Towards a Robotics Strategy

LTG Michael A. Vane

Deputy Commanding General, Futures, and Director,
Army Capabilities Integration Center
US Army Training and Doctrine Command

25 Mar 09

Army Capabilities Integration Center

Mission: The Army Capabilities Integration Center leads the development and integration of force capabilities across the DOTMLPF for the Army within a Joint, Interagency, Intergovernmental and Multinational (JIIM) environment to support the Joint Force Commander through ARFORGEN.

TR HQ

ARCIC

Army Accessions Command	Combined Arms Support Command	Combined Arms Center
First hand-shake to first unit of assignment	*Providing Combat Service Support*	*Training, education and leader development*

LTG Mike Vane

BG Joe Martz

D G-9

Concept Developments & Experimentation	Accelerated & Capabilities Development	Capabilities Development & Assessments	Future Force Integration	International Army Programs	Architecture Integration & Management
COL(P) McMaster	**Mr. Mazzanti**	**Mr. Resnick**	**MG Terry**	**Mr. Rogers**	**Mr. Vandiver**

FCS STRATCOM — **COL(P) Ferrell**

ARCIC Forward — **Mr. Smith**

Force Design — **Mr. Twohig**

Air Land Sea Application

JFCOM LNO

CDID
TCM
Battle Lab
(Senior Rater)

LNOs

Vision: World class professionals developing innovative, integrated, resource-informed, and outcome-based solutions for the current to future force.

ARCIC Priorities

- **Army Level Priorities**
  - STRATCOMs – engage OSD, Congress
  - Outreach to ASCCs and COCOMs
  - QDR
  - Environmental Strategy
  - Unified Quest
  - Future Combat Systems
  - Develop a one Army Modernization Strategy
- **Generating Force Priorities**
  - Generating Force Study
  - Leading from the Edge
  - ARCIC Campaign Plan tied to TCP, metrics, and ARCIC organization design
  - Metrics for Future Readiness
  - Campaign of Learning
  - Integration – Trades, Organizational based TCMs
  - FCS COE
  - Capability Needs Analysis
  - People – training, education, certification
  - Link support forms to ARCIC Outcomes (NSPS, 67-9-1, TAPES…)

- **Operating Force Priorities**
  - FCS enabled Army Analysis and Way-ahead
  - Accelerated Capabilities & Spinouts
  - Revised Army Capstone Concept
  - S & T Warfighter Outcomes
  - Unified Battle Command
  - Affordable and Achievable LWN
  - Network Vulnerability
  - More efficient and effective 1.1m Army
  - Energy Strategy for the Operating Force
  - Precision Fires
  - Tactical Wheeled Vehicle Strategy
  - ISR Metrics
  - SOF / GPF
  - Organizational and conditioned Force Protection
  - Joint Future Theater and Tactical Lift
  - Small unit excellence
  - Commander's Appreciation and Campaign Design FMI

A Robotics Strategy….how far can we go?

21st Century Security "Landscape"

Global Trends

"Interdependent economies, Porous Borders, Decline of the Nation-State"

Strategic Environment

"Information Revolution…the death of time and distance"

Greater disparity creates tremendous "friction"

Rise in power and influence of Non-State Actors

Increased willingness to use violence

Complex challenges require all elements of power to address

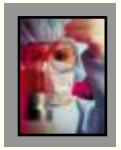
Operational Context

Irregular — Catastrophic

Diverse Actors

Hybrid Threats

Operations "Among the People"



Unpredictable

Global Media

Radical extremism attacks fragile Institutions

Joint, Interagency, Multinational and Indigenous Partners

Traditional — Disruptive

***Persistent Conflict**: Protracted confrontation among state, non-state, and individual actors that use violence to achieve their political and ideological ends.*

Landpower in the 21st Century

Landpower: *The ability to achieve decisive results on land*

Land Forces: *The military component of Landpower*

Role of Landpower: *To provide the Nation with a full spectrum capability to conduct these essential strategic functions:*

- *Engage*
- *Compel*
- *Deter*
- *Integrate*
- *Prevent*

Land Force Qualities in the 21st Century:

- *Versatile*
- *Expeditionary*
- *Agile*
- *Lethal*
- *Sustainable*
- *Interoperable*

Gaps

- Interoperability – COP and network
- Agility – too much, too heavy
- Sustainment – still tied to ground LOCs
- Enduring, lightweight, low power
- Not mastered IED threat
- Enhanced individual and unit training
- Tooth to tail ratio

Land Power consists of US and Coalition Armies, Marines, SOF, Interagency teams, and joint integrating effects delivered by Air Force and Navy in the land domain

Big-Five Warfighter Outcomes that Guide S&T Investment

Battle Command Network

- *Beyond-line-of-sight*
- *Optimized for mobile operations*
- *Increase access to the individual Soldier*

Counter IED and Mine

- *Detect, identify and neutralize CBRNE obstacles*
- *Safe standoff distance*
- *Maintains maneuver force momentum while protecting Soldiers and platforms*

Power & Energy

- *Enhanced agility to operate worldwide, reducing weight and volume*
- *Sufficient pulsed power enabling advanced lethality options*
- *Increased continuous power and fuel economy*
- *Dismounted Soldiers to possess twice available power, at half the tactical weight*

Human Dimension

- *Enhance & restore cognitive and physical performance*
- *Soldiers incorporated into highly trained and competent small units*
- *Access on potential vs. high school performance*
- *Mitigate the increase in physiological and psychological stress*
- *Improving mental, moral and physical capacity and performance*

Training

- *Live, virtual, constructive and mixed venues*
- *Impart more skills, faster, at lower cost, with greater retention than currently achievable*
- *Use non-traditional home station training techniques; train prior to employment*
- *Enhance and account for individual proficiencies and learning rates (outcome based)*

Robotics in Support of the "Big Five" Integrated Warfighter S&T Outcomes

Battle Command Network

- Reduce time lag in the "sensor-to-shooter" chain via reconnaissance and target designation
- Communications / data relay
- Synergy with C4ISR systems for autonomous capability

Counter IED

- Detection and removal
- Increased standoff

Power and energy

- Increased range of unmanned fighting systems
- Possible use of alternative fuels for extended range and mission duration

Human Dimension

- Extend human perception and action
- Assist with or conduct physically demanding tasks
- Improve tooth to tail ratio (More effective and efficient use of Soldier resources)

Training

- Ability to train on use of unmanned systems in simulations or simulators

- ***Impact on available bandwidth and network spectrum management***
- ***Socio-moral implications***
- ***Leader training required to ensure effective integration of manned-unmanned systems***
- ***Requires sufficient availability of systems to enable training at home station, power projection platforms, and CTCs***

Current Army Robotics Strategy

- Future Combat System Inserts

UAS CL I and IV

ARV-AL

MULE-T

Small Unmanned Ground Vehicle (SUGV)

MULE-CM

- OIF / OEF developmental items and fielding (ONS & JUONS)

Multiple platforms & payloads

Initial Priorities

- Reconnaissance and Surveillance Systems
- Target ID and Designation
- CBRNE Reconnaissance
- Counter-Mine Warfare

Other Developments

- Convoy Active Safety Technologies
- Exoskeleton – Sustainment Variant
- Battlefield Extraction Assist Robot
- Robotic Combat Casualty Extraction & Evacuation

- On-going S&T developments – Studies and Road maps

The objective is to <u>empower</u> Soldiers and Small Units

A Next Step in the Army Robotics Strategy

Current Strategy

- Future Combat System Inserts
- OIF / OEF developmental items and fielding (Multiple platforms and payloads)
- On-going S&T developments

+

- Manpower intensive tasks for which robotics provides a technical solution
  - Combat, CS, CSS tasks from UJTL and AUTL
- Include CONUS and forward deployed operations

- ***Leverage emerging robotics technologies – commercial and military applications that reduce the burden on the Soldier and the Force***
- ***Adhere to designated DoD interoperability standards and objectives***

1.1m Army

Some Guiding Principles for Continued Development

- Robotics ***enable the humans***
- Humans should ***not have to accommodate*** the technology
- Good design early user and technology developer collaboration -- ***User Juries are an effective means!***
- Robotics – the potential *to get more from force structure*
  - Explore all mission areas
  - Move beyond capability gaps and JUONS. Pursue new paradigm to determine emerging technologies investment
  - Unambiguous and defensible Return on Investment
  - Leverage modeling and simulation for comprehensive DOTMLPF impact and effectiveness analysis
- Use “system of system” to measure effectiveness

Thoughts on Autonomous Robots

- ***Seamless integration*** of robots into military and civilian society
  - Trust and confidence: transparency of action, cues to activity, tolerance to failure
  - Operating within society: adaptability to varying social cues and context
  - ARL via the Robotics Collaborative Technology Alliance program
- ***Autonomy is "conditional"*** … largely based on three factors
  - Reliability: what are the effects of an inability to control the system?
  - Task complexity – what are interdependent tasks and subtasks?
  - Variety of the operational environment – how rapidly does it change and can it be "conditioned?"

Soldiers must be able to control autonomous systems to suit conditions as they change over time

How you can help …

- TRADOC and TARDEC **Robotics White Paper**:
  - http://www.arcic.army.mil/res_keydocs.htm
  - Feedback is welcome and encouraged. Provide feedback to:
    - COL Jim Henderson, TRADOC ARCIC
    - Dr. Jim Overholt, Director, Joint Center for Robotics

- **Technology Information Exchanges** (TIE)
  - The TIE Program provides a two-way dialogue mechanism to address Army "warfighter" needs and to help industry Focus their Research and Development resources and efforts.
  - ARCIC, Science and Technology Division is responsible for facilitating the program.
  - Forward Inquiries to Mr. Kenneth Hamilton
    - Telephone: (757) 788-5749
    - Facsimile: (757) 788-3445
    - Email: Kenneth.hamilton4@us.army.mil

"I'll be happy to give you innovative thinking. What are the guidelines?"

Towards a Robotics Strategy

LTG Michael A. Vane

Deputy Commanding General, Futures, and Director,
Army Capabilities Integration Center
US Army Training and Doctrine Command

25 Mar 09


ARCIC
ARMY CAPABILITIES INTEGRATION CENTER
DOCTRINE - ORGANIZATION - TRAINING - MATERIEL - LEADERSHIP - PERSONNEL - FACILITIES

Back-up