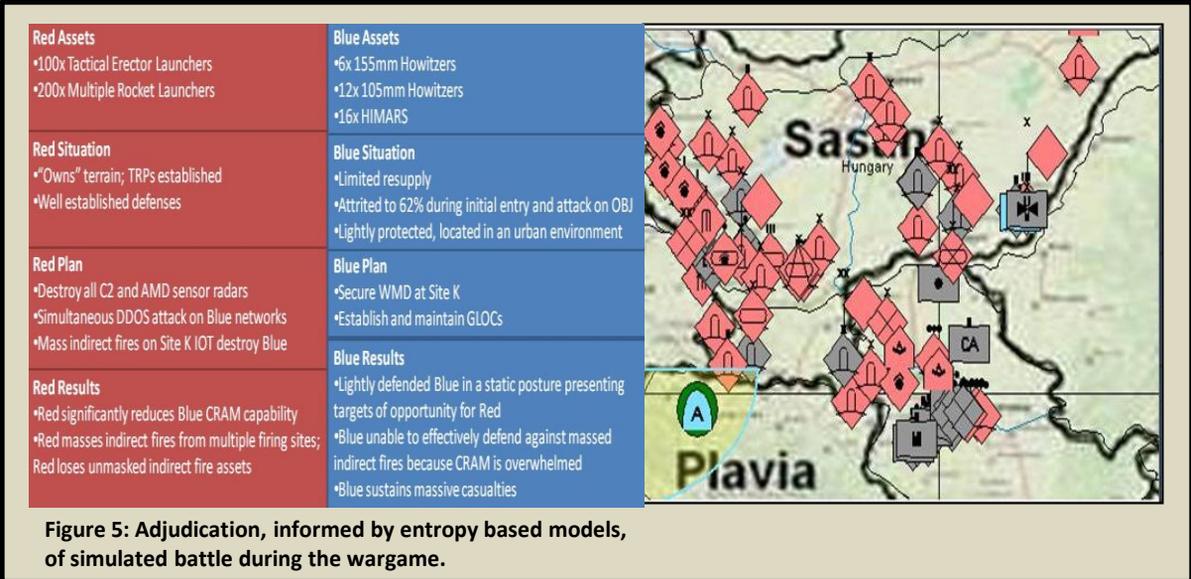
There were instances during the wargame that despite technological advances, U.S. forces were unable to balance protection, lethality and mobility, thus creating an opportunity for adversarial forces to gain tactical overmatch. Following initial airborne operations and six days of combat, an Infantry Brigade Combat Team culminated at 70 percent strength. Without a reserve and challenged by limited resupply due to an absence of ground or air lines of communication, the brigade was targeted by enemy forces. Figure 5 depicts the U.S. Forces defeated in gray following the adversary’s ability to mass fires on this vulnerable force. Mutually supported U.S. fires including counter battery and close air support were overwhelmed by enemy capacity and capabilities.

The Wargame highlighted that the speed at which the Army deployed mission-tailored force packages became dependent on capabilities with varying velocity, speed, protection and capacity. Joint and Army forces conducting tactical and operational level integrated distributed operations (IDO) challenged the current “enabler”

infrastructures. As an example, logistics needed resilience, adaptability and built-in redundancy without an increased footprint.

New capabilities and organizational structures are required if the combat to sustainment (tooth-to-tail) ratio and protection requirements are to be improved. The wargame highlighted that current force structure and allocation of the capabilities provided by the intelligence, fires, protection and sustainment warfighting functions may not adequately address the demands of a geographically distributed force. Moreover, IDO may require altering the current allocation rules for enabler capabilities (materiel and organizations).

Evolution Group: Increased strategic and operational risk due to lack of speed; decreased tactical risk due to our ability to mass and provide protection and sustainment through concurrent arrival



Expeditionary Maneuver

Employing vertical overmatch capabilities, the Innovation working group optimized simultaneous, noncontiguous offensive operations throughout the battle space.

In 2030-2040, the wargame found that expeditionary maneuver can exploit knowledge, access and advantages gained through strategic maneuver to rapidly deploy operationally decisive forces under austere conditions to achieve strategic objectives and restore strategic balance. Operational working groups conducted operations consistent with the future Army Operating Concept (AOC.) Using the tenets of IDO depicted in Figure 6, the below vignette shows a comparative analysis of the working groups employment of forces.

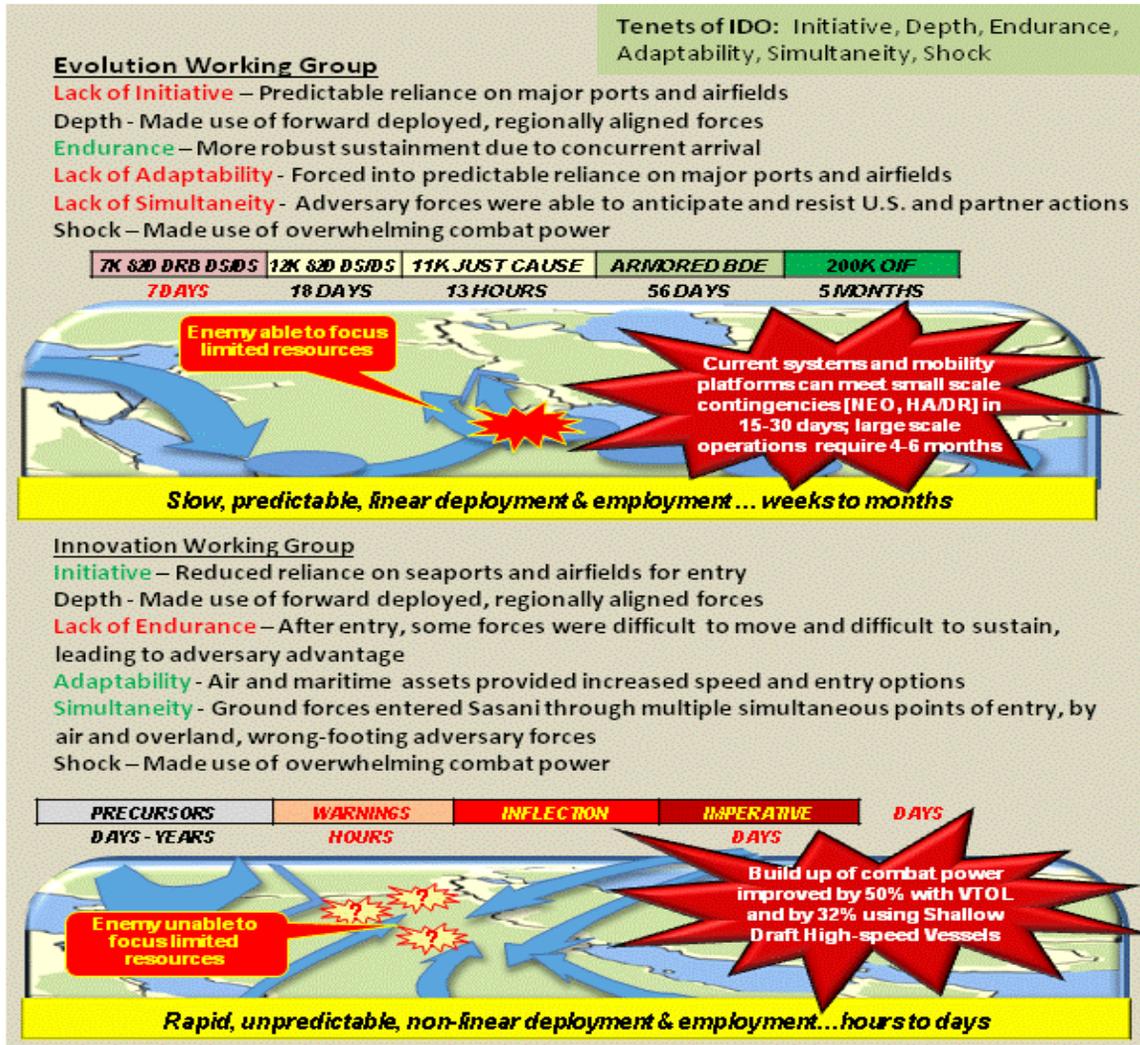


Figure 6

Through IDO, mission-tailored Army units were enabled by a collaborative network of units and capabilities. Army forces engaged the enemy with multiple, often simultaneous dilemmas integrated in time, space and purpose to accomplish campaign objectives. However, the wargame found the Army must recognize the intangible aspects of mass. Future Joint operations will require commanders to mass through a system of units and capabilities. Critical to employing an operationally decisive force, a commander’s visualization of mass cannot be computed solely upon the physical attributes of the units.

Tailored force packages will mitigate some challenges, but the Army needs new Joint systems and deployment platforms to execute responsive expeditionary maneuver

The wargame reinforced the effectiveness of expeditionary maneuver from strategic distances and simultaneous employment of combat ready units upon arrival. In presenting the enemy with multiple dilemmas, we ceded opportunities for tactical overmatch. To produce sufficient mass in the face of well-armed adversaries, the Army must deploy and fight as a joint force and analysis of the projected operational environment highlighted the need for innovative force projection capabilities.

During the wargame, the ability to leverage a seabasing concept greatly varied between operational workgroups. Detailed in Figure 7 below, the ability to project power can be exponentially improved through the development of enhanced strategic lift. However, operational maneuver was limited

by the range and capacity of rotary wing intra-theater movement. The Evolution group failed to leverage a seabasing approach whereas the Innovation group maximized intra-theater maneuver options. The simultaneous use of strategic and improved intra-theater lift enabled the Innovation group to conduct expeditionary maneuver from strategic distances and bypass normally well-defended, fixed terminals and ports.

Improvements in vertical lift and the joint high speed vessel are two prime examples of how the joint force must operate collectively. Without a holistic investment strategy across DOD, however the joint force will continue to be constrained in its ability to build and deliver adequate combat power quickly at the decisive place and time.

Vessels Characteristics

VESSEL	PAX	SQ FT (Avg)	SPEED (Knots)	DRAFT (Feet)	Delivers Combat Ready Forces
LMSR	NA	250,000	22	35	NO
FSS	NA	140,000	27	39	NO
JHSS * (Austere Access) Innovation Team	1000	116,339	35	25	YES
SEATRAIN * (3 Modules) Innovation Team	3000	180000	24	15	YES

Strategic Movement Comparison

VESSEL	Days to SPOD	Days to Load Ship	Sailing Time	Unload Ship SPOD	Time to POD
LMSR	2	2	12 days 3 hrs	2	18 days 3 hrs
Fast Sealift Ship (FSS)	2	2	8 days 12 hrs	2	14 days 12 hrs
Joint High Speed Ship (Austere Access) Conceptual	2	16 hrs	6 days 6 hrs	8 hrs	9 days 6 hrs
SEATRAIN (3 Modules) Conceptual	2	16 hrs	9 days 2 hrs	8 hrs	12 days 2 hrs

Conceptual Vessels

- The shallow draft nature of the Joint High Speed Ship (JHSS) & SEATRIN expanded throughput at the sea port of debarkation (SPOD). JHSS/SEATRIN could utilize 14 piers at the SPOD while the Large, Medium-speed Roll-on/Roll-off (LMSR) and Fast Sealift Ship (FSS) were restricted to 2 piers.
- The ability of the JHSS and SEATRIN to deliver both personnel (PAX) and cargo eliminates the requirement to airlift personnel. Each JHSS/SEATRIN module eliminated the requirement for 38 C-17 sortie equivalents to fly PAX into already congested air ports of debarkation (APOD.) This allowed aircraft to be committed to other priority missions like air insertion operations. The future sealift vessel JHSS and SEATRIN significantly improved the strategic movement time of forces over current sealift.
- The JHSS reduced unit movement time by 50% and Seatrains by 33% over the LMSR.
- Simplified Reception, staging, onward movement and integration (RSOI) by deployed complete units on the same platform. Eliminated the requirement to move unit personnel by air.

*** Transit Origin, sea port of embarkation and debarkation were constant variables.

Figure 7: Compilation of data that was used in the Joint Flow Analysis Support Tool (JFAST) for strategic movement within the Deep Future Wargame 2030-2040

Efficacy of Regional Engagement

Engagement Builds the Coalitions of the Future

Historical precedence, current U.S. national strategic guidance, and the ongoing global conditions of downward fiscal pressures on defense expenditures, as well as austerity and uncertainty, lead many to conclude the United States will continue to operate as part of a coalition to meet the challenges and threats of the near, mid-term and deep future. This will require the Army to operate successfully in a multinational context in an environment of increasingly complex operations and fiscal constraints in the 2030-40 timeframe. Figure 9 depicts the reduction of defense spending over the next five years in countries with whom we have a collective defense arrangements.

The Army must plan and integrate the unique capabilities future partners offer now in order to leverage and set the conditions for successful multinational operations in 2030-2040.

The Deep Future Wargame integrated multinational officers across the working groups. The Strategic Working Group included a panel of foreign liaison officers discussing the challenges associated with partnering with U.S. Forces in the future. Additionally, each operational working group incorporated these professionals into the planning and execution of contingency operations.

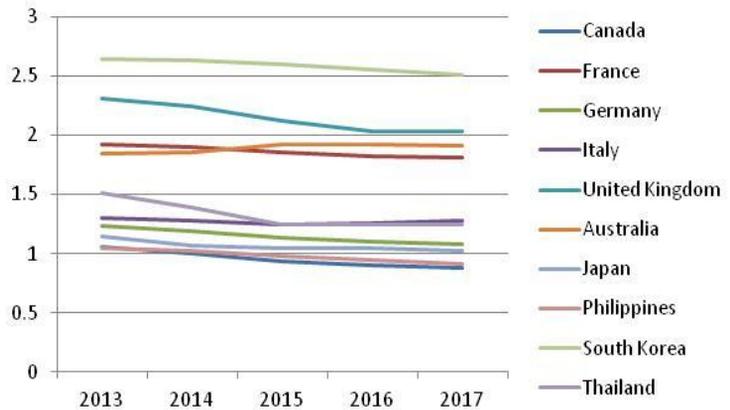


Figure 8: Gross Domestic Product (GDP) Expenditures for Defense (*Jane's Sentinel Security Assessment – 19 Feb-2013*)



Figure 9: Shows the reliance on the “coalition of the willing” to gain access, basing and overflight thereby achieving operational reach beyond the capabilities of the current Joint Force.

Regional Alignment and SOF/CF Interdependence provided the Army increased operational effectiveness through understanding, leverage, and access.

In the future, diverse challenges may make forming coalitions difficult. Effective, broad and enduring engagement offers an opportunity to expand the “bench” of potential coalition members to aid U.S. forces ideally avoiding the operational challenges the Evolution group faced and geographically depicted in Figure 10.

Multinational (MN) partners provide rapid access and integration in foreign environments; however, U.S. technological advances, relative to the technology likely used by foreign partners, may limit interoperability.

Future capabilities necessary for integration with MN partners must include provisions for interoperability possibly requiring backward compatibility with legacy systems.

The Deep Future Wargame 2030-2040 found that regional engagement provides critical expertise to understand requirements for such technological interoperability.

Army and joint forces must integrate rapidly and protect key systems in foreign partner nations, across all domains building

legitimacy and credibility for operations.

The wargame demonstrated that without access to sufficient and timely protection capabilities, Army forces will be challenged to prevent or mitigate an adversary’s ability to damage or destroy critical civilian and military infrastructure, transportation and power networks, thereby complicating restoration of regional stability.

Throughout the near-to-mid, and mid-to-far term, Unified Action Partners will be increasingly dependent on U.S. capabilities across Warfighting Functions to deploy and operate. Achieving strategic “Ends” requires synchronizing complex future “Ways” and “Means.” Future operations may require habitually associated, regionally aligned, joint, inter-agency, and Army elements to work closely together within complicated environments to achieve common objectives.

Described in figure 10, the wargame highlighted how integrating the effects and knowledge gained through years of Special Operations Forces and Regionally Aligned Forces (RAF) engagements set conditions for other operations, including unconventional warfare, in support of global objectives.

Since the Army builds partners and coalitions over long periods of time with the intent on creating mass, the value of that mass in preventing or shaping may not be evident until a decisive point in time. This graphic depicts successful operations through SOF/CF integration. Within the complexities of the operational environment in the wargame, the decisive effect required years of building capacity, command and control and interoperability.

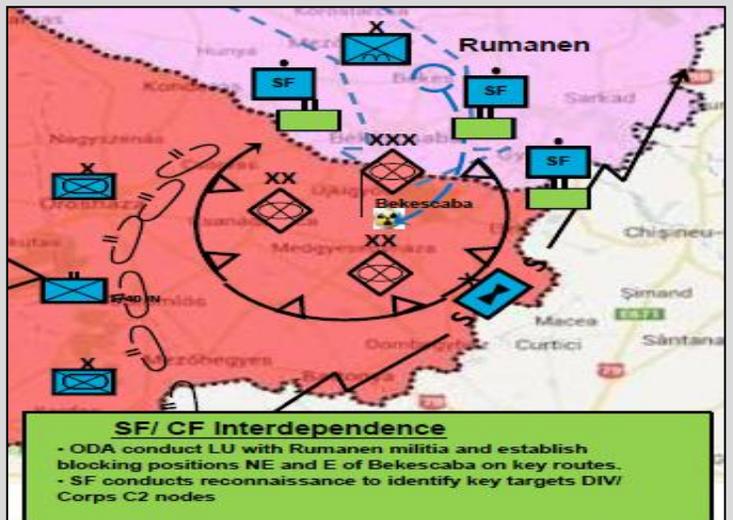


Figure 10: Integration of SOF/CF forces securing WMD

People, Information and Performance in 2030

The Army must recruit and develop leaders for evolving mission areas such as space, cyber, missile defense, countering weapons of mass destruction and information.

Future adversaries may attempt to protract any armed conflict, avoiding decisive defeat, with the intent to erode the American will. As such, the Army must be proactive in facing these challenges by developing the necessary knowledge, skills and attributes of the members of our profession. The Army must be an adaptable, agile force responding to the security needs of the nation within politically acceptable ends.

Strategic success requires leaders capable of understanding national interests and the application of military power in order to amplify tactical and operational success. Foremost, the Army must maximize its number one capital investment-the Soldier. Future Soldiers must have the cognitive capability to rapidly assess complex situations and then act to resolve conflict.

The Deep Future Wargame explored the challenges future Soldiers will face and opportunities that can be leveraged. In the wargame, unbridled by ethical and moral standards, adversaries employed a combination of high-tech, low-tech and mass that enhanced their resiliency and challenged coalition forces. While potential opportunities in human sciences may allow Soldiers to overcome some points of tactical overmatch, it was apparent that to have a mission-ready force in 2030, the Army must enhance Soldier performance, professionalism and resilience to complete the required tasks effectively and efficiently.

Moreover, the wargame determined leaders must understand land forces are more than the sum of tactical and operational capabilities. They are the only instrument of strategic power that can influence the will of an opposing military, people and its government, and therefore must be capable of providing that effect.

The Army and Joint force must comprehensively address “People” and “Government” as well as the “Military” paradigm; information is critical to changing human behavior as a key element of Strategic Landpower (SLP)

Today

Training and growing leaders takes years to develop superior competence and judgment

Echeloned Decision Making. Junior Soldiers & leaders lack decision authority to employ maximum combat power

Speed, complexity of battlefield, and quantity of information overburden Soldiers' cognitive capacity to make decisions and perform combat mission

Battlefield injuries as a result of overburdening of Soldiers and the psychological rigors of the battlefield remove Soldiers from the fight

Our combat power and social legitimacy are hindered by moral and ethical transgressions of our Soldiers and leaders

Tomorrow

Reduce time required to grow leaders; increase their physical and cognitive capacity by compressing “the 10,000 hours” – Impart more skills, faster, with greater retention and at less cost, making the most of the Soldiers we have

Empower Junior leaders with accelerated knowledge, judgment and “experience” needed to make critical decisions

Increased cognitive capacity turns data into decisions quicker; enable overmatch in an increasingly complex environment

Enable effective decision making at the point of need and the speed of war; reducing need to rely on decisions at higher echelons before taking action

Improved accessions; match Soldiers' physical and cognitive aptitudes to the most appropriate MOS and identify those more susceptible to injury and employ means to prevent it

Baseline and screen out those with higher levels of potential for aberrant behavior

Improved mental, moral and physical capacity and performance, better performance, lower life-cycle costs

Rebalancing Science and Technology

2030-2040 is a distant era until understood as an inevitable environment that the next generation of Americans will face as leaders and decision makers. The Soldiers who will serve and face the risks of conflict in 2030-2040 are currently elementary school students across the country. Figure 11 depicts the technology advances of today's investments in conjunction with the development of the leaders who may fight with our military capabilities in 2030-2040. The wargame highlighted how focused investments now in critical capabilities can reduce operational risk and overmatch challenges for future Soldiers.

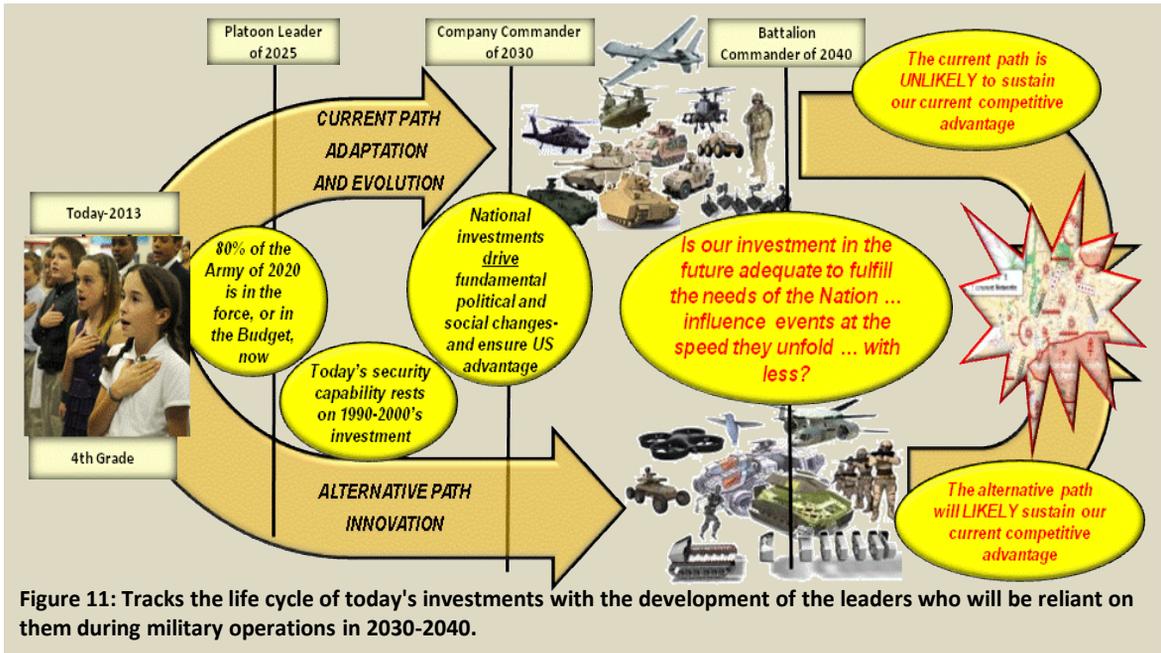


Figure 11: Tracks the life cycle of today's investments with the development of the leaders who will be reliant on them during military operations in 2030-2040.

DOD must re-balance now onto a path of innovation to prevent overmatch and to provide new capabilities for the future force.

The technologies and systems available to the Army of 2030 are in our science and technology budgets today and will lead to little change in the physical characteristics of the future force. Absent a focused investment strategy and key technology breakthroughs, these capabilities are inadequate to meet the challenges of this time period. Figure 12 depicts several opportunities that can address the overmatch equation explored within the wargame and further explored in the report.

The wargame highlighted that meeting the challenges of 2030 and beyond requires focused investment in fundamental scientific research to further leverage the information and exploit emerging Human Science and Materials "revolutions." Moreover, information management and advances in computational power appear to be the gateway to the exploitation of Human Sciences and Materials that can deliver new mission command environments, advanced materials to physically transform the Army without losing our competitive military advantage and significant opportunities for human performance optimization.

Improved agility and responsiveness can come from advanced materials with equivalent or greater protection and significantly lower platform and Soldier equipment weights. Discriminate, lethal and overmatching capabilities are possible by combining these physical gains with the power of advanced computing and improved Soldier cognitive and physical performance to gain situational awareness, decision superiority, reduced tactical surprise, increased lethality and greater tempo.

An integrated science and technology (S&T) strategy is required for the Army to operationalize the desired attributes of an Expeditionary Force.

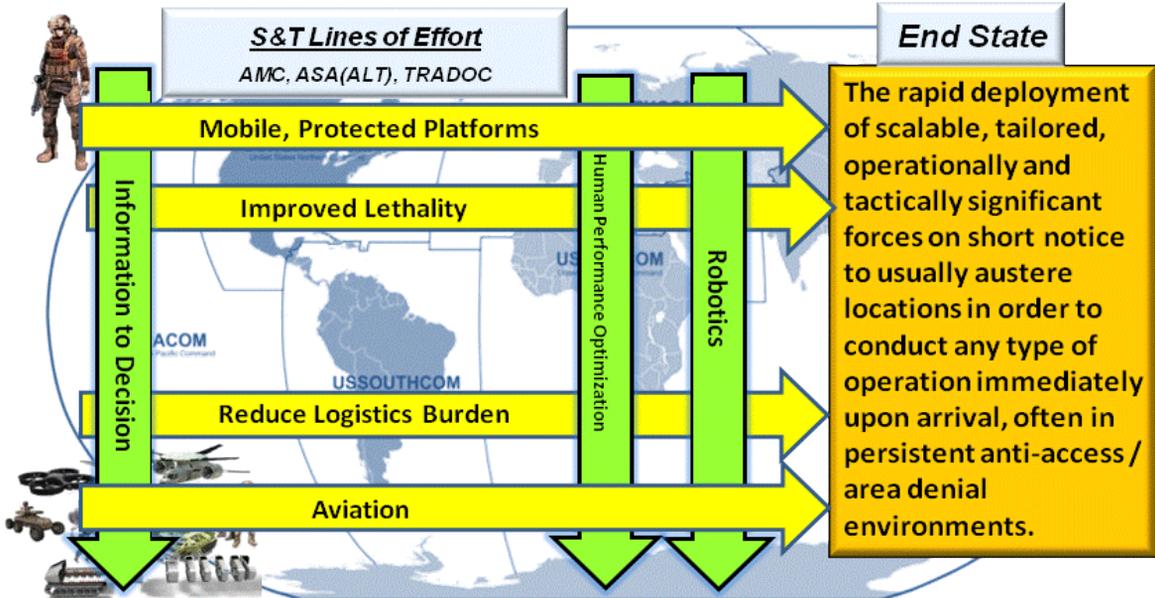


Figure 12: Attributes of an Expeditionary Force

Human Performance Optimization

Maximize cognitive “space” devoted to the enemy and problem solving ... More Capability and Decisions at lower levels ... Better outcomes ... Faster.

Given budget limitations, the time is right for the Army to increase its focus on a more cost-effective approach to meeting current and future training challenges in the human dimension of warfighting. Tremendous opportunities exist for collaboration with non-governmental research organizations. Breakthroughs across the entire medical community can be implemented including many that improve survivability, strength, endurance and cognition. Investments now in Human Science, coupled with Professional Military Education (PME) and Leader Development will produce Soldiers, leaders and units prepared for a complex future.

Figure 13 depicts the Army profession of arms within Malcolm Gladwell’s theory that it requires 10,000 hours of practice to achieve mastery in a field. The Army must compress this time to encapsulate the expertise of a 35 year old special forces operator into a 25 year old unit leader.

35 year old Special Operators

Compress the “10,000 hours”

25 year old Officers and NCOs

Figure 13

Maximizing performance of our #1 Capital Investment

Accelerated Information to Decision

Enables Mission Command, Reduces Surprise, Increases Decision Superiority, Operational Overmatch, Discriminate Lethality, Stronger Encryption and Cyber Dominance.

Today, a majority of the information coming to a young leader is through the same type of radio that his father used in the first Gulf War and Panama, his grandfather used in Vietnam and his great-grandfather used in WWII.

Accelerated information to decisions will play a major role in addressing the challenges of the dynamic and complex future operational environment through massive computing power and processing speed. Advanced computing offers the opportunity for greater situational understanding and decision superiority and enables more agile forces with more lethality and protection.

Additionally, these beyond-digital advances in computing may accelerate the speed of information management as

well as provide unbreakable encryption, unassailable cyber defenses, and undefeatable cyber attacks.

The Soldier of 2030-2040 will wear an advanced combat multi-capable helmet with a hands-free heads-up display (HUD). Much or all of the communication will come in through the helmet and eliminate the need for a hand-held microphone. The HUD and advanced combat helmet will also assist with target acquisition, real time written and oral translation, intelligence dissemination and even include the control semi-autonomous wingmen (both ground and air).

<u>Today</u>	<u>Tomorrow</u>
Commercial, digital dependence creating vulnerabilities and hampering ability to push all enablers and capabilities to, to the point of need and at the speed of war	Decentralize and distribute information and systems to fully enable mission command
Current systems and approach drives consolidation and centralization of systems/data vice increased distribution and decentralization to enable Mission Command	Access and integration and presentation of data to decision; greater situational understanding and decision superiority
Binary processing challenges integration and presentation present data to support decisions against a 9-12 vector problem: self, unit, enemy, locals, air, sea, cyber, space, land x 3, with more than a handset and a smart phone screen	Greater situational understanding and decision superiority, rapid, discriminate lethality, impenetrable cyber protection.
Significant increase in empowered, cyber actors challenges cyber dominance; wide-spread vulnerability to cyber attack	More agility, lethality and protection at lowest levels with reduced support echelons
Quantity of data accumulating outstripping the ability to leverage it efficiently	Address the challenge of the dynamic and complex operational environment through in stride use of large quantities of information and data
Critical information to inform decisions lies in the hands of key leaders	Reduce or eliminate risk of commercial dependence
Units surprised on 70% of enemy engagements.	Stronger encryption, stronger cyber defenses

Young leaders today use the same type of radio that his grandfather used in Vietnam, and his great-grandfather used in WWII

By leveraging advances in computational power, the cellular network will provide real-time and relevant information to the Soldier at the point of need and at “the speed of change” and war. This effort is clearly cross-domain and will demand the integration of all sensors into the information network. This will require innovative ways of automating information management networks to deliver real-time and relevant information at the lowest tactical level, similar to the capabilities of internet search engines. A distinguishing factor however, is that relevant information is pushed, instead of pulled, using a hands-free interface that give Soldiers and

leaders complete situational awareness and the ability to zoom in and out as the tactical and operational situation unfolds.

Figure 14 describes the desired evolution of systems required to enable mission command. With access to real-time and relevant information, the Soldier and leader can be empowered to seize and maintain the initiative by reducing surprise and conducting multi-dimensional operations as part of a cellular network.

**Keeping our edge ...
leveraging the full potential of
our People and Systems**



Mobile, Protected Platforms

A material science breakthrough is needed to significantly reduce vehicle weight, improve the tooth-to-tail ratio, enhance strategic responsiveness and maintain operational and tactical overmatch

Converting from analog to digital systems significantly increased the strategic, operational, and tactical cognitive agility of the Army. Advanced materials, i.e., changing what the Army is “made” of, will increase the physical agility of the Army in similar ways. Combining enhanced cognitive and physical agility from the strategic to the tactical level will enable the Army to quickly deliver military effect at the speed events unfold, the same effect with less manpower, or significantly greater effect with the same levels of manpower.

Mobile, Protected Platforms

Advanced materials can break the direct relationship between protection and material/system weight. In the face of increasing lethality, greater protection has produced heavier platforms and Soldier loads challenging mobility, increasing the physical burden, limiting deployment options, and increasing support demands that drive unfavorable tooth-to-tail ratios. Lightweight advanced materials can reverse this progression improving agility, maintaining protection and reducing sustainment demands. The second- and third-order effects of advanced materials will be significant.

The benefits of materials like carbon fiber are well known, but cost and physical properties can preclude widespread use. Advances in material science, such as nanotechnology, biometric materials, and additive manufacturing, have great promise to overcome these limits. The first combatant to capitalize on these possibilities will gain an important operational advantage. A significant increase in the amount and focus of our advanced materials investment is necessary to provide achievable options for the future.

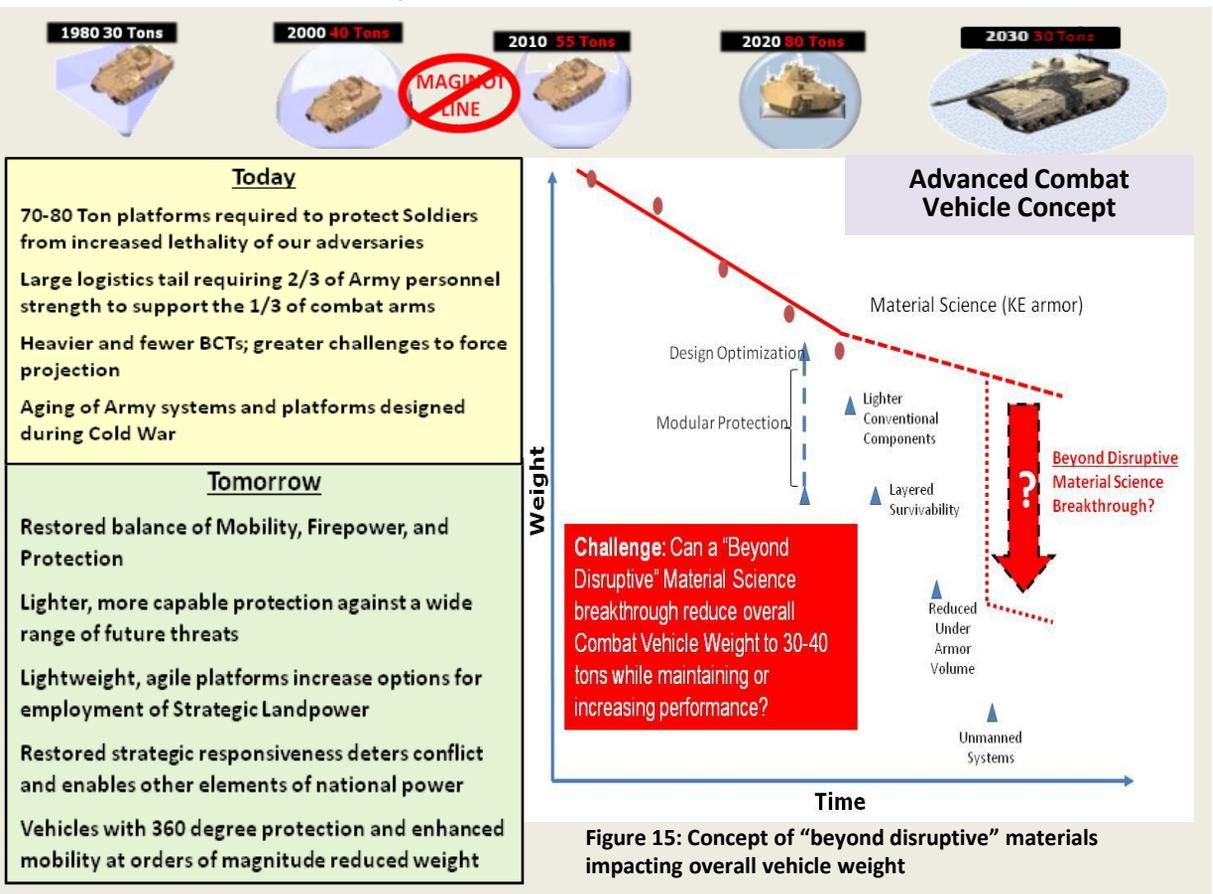


Figure 15: Concept of "beyond disruptive" materials impacting overall vehicle weight

Advances in material science will underpin more agile and robust platforms and equipment for the Army of 2030-2040. Material science advances of the past 20 years will be overcome by the emerging 360 degree battlefield geometry and increasing threat lethality. Soldier protection, though critical to mission success, has increased system weights and Soldier loads, hampered force projection, and increased sustainment requirements.

Significant scientific breakthroughs could yield materials that are ultra-light weight while providing improved protection and survivability

Aviation

Platforms are reaching the end of their service lives. Merely upgrading current designs will not be enough for the Army to maintain its edge.

The future vertical lift platforms of 2030-2040 are needed to replace several current aviation platforms that will reach their end-of-life-cycle in the 2030-2040 time frame. The vertical lift platforms of 2030-2040 may be manned or unmanned depending on the mission such as logistics or tactical combat reconnaissance. Breakthroughs in materiel science may increase payloads as a result of lighter materials. New engines may provide greater speed,

lift and range on less fuel while operating at higher altitudes. Emerging technology may provide stealth flight characteristics with minimal maintenance requirements.

Reliability and maintainability are also essential to future vertical lift platforms and future designs may incorporate interchangeable parts and robotic self repair to inherently reduce the future vertical lift platform's logistical footprint.



Currently the best in the world...but with capability shortfalls in altitude performance, speed, range, and cockpit awareness.

Delivering decisive combat power, to austere points of need, with the speed that matters.

Today

UH60 capabilities

- 160 knots cruising speed
- 368 mile range
- 23,500 lbs max take-off weight

CH47 capabilities

- 139 knots cruising speed
- 450 mile range
- 50,000 max take-off weight

Anti-access / area denial prevents sea-based operations because of standoff distances.

Continued vulnerability to Man Portable Air Defense Systems (MANPADS).

Tomorrow

Tiltrotor technology that enables speeds greater than 250 knots at twice the range of conventional helicopters

Medium, Heavy, and Ultra-heavy lift Future Vertical Lift (FVL) variants with order of magnitude increase in Soldier and equipment payloads.

Nap-of-earth automated flight, urban operation near buildings, slope landings, and automated selection of landing areas.

Advanced integrated sensors that significantly reduce degraded visual environments.

Improved Lethality

Expeditionary maneuver requires capabilities that are both responsive and decisive.

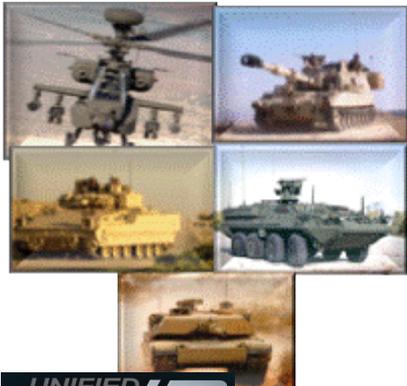
Improved lethality is required through innovative technologies to provide Army weapon systems increased capability for incapacitating or destroying enemy personnel, materiel and infrastructure across the full-spectrum of Joint operations.

The integration of autonomous and semi-autonomous systems across domains is necessary to succeed in the complex future environment and provide increased lethality.

The automated systems must be integrated among themselves and capable of integration across the unified action partners' systems. The autonomous systems will perform across the spectrum of warfighting functions independently or in conjunction with manned or semi-autonomous systems. The ratio of these systems will be mission and situation dependent.

Today	Tomorrow
<p>Line of sight munitions restricted by defilade, obstruction, and range.</p> <p>High-yield explosives that create high likelihood of significant collateral damage.</p> <p>Operational effects with limited allocation and delayed response to on-site tactical actors.</p> <p>Direct and indirect munitions physically limited by chemical propellants.</p> <p>Lethality limited to delivery through entry operations largely dependent on large logistics tails.</p> <p>Tactical tasks with extremely high risk assumption and decision restraint.</p>	<p>Extended range precision surface-to-air and surface-to-surface fires that overcome anti-access and area denial threats and enable assured access to global commons.</p> <p>Discriminate, scalable, tailorable effects that achieve combatant commanders' objectives while preventing fratricide and minimizing collateral damage.</p> <p>Achieve strategic effects with enabled, multi-functional tactical formations.</p> <p>Renewable directed energy resulting in "bottomless munitions stowage" and order of magnitude standoff increase.</p> <p>Multiple, simultaneous entry operations of rapid, modular forces able to fight and sustain themselves on arrival.</p> <p>Commanders empowered by autonomous systems substituted to conduct the most hazardous battlefield tasks.</p>

Lethal formations constrained by time, terrain, distance, and uncertainty.



Lethality, Mobility and Survivability-balanced formations that overcome terrain, distance, and uncertainty.



Optimizing Logistics

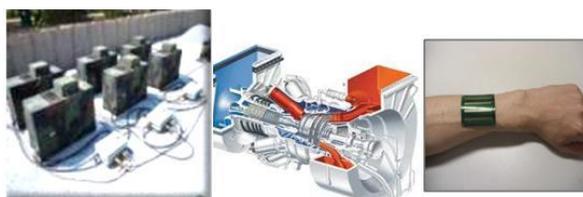
Innovative, efficient and effective solutions to increase tooth and decrease tail.

Army operations span a diverse range of tasks and operating environments, from enduring activities and infrastructure under little threat to expeditionary operations and sustained campaigns in hostile zones.

The Army must establish capabilities and procedures to manage power and energy as an integral aspect of its operations. Moreover, we need to identify those

critical performance measures corresponding to operational challenges beyond the historical focus of cost and environmental impacts.

Military requirements demand that we consider additional criteria, such as power and energy densities, logistics, ease of integration into military applications, safety, security, reliability, availability, flexibility, and adaptability.



Outdated technology that is a logistical burden and manpower intensive to support



Increased capability and efficiency at less cost. Evolutionary training and employment solutions.

Today

Multiple, non-rechargeable batteries that increase soldier load and present renewal dilemmas when dismantled (Soldier Power).

Outdated technology and power distribution systems increasingly reliant on fossil fuels (Power Generation).

Inefficient shelters dependent on non-standard power generation / spot generation (Contingency Basing).

Units of action heavily reliant on routine logistics resupply of fuel, water and the formations that transport them

Tomorrow

Standardized rechargeable batteries with integrated hybrid power and recharging solutions.

Solar, wind, and hybrid-electric technologies resulting in "Net Zero" installations and lighter footprint forward basing options.

Contingency basing that includes:

- Energy efficient shelters
- Hybrid power solutions with micro-grids
- Bottled water at the point of use
- Waste water reuse systems
- "Water from air technology"

Decentralized units of action operating unconstrained of energy burdens.

Implications for the Army of 2030

Anticipated challenges of the future operational environment demand the Army operate differently than it does today

Current strategic maneuver platforms are inadequate.

Science and technology investments and capability development must continue to focus on lift systems that improve strategic, operational and tactical maneuver. Reducing predictability and leveraging force projection across all domains increases employment options and creates multiple dilemmas for the adversary, stressing their defense systems.

Investment is required to make expeditionary maneuver feasible.

Investment in advanced technologies, materials, and lift systems may reduce sustainment demand and increase strategic responsiveness. The Army requires advanced vertical lift systems to enable the conduct of simultaneous distributed maneuver. Army aviation forces, which can self-deploy from the continental United States (CONUS), contribute to rapid deployment. These advanced lift systems enable the conduct of vertical envelopment with medium forces, thus giving the ability to employ forces with greater mobility and combat power at greater distances.

Space and cyberspace capabilities are essential to operational success.

Space and cyberspace capabilities provide significant contributions to achieve overmatch. The Army and joint forces must develop capabilities to integrate space and cyberspace into current forms of maneuver to retain competitive advantage and achieve overmatch in the future. These capabilities provide new mechanisms to create physical, virtual, and moral dilemmas.

Knowledge overmatch is a critical capability.

Achieving knowledge overmatch in the future requires the integration of all forms of maneuver in all domains, combined with executing timely and accurate information management. The development of control measures, such as a cyberspace engagement area, is required to effectively visualize and synchronize cyberspace effects with the overall scheme of maneuver. Effective knowledge management at all levels of war will be critical in the information-saturated environment of the future. During expeditionary maneuver, cross-domain cyberspace effects can deceive the opposing force, resulting in lower casualties and successful entry operations.

Mission command systems must be capable of handling “big data.”

A mission command system that supports rapid sharing of information and improves understanding is essential for planning and conducting future operations. Emerging Army capabilities must retain the ability to link seamlessly with legacy and partner mission command systems. Future systems must provide timely decision-support information to decision makers. The ability to decipher “big data” into actionable information enables rapid decision making and is critical to responding at the speed of events. Training and leader development must expand the understanding of the role of military deception in future joint and Army operations. Deception planning maximizes protection and operational surprise even when conducting operations at multiple improved and unimproved entry points. The Army must continue to invest to ensure the mission command system is robust, resilient, and sufficiently redundant so forces can continue to operate even when communication networks are degraded and/or compromised.

Implications for the Army of 2030

Adversaries will seek out and capitalize on our vulnerabilities

Change is needed to improve partnerships between special operations and conventional forces.

Without resolution of the current cultural, training, leadership and awareness challenges the Army cannot achieve sustained SOF-CF interdependence. The Army requires changes in institutional and operational paradigms to facilitate SOF-CF interdependence. Interdependence is limited currently by artificially introduced factors such as mission command relationships, culture, training and education, and resource allocations. Changing doctrine and training can be achieved quickly, even in times of fiscal challenges.

Partner contributions will be limited by means available.

Integration of allies and partners is limited by capabilities and national interests. Joint and Army planning must address the ability of allies and partners to operate with U.S. forces. To build mass, joint force commanders will still rely on allied and partner capabilities; however, accounting for national caveats; political will, levels of coalition interoperability, and availability and use of non-traditional partners will remain paramount. At a strategic level, ensuring that allies and partners can participate in an operation may be more significant than their individual contributions at the tactical level. For the Army and the joint force, force allocation and force development efforts need to address now to ensure unified action partners can contribute unique military and non-military capabilities.

Global posture and regional alignment will influence expeditionary responsiveness and speed.

A2AD threats present new challenges to sustaining joint operations globally. Army sustainment capabilities must be resilient and adaptable and possess built-in redundancy without sacrificing expeditionary capabilities. Mission command on the move, just-in-time distribution, mission-tailored organizations, increased self sufficiency (both Soldier and unit) and increased joint interdependence are methods of sustainment force design characteristics worth exploring. Additionally, the Army must consider redesigning Army prepositioned stock (APS) concepts. Combat configured pre-positioned stocks afloat – optimized for maneuver, not mobility – can mitigate some strategic hazards created by reduced access to forward staging and basing. Redesigning APS could decrease the time necessary for units to deploy by overcoming challenges created by global posture changes. Consideration of joint interdependence when configuring and deploying APS allows the joint force to increase the speed of employment while decreasing capital investments. While costs will increase to maintain higher APS readiness standards and to train Soldiers on compatible systems at home stations, operationally relevant benefits are realized in the decreased strategic mobility requirements to project power. RAF must fulfill an existing combatant command's requirements and integrate with existing missions, systems, and formations across the U.S. Government. Therefore, allocation of RAF must nest within DOD's Guidance for the Employment of the Force (GEF) and geographic combatant commander (GCC) campaign plans, and integrated with Theater Special Operations Command (TSOC) plans. While RAF will not satisfy all of the GCC's demands, it must assist combatant commanders in meeting GEF objectives within their theater campaign plans.

Implications for the Army of 2030

The Army must invest in change NOW to retain competitive advantage

Counter anti-access and area denial threat requires new doctrine and focused investment.

The Army's ability to contribute to power projection in anti-access and area denial (A2AD) environments requires improved technology. The Army requires more capable Army air and missile defense capabilities to overcome enemy A2AD. These capabilities could include land-based anti-ship ballistic missiles; maritime autonomous target recognition; guided-multiple launch rocket system (GMLRS); and directed energy anti-ballistic missile systems. Directed energy systems should require less sustainment demand, especially with no ammunition requirements. Landpower must continue to contribute to counter A2AD activities. These activities include: special operations, critical infrastructure protection, forcible entry (airborne, air assault, ground assault), building partner capacity, collecting human intelligence, and establishing a theater framework. The Army's ability to project an operationally significant force to challenge a potential adversary's strategic center of gravity provides real options to decision makers.

Soldiers must be empowered to successfully operate in a communications degraded environment.

Soldiers need to learn to operate with degraded or failed network communications, and be trained and capable of restoring functionality to degraded or failed networks. Additionally, the time from information to decision must be reduced at the strategic, operational, and tactical levels. Soldiers require the skills and abilities to operate when automation fails. The proliferation of technology into all aspects of warfighting will not replace the Soldier. Training cannot focus solely on the technology; it must also address the ability to operate effectively in the absence of that technology.

Robotics offer promise; however further study is required.

The use of automated combat systems (robotics) require the development of integrated solutions across doctrine, organizations, training, materiel, leader development, education, personnel, and facilities activities. Assessments are needed to validate the value of tactical and operational robotics and the impact on the joint force's ability to project power from strategic distances, since these requirements may increase the time required to project the capability into a theater of operations. Although unmanned air and ground systems provide depth and survivability to tactical and/or operational leaders, the Army must weigh any additional lift and sustainment requirements created by automated systems against their usefulness. Additional study is needed to understand how and when robotics should replace or augment formations. The Army must ensure the use of robotics does not place an increased burden on a Soldier or leader. Effective systems limit second- and third-order effects on the organizations utilizing the system. The use of robotic sustainment systems can produce efficiencies by conducting difficult or repetitive tasks more quickly and for prolonged durations. This reduces the number of Soldiers needed for sustainment tasks and reduces risk of death, injury, and exhaustion to sustainment Soldiers. However, robots have their own supply, maintenance, and parts requirements that effect sustainment activities.

Partner cyber defense capability is a potential vulnerability.

To sustain combat power, the joint force must be prepared to support the defense of allied and partner cyberspace. Partner transportation systems and the sea- and air- ports of debarkation normally operate on an unclassified network. The ability of those partners to project power will be compromised if these networks cannot be defended.

Way Ahead

As the Army transitions from execution to preparation, studying future challenges is critical to ensuring national leaders possess relevant options to protect the country in coming decades. Army Capabilities Integration Center (ARCIC) will build on the success of the 2013 Deep Future Wargame throughout Unified Quest 2014.

The study objectives and analytical learning demands will transition from an infusion of key technologies to exploring new Joint formations that may be required to protect vital national interests in the 2030 period.

2014 Key Events Summary

- Strategic Trends Seminar: Examine intersecting trends, emerging capabilities.
- Focused Environment Workshop: Examine future environments such as Megacities and consequence management environments including mass atrocities and contaminated environments.
- Deep Future Wargame II: Explore future capabilities across the range of military operations in a megacity environment.

The Army Campaign of Learning

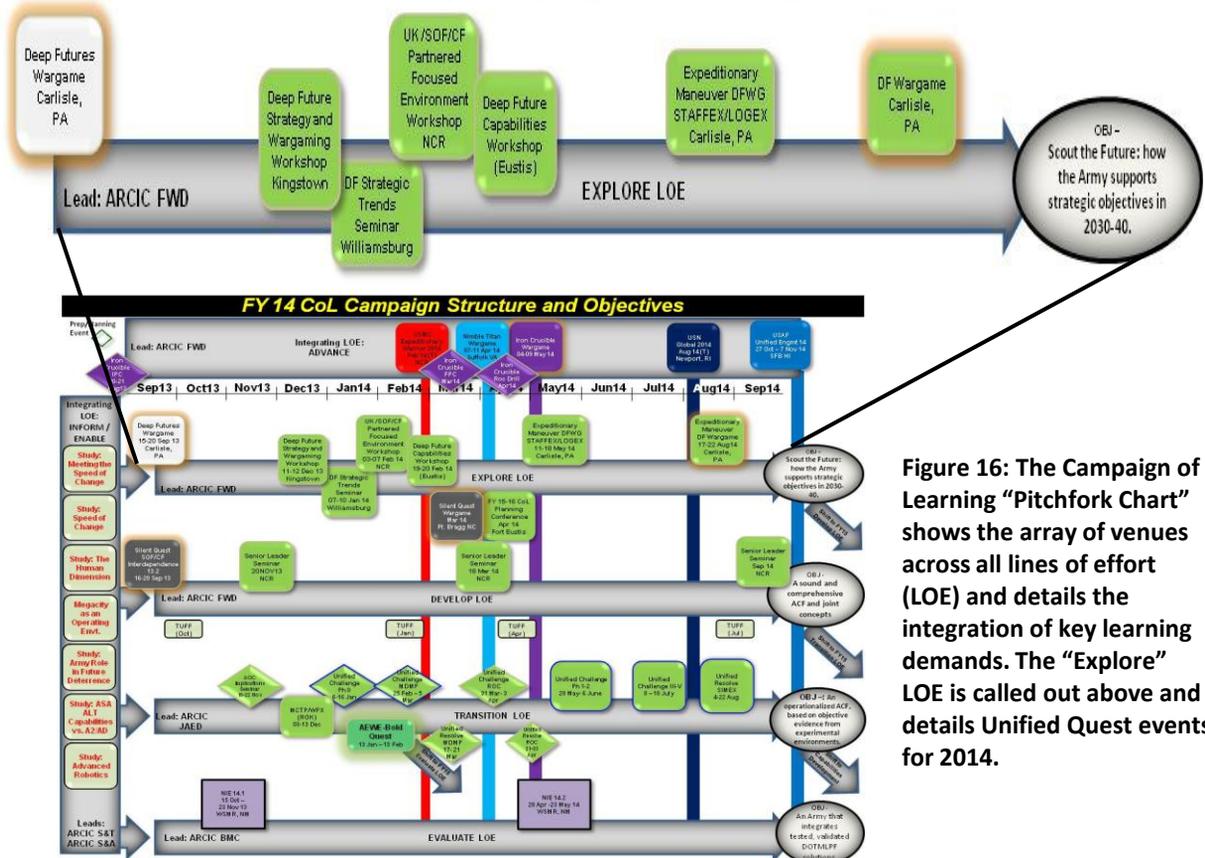


Figure 16: The Campaign of Learning "Pitchfork Chart" shows the array of venues across all lines of effort (LOE) and details the integration of key learning demands. The "Explore" LOE is called out above and details Unified Quest events for 2014.

Every nested Campaign of Learning effort has potential to drive change in any of the time horizons resulting in development of concepts, required capabilities and better informed Army and Joint programs



“While we cannot predict the future of our increasingly uncertain and complex strategic environment, we can be certain that our Nation will continue to call on America’s Army.”

General Raymond T. Odierno
38th Chief of Staff of the Army



***For Additional Information on Unified Quest Deep Future Wargame 2030-2040
or the Army Campaign of Learning***

contact Future Warfare Division, Army’s Capabilities Integration Center
US Army Training and Doctrine Command
Fort Eustis, Virginia 23604



Victory Starts Here