Army Science & Technology

Technical Directors' Meeting
ASTAG Follow-on

Army S&T Challenges for POM 14
The Way-Ahead

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for Research and Technology

14 July 2011

Why we are here

- **To provide you with an overview of the new processes we are implementing in Army S&T to better reflect Senior Leadership priorities and budget synchronization**
- **To share with you Army Leadership S&T priority investment areas.**

ASTAG/ASTWG Process Change

Existing ASTAG/ASTWG Process

Process endorsed next year's program—4-star input only at the end

Dec (FY-1)

Guidance—Priorities
urrent War Effort
rmy Focus Areas
arfighter Outcomes

DASA(R&T) ★★

- WFOs dominated tech focus; other issued marginalized
- Guidance very broad and focused on addressing parts of WFOs with technologies not on providing capability
- Fo[illegible] FY (i.e. DEC 2009 gave guidance for FY[illegible])

$90K

Capability Challenges

NEW

Jan-Feb (FY-1)

Lab/R&D Centers Proposals Developed

PEO/PM
Coordina[illegible]

- No binding PEO/PM commitment
- Focus on preserving money in PE/Proj in ASTMIS and on using existing resident skills
- ATOs promised "protection from cuts"

COMBINED

Mar-Apr (FY-1)

Validate Quality and Resources

AMC(RDECOM), COE, [illegible], MRMC, SMDC

- Non Synchronous budget info -field not privy to HQ changes
- Partnership considerations secondary – "endorsements" not "commitments"

May (FY-1)

Validate Relevance to Warfighters

TRA[illegible]CIC
Re[illegible]s

- Verified [illegible] proposa[illegible]Os address[illegible]) but did not [illegible] effort to[illegible]

($30K)

May (FY-1)

ASTWG ★★
Update & New Member O[illegible]

DASA(R&T)/
[illegible] FD, [illegible]irs

DA S[illegible]ACOMs
/[illegible]RUs

$(35K)

- Out of sync with process
- Frequently subject to slippage

Jun (FY-1)

HQDA Warfighter Technical Council ATO Nominations ★

Chaired by
ODASA(R&T[illegible]hnology;
G-8, Dire[illegible]ures;
TRADOC [illegible]Concepts
Development and Learning

DA Staff/[illegible]&D[illegible]ters Reps

$(140K)

- Proposal must [illegible] fu[illegible]r consideration – no flexibility t[illegible]eprogram
- Proposals not prioritized – accept or not
- Selected based on achieving functional not capability balance.
- Only addressed approx 40% of 6.2 and 6.3 funds

Jul-Aug (FY-1)

ASTWG ★★
ATO Update/ Approval

DASA(R&T)/
[illegible] FD, Chairs

DA Staff/ACOMs
/ASCCs/DRUs

$(35K)

- No alignment with ARFORGEN & POM – too late
- [illegible] executed [illegible] of strategic investment decisions (prior year)
- Focus on approval only, not on results during or after program execution

COMBINED

Oct (FY)

ASTWG ★★
ATO Portfolio Completions

DASA(R&T)/
G-8, FD,
Chairs

DA
Staff/ACOMs
/ASCCs/DRUs

- Was comb[illegible] with the p[illegible] ASTWG before 2009. Not a decision forum

Nov/Dec (FY)

ASTAG ★★★★
Portfolio Validation

VCSA/ASA(ALT), Chairs

DA Staff/ACOMs
/ASCCs/DRUs

- Usually delayed to Jan-Feb timeframe - relevance further degraded
- Leadership felt they had no opportunities to provide guidance/input in process
- Enhanced notion of IRRELEVANCY

Approx 90 Programs 40% of the S&T Budget

New process will save $150K by eliminating non-value-added meetings.

New ASTAG/ASTWG Process

Now influences out-year POM with 4-star input at the beginning

May-Jun (FY-3)	Jun-Jul (FY-3)	Aug-Sep (FY-3)	Oct(FY-2)	Dec (FY-2)	Feb - Apr(FY-2)
Develop Capability Challenges against which Technology Enabled Capability Demonstration (TECD) S&T Programs can be built to deliver capabilities in 2-3 years	★★★★ ASTAG Capability Prioritization guides strategic and tactical planning	Preliminary TECD Program builds	★★ ASTWG Review/ Approval	★★★★ ASTAG TECD Approval	POM Build supported relevant fiscal data
DASA(RT), G-8, TRADOC ARCIC, AMC(RDECOM), COE, DCS G-1, MRMC, SMDC,	VCSA/ASA(ALT), Chairs	AMC(RDECOM), COE, DCS G-1, MRMC, SMDC	DASA(R&T)/ G-8, FD, Chairs	VCSA/ASA(ALT), Chairs	DASA(R&T)
5-20 Challenge Statements	DA Staff/ACOMs /ASCCs/DRUs	5-20 Potential Programs	DA Staff/ACOMs /ASCCs/DRUs	DA Staff/ACOMs /ASCCs/DRUs	S&T POM submission endorsed by Leadership and Army-wide Stakeholders & Partners
		DASA(RT) Issues Guidance in terms of Challenge Statements			EEPEG to G8 for POM Approval
					5-20 Programs = 40-50% of 6.3 funding (first yr)

Broad challenges prioritized up front → ***Detailed program planning to examine technical feasibility and affordability*** → ***Priority programs validated for POM build***

Moving from ATOs to TECDs

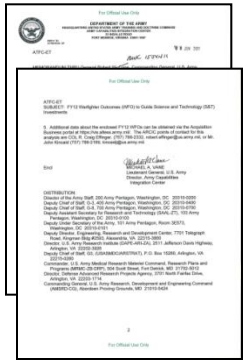
Characteristics of ATOs

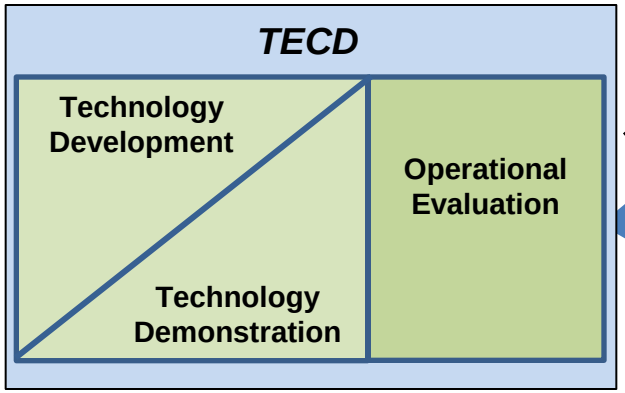
- Three types of ATOs: ATO-R, ATO-D, ATO-M
- Bench-level initiatives generated from the bottom up
- Focused on individual technical objectives, not capabilities
- Mapped to Warfighter Outcomes and *endorsed* early by TRADOC schools
- Needed to be combined after S&T to provide an operational capability
- Difficulty transitioning
- Difficult for Senior leadership to understand the value of individual ATO products

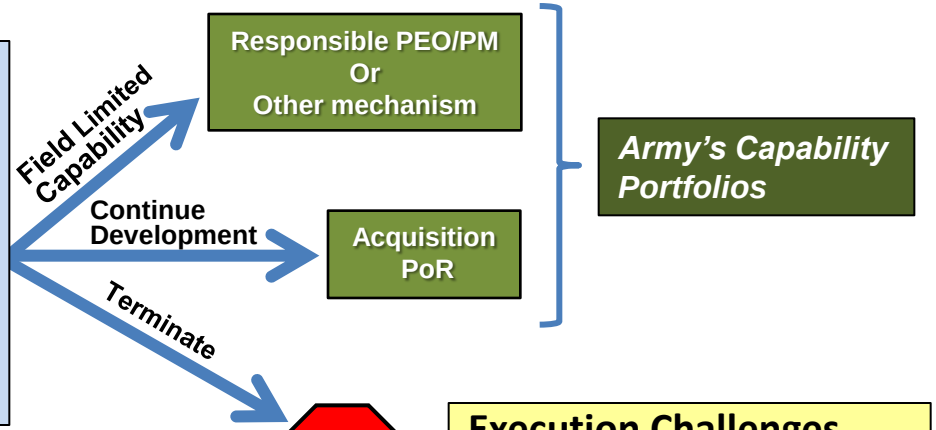
Execution Challenges
- Cooperation
- Transition
- Adaptability/ Responsiveness
- Visibility & Oversight

Characteristics of Technology Enabled Capabilities Demonstration (TECD)

Warfighter Outcomes







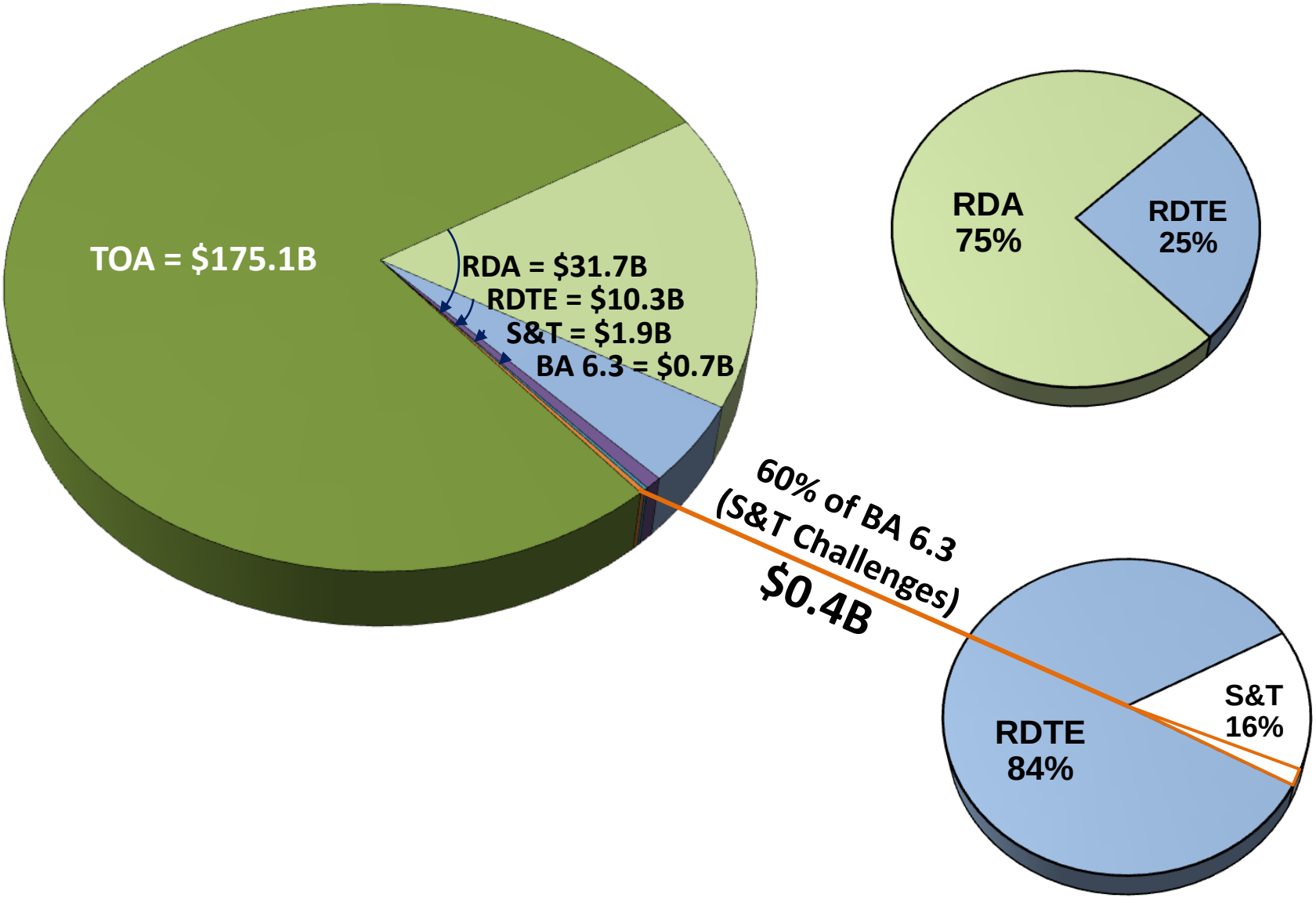
- Integrated programs across all S&T
- Integrated solutions/multiple systems
- Output is a full capability
- High-level oversight, including TRADOC involvement

Execution Challenges
- Cooperation
- Synchronization
- Moving funding
- Program Management

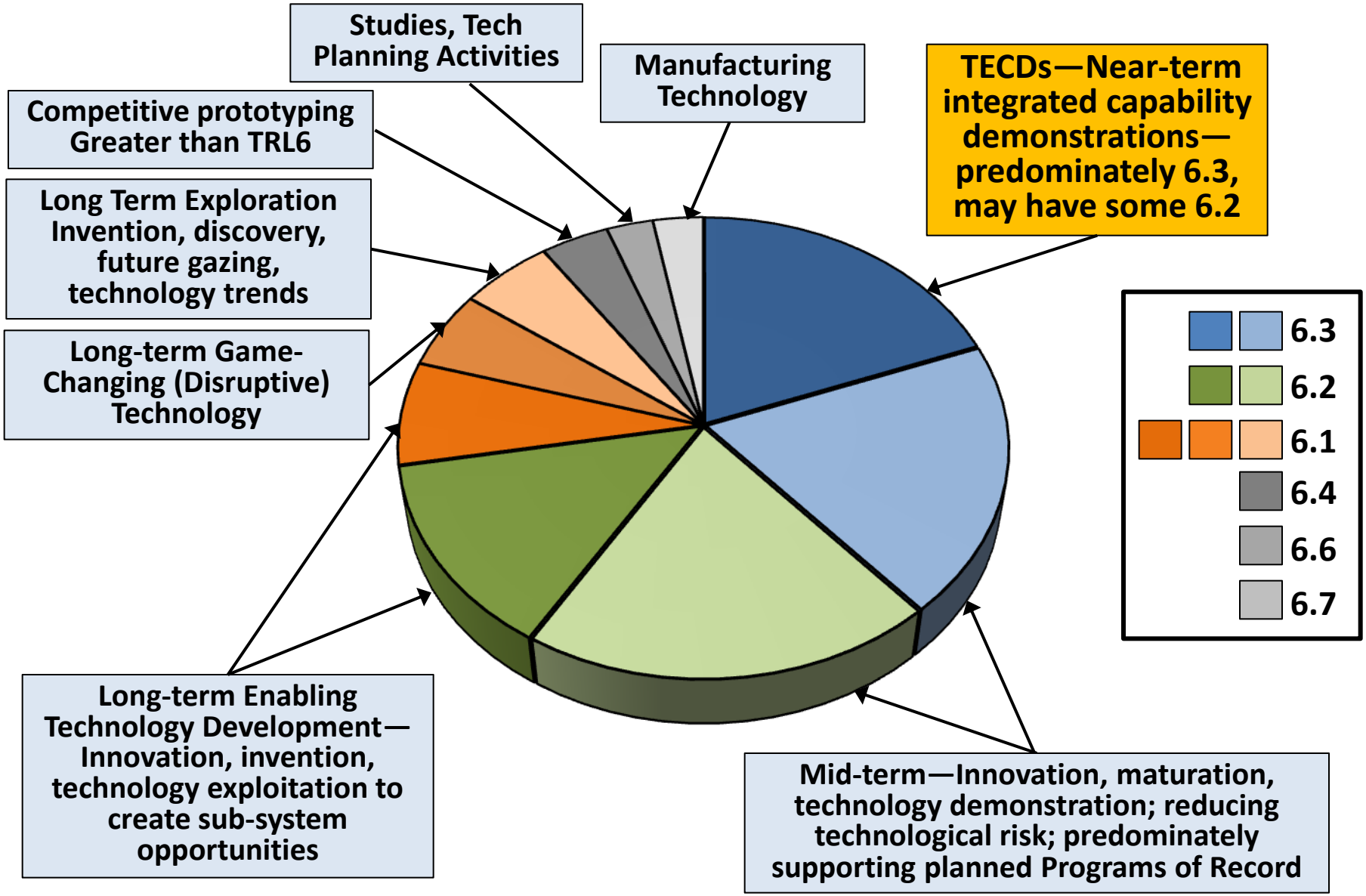
New S&T Initiative

Big Problems/Challenges

Army Investments Break-out PB11



New S&T Investment Strategy



Steps to TECDs
Problems and Challenges

TRADOC S&T Domains

- Training
- Mission Command
- Power and Energy (Sustainment)
- Counter IED & Mine (Protection)
- Human Dimension
- Fires
- Movement & Maneuver
- Intelligence

7
Broad Problem Areas

24
Focused Challenge Statements

Specific Challenge Objectives

X
S&T Programs "TECDs"

Workshop 1-2 June 2011 focused on "Soldier as the Decisive Edge"
Engaged over 100 stakeholders from across the Army to identify critical problems and challenges that S&T could solve or meaningfully address in the near-term.

5 Jul 2011
ASTAG

Fall 2011
ASTWG & ASTAG

Problems listed in no particular order

Big Army Problems
"Soldier as the Decisive Edge"

1. There is insufficient **FORCE PROTECTION** to ensure highest degree of survivability across the spectrum of operations.

2. Soldiers in Small Units (squads/fire teams/crews) are **OVERBURDENED** (physically and cognitively); this degrades performance and may result in immediate, as well as, long term consequences.

3. U.S. Army squads are too often **SURPRISED** in tactical situations. Soldiers in Small Units lack sufficient timely **MISSION COMMAND & TACTICAL INTELLIGENCE** to understand where their assets are, who and where the enemy is, who and where non-combatants are and to document and communicate this information to each other and higher echelons.

4. We spend too much time and money on **STORING, TRANSPORTING, DISTRIBUTING and WASTE HANDLING** of consumables (water, fuel, power, ammo and food) to field elements, creating exposure risks and opportunities for operational disruption.

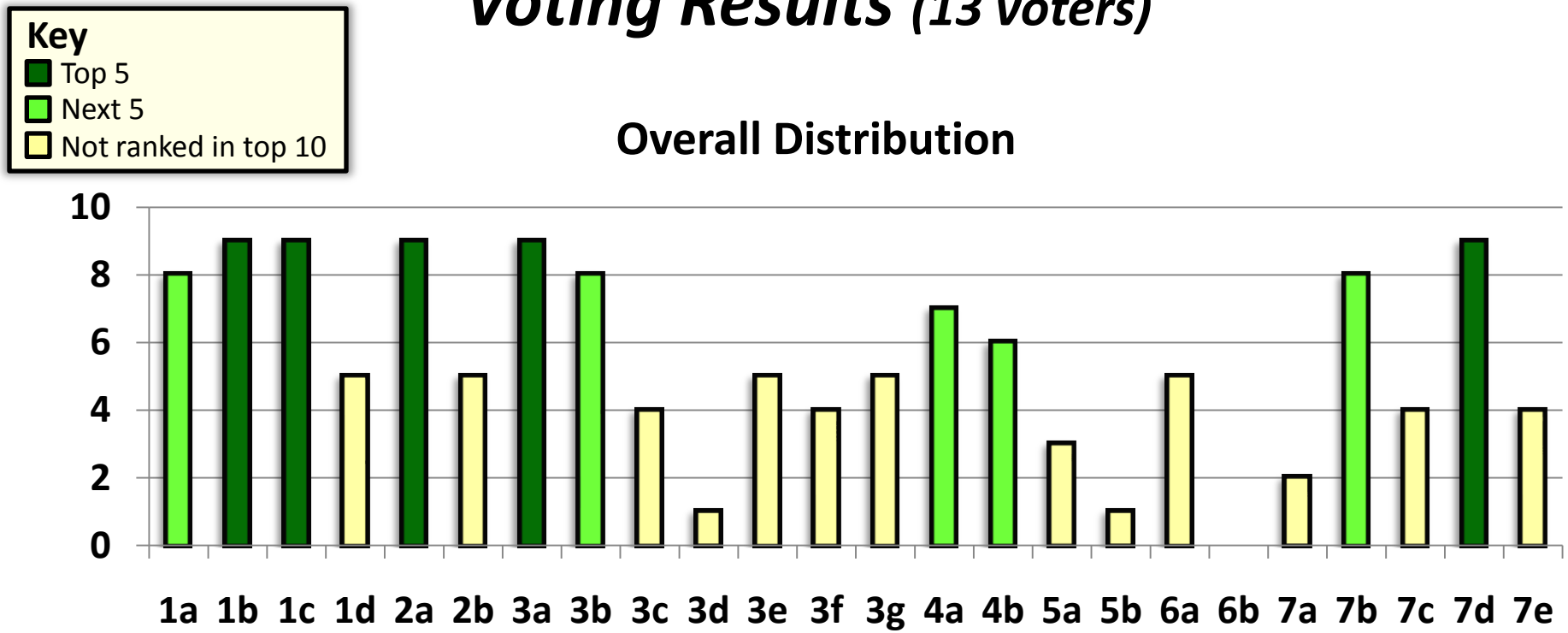
5. Soldiers in Small Units have limited capability to integrate maneuver and fires in all environments to create **TACTICAL OVERMATCH** necessary to achieve mission objectives.

6. Operational **MANEUVERABILITY** (dismounted & mounted) is difficult to achieve in complex, austere, and harsh terrains and at high OPTEMPO.

7. We do not understand **WHAT MAKES THE HUMAN TICK** in a way that can lead to assured ability to perform operational, high OPTEMPO missions effectively and without secondary negative effects.

The Workshop Identified S&T Big Challenges (24) and the ASTAG Prioritized those Challenges

ASTAG Priority Challenges
Voting Results *(13 voters)*



Challenge #	# of votes	Challenge Title	% of ASTAG votes
1b	(9)	Force Protection – Soldier & Small Unit	(69%)
1c	(9)	Force Protection – Occupant Centric Platform	(69%)
2a	(9)	Overburdened – Physical Burden	(69%)
3a	(9)	Surprise/Tactical Intelligence – Mission Command	(69%)
7d	(9)	Human – Medical Assessment & Treatment	(69%)
1a	(8)	Force Protection – Basing	(62%)
7b	(8)	Human – Individual Training to Tactical Tasks	(62%)
3b	(8)	Surprise/Tactical Intelligence – Actionable Intelligence	(62%)
4a	(7)	Sustainability/Logistics – Basing	(54%)
4b	(6)	Sustainability/Logistics – Transport, Distribute & Dispose	(46%)

Top 5

Army S&T Vectors
(cross-walked to S&T challenges & ASTAG priorities)

Top 5 | Next 5 | Not in Top Ten

Domains	"Big Issues"			
Training	Home Station/Mission Cmd-Centric Trng (Build Adaptive Teams & Units) 7.b, 7.c	Accelerate Indiv Learning 7.b	Persistent & Adaptable Tng/Educ. Infrastructure 7.b, 7.c	
Mission Command	Network the Force 3.g	Common Situational Understanding 3.a, 3.b	Mission Command on the Move 3.a, 3.g	
Power and Energy (Sustainment)	P&E Mgt 2.a, 4.b, 6.a	Enhanced Energy Agility 4.a, 4.b	Supply Chain Logistics 4.a, 4.b	Force Health Protection 7.d, 7.e	Expeditionary Base Camps 1.a
Counter IED & Mine (Protection)	Enhanced Protection 1.b, 1.c, 2.a	Combat ID 3.b, 3.d, 3.e	Hazard Detection on the Move 1.d	
Human Dimension	Soldier Load 2.a, 2.b	Assessment, Readiness, and Resilience 7.a, 7.b, 7.c, 7.d	Excessive Cognitive Demand 2.b	
Fires	Air Defense 5.a	Integrate Maneuver and Fires 1.a, 3.d	Scalable Effects 5.a, 5.b	Dismounted Target Acquisition 5.a, 5.b	
Movement & Maneuver	Joint Multi-Role Aviation Capability 6.a, 6.b	Unmanned Ground Autonomy 2.a, 4.a, 4.b	Enable Soldier and Small Combat Teams 1.b, 1.c, 5.a, 5.b	
Intelligence	Small Unit Operational Surprise 3.b, 3.c, 3.d, 3.e, 3.f	Precision Collection 3.b, 3.d, 3.e, 3.f	Data-to-Decision 3.f	Holistic Human and Societal Assessment 3.c, 7.a	

Next Steps

1. **Refine challenge statements with**
   - **Army S&T—RDECOM, Corps of Engineers, Army Research Institute, MRMC, Space and Missile Defense Center, etc.**

Also seek help from:

- **Industry (IRAD and Rapid Innovation Funds)**
- **DARPA**
- **OGAs**

Detailed review of technical feasibility and affordability

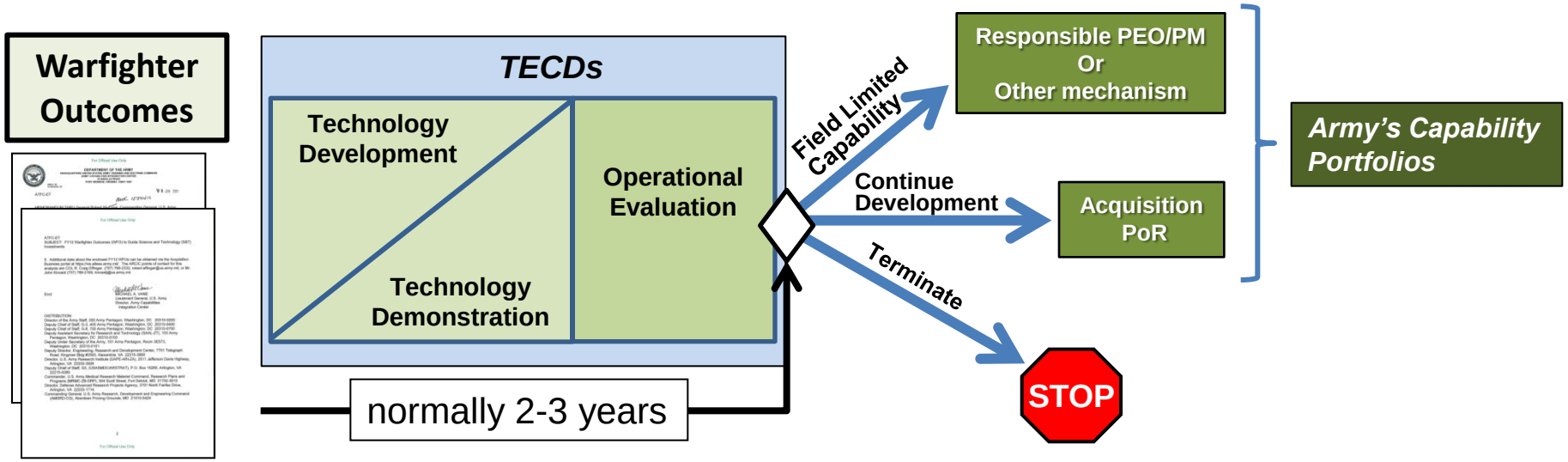
Continue cooperation and collaboration with TRADOC—ARCIC and all CoEs to refine objectives

2. **Facilitate collaboration/cooperation to develop concrete S&T programs to address challenges**
3. **Vet and reconcile program proposals with ASTWG (28 Oct 2011)**
4. **Present final programs to ASTAG for endorsement (Dec 2011)**
5. **Execute programs and/or seek additional resources if needed through POM process**

Guidance to the Army S&T Community

What are TECDs

Characteristics of Technology Enabled Capabilities Demonstration (TECD)



- **Integrated programs across all S&T**
- **Integrated solutions/multiple systems**
- **Output is a full capability**
- **High-level oversight, including TRADOC involvement**
- **End of program is a decision point**
- **TECDs are centered around near term technologies brought together in a new, novel , unique way to demonstrate an operationally meaningful improvement**

My expectations

1. **ONE** proposal will be developed for each of the top 10 challenge statements using the 19 chart format. (Hint-Start with the Heilmeyer Questions)
2. At end of 2-3 year, the program to be at decision point.
3. Mature technologies will form the basis of the effort . Leverage prior and ongoing efforts where ever possible. Evidence of maturity must be provided/documented in the program plan.
4. Program plans must identify the critical path and risk reduction plan for managing technical, programmatic, policy and other risks
5. There is nothing in any of the challenges that precludes any organization from participating in developing the proposals and offering solution options. Be open to working together in interdisciplinary teams to achieve the best outcome(s)
6. Program proposals must:
   a) Clearly identify the baseline (what is the representative mark on the wall for capability in the current state?)
   b) Provide a recommendation on who the Technology Program Manager (TPM) should be for your proposal.
   c) Have clearly stated deliverables

TECDs

IS / DOES

- Clearly define the baseline capability
- Clearly identify hard targets
- Clearly identify necessary (and sufficient) steps to close gaps to an operationally meaningful degree
- Contain sufficient metrics to monitor progress and success
  - Technical
  - Operational
- Create common and shared expectations among the challenge partners - - each committed and responsible for bringing the proposed solution to fruition

IS NOT / DOES NOT

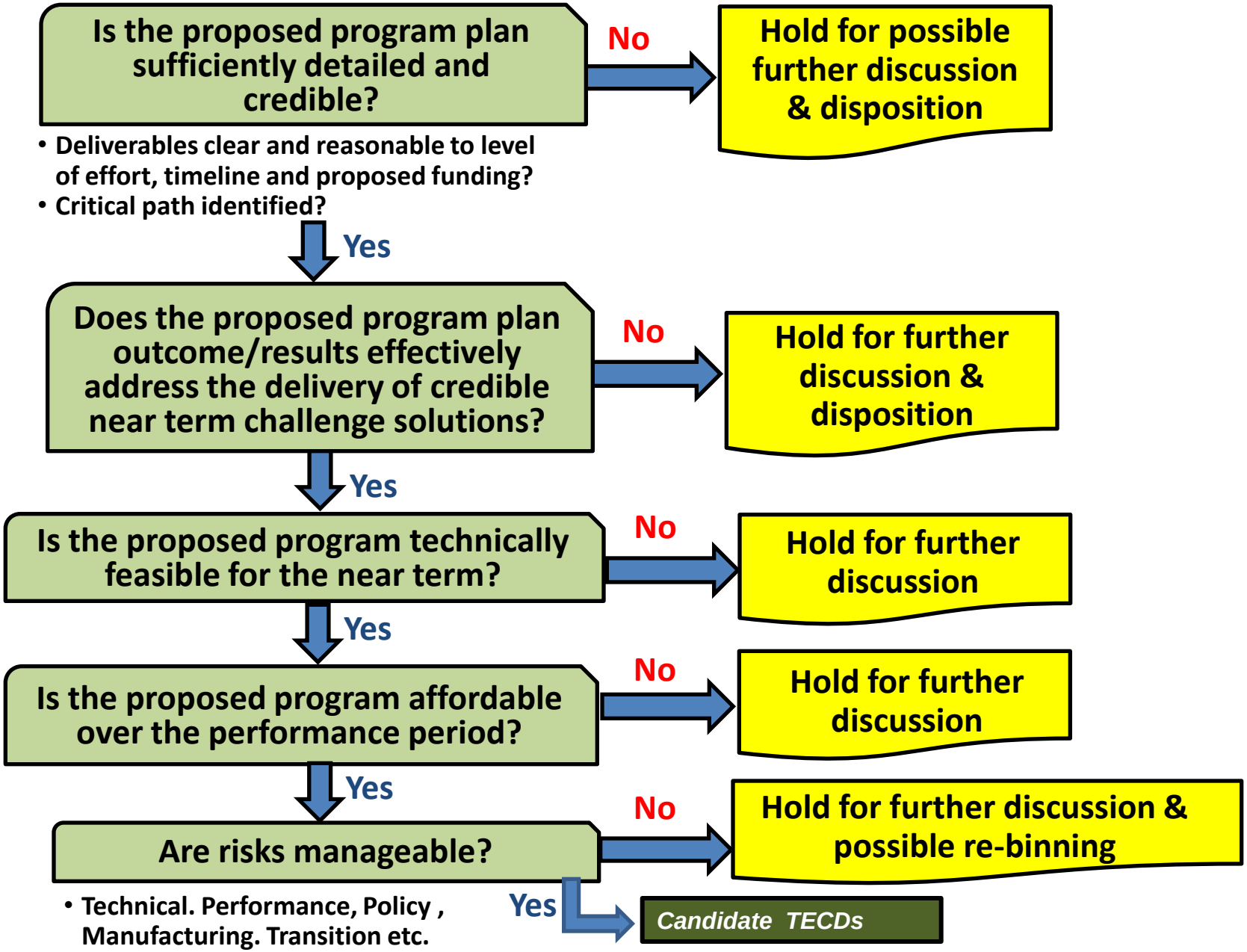
- Result in mega ATOs
- A collection of related efforts rolled into one
- A means to protect your organizational funding
- Generalized description of objectives, goals, vision for the desired capability
- Contain wishy-washy or movable end-states

What are the questions you should be asking?
(The Heilmeyer Questions)

- **WHAT ARE YOU TRYING TO DO?** What is the problem? What are you trying to accomplish?
- **HOW DOES THIS GET DONE, AT PRESENT?** Who does it? What are the limitations of the present approaches? Why is it hard?
- **WHAT IS NEW ABOUT YOUR APPROACH?** What is the new technical idea? Why do we think we can be successful at this time?
- **IF YOU SUCCEED, WHAT DIFFERENCE DO YOU THINK IT WILL MAKE?** What is the impact? Provide metrics.
- **HOW LONG DO YOU THINK IT WILL TAKE?** How will the program be organized? How will intermediate results be generated? What are our mid term and final exams to see how we are doing?
- **CAN THE PRODUCT TRANSITION?** How could this transition to the end user?
- **HOW MUCH WILL IT COST?**

What are the alternate solution courses of action and trade-offs?

TECD Decision Tree



Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

ARMY S&T
SCIENCE & TECHNOLOGY

Hyperlinked Slides

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
1.a Force Protection	Basing	It takes too long and too much manpower to deploy, setup, protect, sustain, and relocate Combat Outposts (COPs) and Patrol Bases (PBs).	• Deployable Force Protection • Robotics for labor intensive tasks • Rapid insertion and prefab shelters • Sensor-to-shooter combinations • Automated smart power • Automated resupply	Expeditionary Base Camps Integrate Maneuver and Fires	ASSURED MOBILITY & PROTECTION SOLDIER	Y/N Challenge Y/N Top 5
1.b Force Protection	Soldier/ Small Unit	The spectrum of threats encountered by Soldiers in Small Units is varied and complex; current equipment, clothing, and other protective measures do not provide adequate protection without adding significant mobility challenges.	• Holistic vs. Christmas tree approach • Lightweight, improved ballistic protective materials • Improved design for OCIE • Lightweight CBRNE—sealing technologies • Fire retardants • Anti-microbials/insecticides	Enhanced Protection Enable Soldier & Small Combat Teams	SOLDIER SOF	Y/N Challenge Y/N Top 5
1.c Force Protection	Occupant Centric Platforms	We design vehicles to put Soldiers in rather than designing vehicles around Soldiers. Increasing protection levels of the platforms impacts interior volumes reducing mobility, maneuverability, and freedom of movement for occupants and leads to heavier platforms.	• Knowledge of alternative vehicle design and protection methodologies • New energy absorption materials/components • Effects of hull shaping • Adaptive suspensions in vehicle configurations • Frangible designs and on-board equipment storage	Enhanced Protection Enable Soldier & Small Combat Teams	MVMT/ MVR AVIATION	Y/N Challenge Y/N Top 5

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
1.d Force Protection	On-the-Move (Ground)	The Army needs improved capability to move at tactical speeds on/off road unconstrained by explosive hazards (mines and IEDs) to conduct wide area security and combined arms maneuver operations. Vehicle convoys and route clearance teams need capabilities to detect, neutralize and defeat mines/IEDs in real-time.	• Ground Penetrating Radar • Restrahlen FLIR • Networked RF Jammers • Miniature VNIR/SWIR Hyperspectral Sensors • Interoperable RF Sensors • Sensor Fusion ATR & Multi-Sensor Correlation	Hazard Detection on the Move	ASSURED MOBILITY & PROTECTION	Y Challenge N Y Top 5 N
2.a Over-burdened	Physical Burden	Soldiers in Small Units (squads/fire teams/crews) are physically overburdened, often carrying up to 130lbs; this degrades performance and may result in immediate, as well as, long term consequences.	• Distributed functions in small team • Robotic carriers • Robotic/UAV resupply • Lightweight packaging • Advanced power & energy • Shared equipment power and computation • Biomechanics;	Unmanned Ground Autonomy Soldier Load Enhanced Protection Power and Energy Mgmt.	SOLDIER	Y Challenge N Y Top 5 N
2.b Over-burdened	Cognitive Burden	We do not understand causes or mitigating factors associated with excessive cognitive load and its impact on Soldier performance.	• Brain-mapping • 3D displays • Data fusion • Synthetic learning and continuous gaming	Soldier Load Excessive Cognitive Demand	SOLDIER	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
3.a Surprise/ Tactical Intelligence	Mission Command	The Small Unit lacks tools and ability to execute mission command on the move (air or ground) to synchronize action, seize the initiative and maintain situational awareness.	• Sensors • Integrated data structures • Automated processing and analysis tools • Battlefield awareness software applications	Mission Command on the Move	MISSION COMMAND/ NETWORK	Y Challenge N Y Top 5 N
3.b Surprise/ Tactical Intelligence	Actionable Intelligence	Small Units don't have capability to send/receive critical tactical intelligence; the tools or training to help them recognize identify friends or foes, know where IEDs are, see inside buildings and around corners or over hills; or awareness of cultural patterns that might indicate imminent danger.	• Sense-through-the-wall • Improved sensors for small UAVs and UGVs • Allocated adaptive links to reach back	Precision Collection Combat ID Common Situational Understanding Small Unit Operational Surprise	ISR	Y Challenge N Y Top 5 N
3.c Surprise/ Tactical Intelligence	Cultural/ Linguistic	Poor understanding of culture and/or language increases risk, leads to misunderstandings, and results in inability to execute mission. It takes too many linguists, translators and cultural advisors in Small Units.	• Small Unit networking OTM • Machine translation • Biometrics/face recognition/Intent determination • Remote ridealong • Non-verbal cueing	Holistic Human and Societal Assessment Small Unit Operational Surprise	SOLDIER	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
3.d Surprise/ Tactical Intelligence	Organic Combat ID	Small Dismounted Units lack organic assets/tools/methods to distinguish enemy combatants from civilians day and night and avoid fratricide in asymmetric warfare environments. The nighttime soldier Combatant/ Non-Combatant ID ranges are woefully inadequate (less than 80 meters), leading to high risk of collateral damage in asymmetric warfare situations where our adversaries are mixed in with civilians.	• Active SWIR for long-range • Intuitive situational awareness for anti-fratricide • Day/night active facial recognition at range • Leveraging tactical Internet	Combat ID Small Unit Operational Surprise Integrate Maneuver and Fires (Dismounted Network) Precision Collection	ISR SOLDIER	Y Challenge N Y Top 5 N
3.e Surprise/ Tactical Intelligence	Overwatch Persistent Surveillance	Small Units lack the ability to rapidly transform data from non-organic overhead assets which can provide persistent surveillance into information and disseminate it to Soldiers on the ground where and when needed to avoid surprise and to enable situation development and improve planning and mission execution and enable persistent assessment.	• Very large, high operating temperature, focal plane arrays with onboard processing • High bandwidth data links	Precision Collection Combat ID Small Unit Operational Surprise	ISR	Y Challenge N Y Top 5 N
3.f Surprise/ Tactical Intelligence	METT-TC D/I/K	Small Units lack capability to rapidly shape operational environment before engagements by exploiting every aspect of populace, terrain, weather, etc. to our advantage in order to control key terrain, erode the threat from the non-combatant populace, and inflict minimal damage or loss of non-combatants in austere environments	• Digital mapping technology • Data fusion with uncertainty indicators • Robotic assets	Precision Collection Data-to-Decision Small Unit Operational Surprise	MISSION COMMAND/ NETWORK ISR	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
3.g Surprise/ Tactical Intelligence	Network	Small dismounted units need sight/beyond line of sight robust network to facilitate command and ensure user access anytime/ anywhere. Current commercial wireless technology has inadequate cyber-security, reliability, availability and does not meet the needs of the Small Unit.	• Exploit advanced commercial developments • Adaptive and affordable security solutions • All-weather low-cost aerial relays • Increased users per channel • Mesh networking w/o a base station • Multicast • Soft hand-off between moving stations/hand sets • Lower-tier architecture	Mission Command on the Move Network the Force Common Situational Understanding	MISSION COMMAND / NETWORK	Y Challenge N Y Top 5 N
4.a Sustain-ability/ Logistics	Basing	The Army needs improved capability to enable sustainment independence/"self-sufficiency" and to reduce sustainment demands at expeditionary basing levels. It is too costly, too unpredictable, and too labor intensive for a Small Unit to carry all required consumables to last for weeks or months at a COP/PB, storage facilities and systems do not meet needs of these small bases, and resupply efforts are highly unpredictable.	• Very high precision low-cost small payload air drop from multiple air platforms • Robotic air and ground platforms • Green Technologies	Enhanced Energy Agility Supply Chain Logistics Unmanned Ground Autonomy	SUSTAINMENT ASSURED MOBILITY & PROTECTION	Y Challenge N Y Top 5 N
4.b Sustain-ability/ Logistics	Transport, Distribute & Dispose	The Army needs improved capability to tactically transport and reliably deliver consumables to Forward Operating Bases (FOBs) and smaller satellite bases in remote, dispersed, austere locations with reduced supplier and equipment risk, including improved efficient and safe methods for disposing waste.	• Precision air drop • Robotic convoys • Waste-to-energy conversion • Water production/ purification	Power and Energy Mgmt. Enhanced Energy Agility Unmanned Ground Autonomy Supply Chain Logistics	SUSTAINMENT (TRANSPORT) SUSTAINMENT	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
5.a Tactical Overmatch	Deliver Decisive Effects	At both fixed and mobile sites, Small Units currently lack the capability to detect dismounted forces and respond rapidly with precision fires and protect against indirect fires, missiles, and armed UAVs; and to enable Army Small Units to provide non-lethal to lethal effects against personnel.	• EO/IR radar combinations • Small precision missiles • Combined EO acoustic hostile fire indicators • C-RAM advances	Air Defense Scalable Effects Dismounted Target Acquisition Enable Soldier and Small Combat Teams	FIRES (INDIRECT) FIRES (AMD)	Y Challenge N Y Top 5 N
5.b Tactical Overmatch	Targeting / Hand-off	Small Units do not have lightweight, day/night target acquisition capability that integrates air and ground systems to facilitate precision fires, intra-squad fires, call for fires, hand-off of targets to other assets and ability to conduct battle damage assessments. Current laser pointers do not work in daytime.	• UV day/night laser pointers and illuminators • Mono-block laser markers • Virtual pointers • Active SWIR sensors • Leveraging the tactical Internet	Scalable Effects Dismounted Target Acquisition Enable Soldier and Small Combat Teams	FIRES (INDIRECT) SOLDIER ISR	Y Challenge N Y Top 5 N
6.a Maneuver-ability	On-the-Move (Air)	The Army needs improved capability to tactically transport (dismounted vertical maneuver/air assault) Soldiers, vehicles and equipment to austere or unprepared landing zones in order to rapidly project combined arms forces; effect rapid loading and unloading; and conduct medical evacuation operations and relief operations.	• Vertical lift with greater range & reliability • Robotics • Improved propulsion • Power and energy management	Power and Energy Mgmt. Joint Multi-Role Aviation Capability	AVIATION	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
6.b Maneuver-ability	Degraded Visual Environment (brown-out)	Approximately 80% of Army helicopter losses in theater result from a loss of situational awareness in degraded visual environments (DVE)/brownout. Cargo and Utility Lift aircraft currently have rudimentary night pilotage (image intensification (I^2)) goggles.	• Sensitive long-wave IR distributed aperture pilotage systems with DVE symbology • Large-format focal plane arrays • Millimeter wave • Automated flight control	Joint Multi-Role Aviation Capability	AVIATION	Y Challenge N Y Top 5 N
7.a Human	Strength-based Soldier Characteristic Assessments & Readiness	The Army lacks capability to rapidly and accurately identify and measure attributes and talents; document them; and use them to predict potential, success, and performance of recruits, deploying units or units preparing for operational missions.	• Human sciences • Brain mapping • Gaming • Field administered rapid assessment tools and data analysis • Data fusion	Assessment, Readiness, and Resilience Holistic Human and Societal Assessment	SOLDIER	Y Challenge N Y Top 5 N
7.b Human	Individual Training to Tactical Tasks	The Soldier today has a larger number and more complex weapons, communications devices and protective systems with which to perform more complex missions. The Army needs a highly adaptable, versatile, easy-to-access learner-centric system of training skills and tasks that is tailored to the individual's developmental needs through timing, content, delivery, and duration.	• PC and cell-phone-based software • Simulators • Interactive software • Networks • Human sciences and learning strategies	Persistent & Adaptable Tng/Educ. Infrastructure Home Station/Mission Cmd-Centric Trng (Build Adaptive Teams & Units) Accelerate Individual Learning Assessment, Readiness, and Resilience	SOLDIER	Y Challenge N Y Top 5 N

Candidate S&T Challenges

Challenge Number	Problem Focus	Problem Statement	Enablers	TRADOC Big Issue	Capability Portfolio	ASTAG Vali-dation
7.c Human	Collective Training for Tactical Operations	The significant number of critical skills required by Soldiers, Leaders and Units in complex tactical operations exceeds the Army's current capability for home-station training and there is no clear set of best-effective training or leadership development methods; fidelity for mission rehearsal is inadequate.	• Gaming • Optically aided video odometry • Visual landmark detection • Laser scanned head-mounted displays • Software to deliver training and feedback • Simulation for mission rehearsal • Embedded training • Terrain mapping	Assessment, Readiness, and Resilience Home Station/Mission Cmd-Centric Trng (Build Adaptive Teams & Units) Persistent & Adaptable Tng/Educ. Infrastructure	SOLDIER	Y/N Challenge Y/N Top 5
7.d Human	Medical Assessment and Treatment	Traumatic brain injury continues to be a significant issue due to IEDs and other hazards. The Army medical community is not able to promptly assess, diagnose, treat and rehabilitate Soldiers who have been exposed to ballistic and blast events or other insults.	• Electronic record-keeping and networking • New diagnostic tools • Understanding TBI and brain functions • Biomarkers	Assessment, Readiness, and Resilience Force Health Protection	SOLDIER	Y/N Challenge Y/N Top 5
7.e Human	Trauma Management	Dismounted Warfighters have significant, complex injuries due to IEDs and other battlefield events that require advanced trauma management.	• Control of non-compressible bleeding • Blood component therapy • Monitoring technologies	Force Health Protection	SOLDIER	Y/N Challenge Y/N Top 5

Enhanced Protection

Enable Soldier & Small Combat Teams

Force Protection – Soldier and Small Unit

1.b

Problem Statement: The spectrum of threats encountered by Soldiers in Small Units is varied and complex; current equipment, clothing, and other protective measures do not provide adequate protection without adding significant mobility challenges.

Challenge: Formulate a S&T program to increase the level of individual protection for male and female Soldiers at reduced total weight and volume while enabling increased physical and mental agility, particularly over extended periods. The goal is to reduce the number and severity of injuries and casualties (including TBI and PTSD causes).

Challenge Boundary Conditions:

Who: Individual Soldiers

What: Develop technologies to increase protective gear performance while reducing weight and volume – protection from weapon threats, blast, fire, insect-borne diseases, weather conditions including excessive heat/cold, and CB threats.

How: Establish baselines 2010/2011 field collection data, injury, and use other data sources to clearly define the focus.

Objectives:

Near term (FY17): Identify trade space to enable holistic protection design and implementation on the individual Soldier and in Small Unit; optimize level and area of protection against threats while reducing total weight of individual protective gear/equipment by 50% and total volume by 30% from baseline; improve clothing, helmet, MOPP gear, fire retardancy, insect repellant, etc.

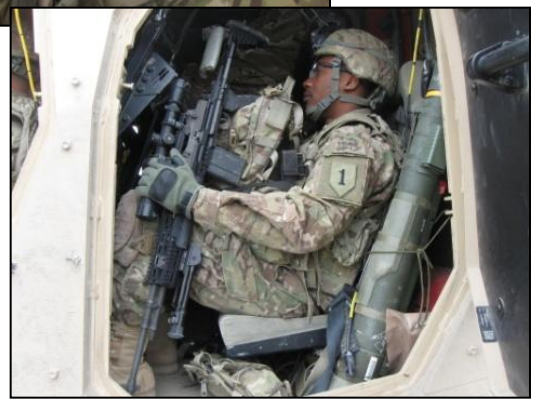
Enhanced Protection

Enable Soldier & Small Combat Teams

Force Protection – Occupant Centric Platform

1.c

Problem Statement: We design vehicles to put Soldiers in rather than designing vehicles around Soldiers. Increasing protection levels of the platforms impacts interior volumes reducing mobility, maneuverability, and freedom of movement for occupants and leads to heavier platforms.



Challenge: Formulate a S&T program to make improvements to existing platforms or develop new platforms that provide appropriate increased protection from current and emerging threats and optimal space allocation for Soldiers and their gear, while decreasing platform weight and maintaining or increasing maneuverability during full spectrum operations. Goal is to reduce overall platform weight by 25% and reduce casualties and WIAs by 50% across each mission role with scalable protection levels to defeat a wide range of threats, enhance mobility, and maintain freedom of action during full spectrum operations.

Challenge Boundary Conditions:

Who: TBD – for Small Unit transport and convoys

What: TBD – specify mission, vignettes, scenarios, conditions of the 2011 representative baseline

How: Establish baselines using 2010/2011 field collection data, injury, and other data sources.

Objectives:

Near term (FY17): Establish baselines; develop occupant protective standards; mature interior and exterior occupant protection technologies; increase lab testing capability; improve confidence in M&S predictions

Unmanned Ground Autonomy | Enhanced Protection | Soldier Load | Power and Energy Mgmt.

Overburdened – Physical Burden

2.a

Problem Statement: Soldiers in Small Units (squads/fire teams/crews) are physically overburdened, often carrying up to 130lbs; this degrades performance and may result in immediate, as well as, long term consequences.

Challenge: Formulate a S&T program to significantly reduce the weight and volume of all items that individual Soldiers in a Small Unit must physically carry to accomplish their missions while maintaining or increasing the ability of the Unit to perform tasks, whether operating as dismounted or in vehicles.

Challenge Boundary Conditions:

Who: Soldiers and Small Units operating in Afghanistan-like environments

What: Reduce physical burden within the squad so that no individual Soldier load exceeds 30% of their body weight.

How: Establish 2011 baseline for various operations and for Afghanistan-like engagement conditions. Measure impact on load (weight, volume, cube) relative to Soldier's body weight and related impacts on Small Units distribution/supply handling against baseline

Objectives:

Near term (FY17): Reduce physical burden of Soldier and Small Unit so that grenadier, SAW gunner and attached combat medic does not exceed 50% of individual's body weight without a reduction in operational capability.

Surprise/Tactical Intelligence – Mission Command

Problem Statement: The Small Unit lacks tools and ability to execute mission command on the move (air or ground) to synchronize action, seize the initiative and maintain situational awareness.

Challenge : Formulate a S&T program to provide an integrated data structure for intelligence and mission command systems that can feed automated processing and analysis tools to reduce time to decision; provide interactive tools to provide relevant, timely information to support decisions; and reduce the timeline needed to develop, accredit and field intuitive, useful, effective mission command and battlefield awareness software applications.

Challenge Boundary Conditions:
Who: Small Units operating in decentralized locations

What: Focus on TOC/COIST capability

How: Assess consolidation of Intel and Battle command decision support and analysis tools by 2015 to inform and shape Science and Technology to shorten/improve the decision cycle to figure out HOW to measure success.

Objectives:
Near term (FY17): Identify how to reduce development time for BFA software applications to 6 months, for all environments,

Human – Medical Assessment and Treatment

Problem Statement: Traumatic brain injury (TBI) continues to be a significant issue due to IEDs and other hazards. The Army medical community is not able to promptly assess, diagnose, treat and rehabilitate Soldiers who have been exposed to ballistic and blast events or other insults.

Challenge: Formulate a S&T program to rapidly conduct in-the -field screening, assessment and mitigating treatment to improve short and long term adverse outcomes of mTBI and TBI.

Challenge Boundary Conditions:

Who: Individual Soldier and combat medic

What: Selected Operational Mission Scenarios

How: Measure the number of Soldiers correctly identified and diagnosed with mTBI/TBI without significant false positives; reduce number of evacuations due to suspected against 2011 baseline

Objectives:

Near term (FY17): Develop tools that accurately and objectively assess Soldiers with mild to moderate TBI in less than 1 hour following Soldier's return to COP/PD without increasing personnel or administrative burden.

Force Protection - Basing

Problem Statement: It takes too long and too much manpower to deploy, set up, protect, sustain and relocate Combat Outposts (COPs) and Patrol Bases (PBs).

Challenge: Formulate a S&T program to reduce the percentage of Soldiers needed to set-up a COP/PB and protect against threats (including small arms, indirect fires, air delivered weapons, and CBRNE) in austere, restricted terrains.

Challenge Boundary Conditions:

Who: Focus on Combat Outposts and Patrol Bases in Afghanistan-like conditions

What: Representative 2011 COP/PBs baseline indicates that it takes 60-90 days using 70% of the manpower assets (i.e., 70% not available for mission tasks)

How: Measure impact on Soldier availability and set-up time

Objectives:

Near term (FY17): Increase Soldier availability for mission tasks vs. set-up and security tasks to 50% in 30 days with increased force protection; decrease tear-down time to no more than 4 days and increase the percentage of material reusable at next COP within 100 miles.

Home Station/Mission Cmd-Centric Trng (Build Adaptive Teams & Units)

Persistent & Adaptable Tng/Educ. Infrastructure

Assessment, Readiness, and Resilience

Accelerate Individual Learning

Human – Individual Training to Tactical Tasks

7.b

Problem Statement: The Soldier today has a larger number and more complex weapons, protective systems and communications devices with which to perform more complex missions. The Army needs a highly adaptable, versatile, easy-to-access learner –centric system of training skills and tasks that is tailored to the individual's developmental needs through timing, content, delivery, and duration.

Challenge: Formulate a S&T program to develop self-training mechanisms which can supplement or replace trainers to monitor and track Soldier learning needs, assess and diagnose problems, and guide Soldiers through training events, provide effective performance feedback, select appropriate instructional strategies, anticipate and seek out information and learning content tailored to the learner's needs, and provide interventions of other assistance as needed.

Challenge Boundary Conditions:

Who: Selected specific tasks (vehicle driving, maintenance mechanic, weapon operations)

What: Baseline of FY11 learning tools and methods of instruction

How: Measures of Soldier comprehension, retention and skill proficiency; determine how this changes requirements for frequency of training/retraining.

Objectives:

Near term (FY17): Develop more effective fieldable simulators and apps-based training modules for key skills and tasks that can be used whenever and wherever Soldiers need to be trained/retrained/certified; develop a mechanism to automatically collect and document proficiency levels that are accessible to leaders.

Surprise/Tactical Intelligence – Actionable Intelligence

Problem Statement: Small Units do not have capability to send/receive critical tactical intelligence; the tools or training to help them recognize/identify friends or foes, to know where IEDs are, to see inside buildings and around corners or over hills; or awareness of cultural patterns that might indicate imminent danger.

Challenge: Formulate a S&T program to provide Small Units with tools and training to efficiently collect, process, exploit, and disseminate data to support situational awareness and decision making without adding more Soldiers or significantly increasing weight or number of devices.

Challenge Boundary Conditions:
Who: Small Units operating COIN/Stability Operations in Afghanistan-like conditions

What: Goal is to provide the ground unit a common operational picture in real time to identify friendly forces in a given AO with 90% accuracy and maintain 90% probability of determining threat interdiction.

How: Measure reduction in unanticipated threat encounters, reduction in loss of equipment and loss of life (friendly/non-combatant) against 2011 baseline.

Objectives:
Near term (FY17): Provide timely accurate/actionable info/intel to obtain in 25% reduction in unanticipated threat encounters at the squad level and increase mission accomplishment (%) measured against loss of life and equipment by 50%

Sustainability/Logistics – Basing

Problem Statement: The Army needs improved capability to enable sustainment independence/"self-sufficiency" and to reduce sustainment demands at expeditionary basing levels. It is too costly, too unpredictable, and too labor intensive for a Small Unit to carry all required consumables to last for weeks or months at a COP/PB, storage facilities and systems do not meet needs of these small bases, and resupply efforts are highly unpredictable.

Challenge: Formulate a S&T program to increase self-sufficiency, reduce supply demands, and reduce waste at COPs/PBs and improve the ability to sustain the Small Unit for the duration of the mission at lower cost and lower risk to suppliers without adversely impacting primary mission Soldier availability.

Challenge Boundary Conditions:
Who: Small Units in Afghanistan-like environments

What: Identify tools, tactics, and techniques to achieve demand reduction.

How: Measure demands for power, water and fuel; waste generated and/or waste-to-energy power; weight/volume of food; time to resupply.

Objectives:
Near term (FY17): reduce need for fuel resupply by 20%, reduce need for water resupply by 75% and decrease waste by XX% while increasing quality of life over 2011 COPs/PBs in Afghanistan

Sustainability/Logistics – Transport, Distribute & Dispose

Problem Statement: The Army needs improved capability to tactically transport and reliably deliver consumables to Forward Operating Bases (FOBs) and smaller satellite bases in remote, dispersed, austere locations with reduced supplier and equipment risk, including improved efficient and safe methods for disposing waste.

Challenge: Formulate a S&T program to leverage all available conveyance modes to ensure supply delivery, to increase the reliability and timeliness of supplies delivery, and to be able to predict when and where all classes of supplies will be needed. In addition, the program will devise methods to reduce waste and use it to provide power.

Challenge Boundary Conditions:
Who: For Forward Operating Bases with applications to expeditionary bases (Small Units in COPs and PBs)

What: Rapidly deliver significant quantities (volume, weight, etc) of supplies. Air drop and convoy operations - develop ability to conduct rapid movement of emergency, planned, or critical logistics support that enables precise delivery of supplies and repair parts to forward battlefield locations, medical evacuation operations and relief operations

How: Representative 2011 Afghanistan-like environment baseline

Objectives:
Near term (FY17): Develop tools that efficiently manage, track, redirect, account for and distribute supplies to support forced entry, early entry, and non-contiguous operations

Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

ARMY S&T
SCIENCE & TECHNOLOGY