



US Army Strategy for Robotic and Autonomous Systems (RAS)



Supporting Army TRADOC Documents



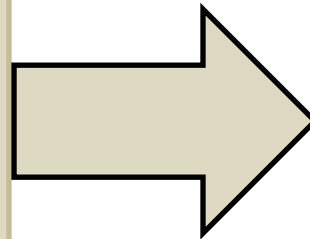
TRADOC Pamphlet 525-3-1

The U.S. Army
Operating Concept

**Win in a
Complex
World**

2020-2040

7 OCTOBER 2014



TRADOC Pam 525-3-1, Appendix C-2. 'Army science and technology investment areas'

"Technologies will....**enable manned and unmanned teaming in both air and ground maneuver** though investments in scalable sensors, scalable teaming, **Soldier-robot communication**, and shared understanding through advancements in machine learning.

Technologies will exist to improve the **autonomy** of unmanned systems. These technologies will enable unmanned cargo delivery via air and enable robots to be a part of the squad to reduce and lighten Soldier loads.

Investments in micro autonomous air and ground systems will also enhance platoon, squad, and Soldier situational awareness."

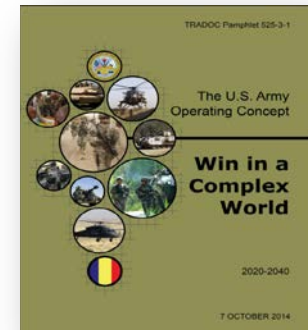


Why RAS Strategy is Needed



- TRADOC's 2014 Robotics Research Study confirmed the utility of RAS systems based on 14 years of war; RAS platforms provide vital human stand-off from dull, dirty, and dangerous tasks
- Most RAS procured through OCO funding; as an enduring capability, the Army must transition to programs of record
- The Army Operating Concept lists RAS as an enduring capability that will:

- ✓ *Reduce risk to Soldiers and units*
- ✓ *Provide opportunities for increased efficiencies*
- ✓ *Provide differential advantages over U.S. adversaries*



The Army is developing a strategy to deliver RAS capabilities, rather than a “spend plan to buy things.” This effort is similar to its approved Combat Vehicle Modernization Strategy.



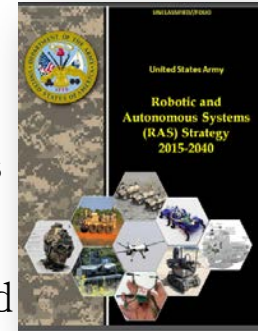
The RAS Strategy



Purpose:

Articulate a strategy that will:

- **Align** and prioritize robotics and autonomous systems requirements across all formations
- **Describe** operational employment of RAS in Force 2025 and Beyond
- **Integrate** RAS as an increase in capability and a key to the Army's *differential advantage over adversaries*



Vision:

RAS capabilities for *expeditionary maneuver* with forces that can:

- *See and fight across extended distances*
- *Share situational awareness and promote operational understanding across all echelons*
- *Operate widely dispersed while maintaining mutual support*
- *Gain and maintain contact with the enemy to set favorable battlefield conditions*
- *Sustain high tempo operations at the end of extended and contested lines of communication*
- *Establish and maintain security across wide areas and pose enemy forces with*

multiple dilemmas
RAS must enable Army formations to retain overmatch, support expeditionary and **joint combined arms maneuver**, while reducing risk to Soldiers and units, and enable Army forces to win in unified land operations



SIDRA Planning



Sustain (*and Integrate*)

- Field the current fleet of tele-operated OEF/OIF- era UGVs and remotely piloted UAS
- Implement programs of record for larger RAS (e.g. M-160, Husky Mine Detection System, Route Clearance Interrogation System)
- Recapitalize older tele-operated robots to address fleet age

Improve

- Upgrade platforms and common controllers, software, and payload capabilities
- Upgrade and field autonomous technologies
- Refine ground and air manned and unmanned teaming (MUM-T) capabilities
- Refine acquisition and management of smaller RAS as short-term programs of record

Develop

- Develop leader-follower tactical wheeled vehicle capability and semi-autonomous capabilities
- Develop combat platforms destined for far term autonomous functions
- Develop Robotic Squad Member and Artificial Intelligence augmented networks

Replace

- Replace Non-Standard Equipment systems with new Programs of Record
- Replace appliqué autonomous robotic systems with fully autonomous platforms
- Replace Manned Systems with Unmanned Systems

Assess Examine formations and RAS requirements in order to transition RAS into “team members”

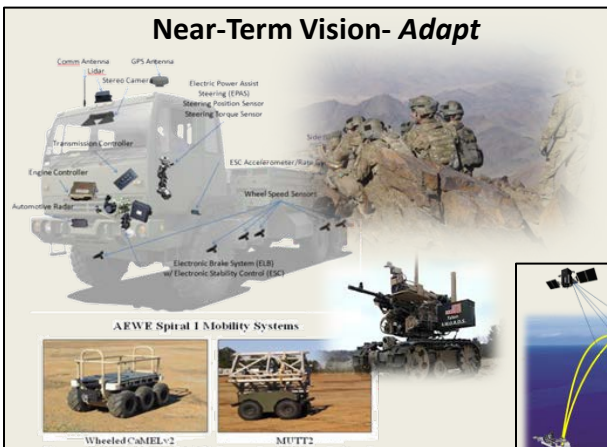


Framing the Plan in Three Phases



As the Army articulates RAS integration across multiple Warfighting Functions, this vision must also show **realistic objectives** in the **near-term**, **feasible objectives** in the **mid-term**, and **visionary objectives** for the **far-term**. Beginning with near-term objectives, each successive phase links its objectives to and builds from the achievements of the previous phase.

Near-Term Vision- Adapt



Near-Term Objectives:

- Leader-Follower Convoy Technology Employment
- Lighten the Soldier load
- Enhance stand-off from threats and improve situational awareness

Mid-Term Objectives:

- Technologies improve the **autonomy** of unmanned systems
- Technologies will enable unmanned cargo delivery
- Robots act as “teammates” rather than tools
- Micro autonomous air and ground systems will also enhance Platoon, Squad, and Soldier situational awareness

Mid-Term Vision (F2025)- Evolve

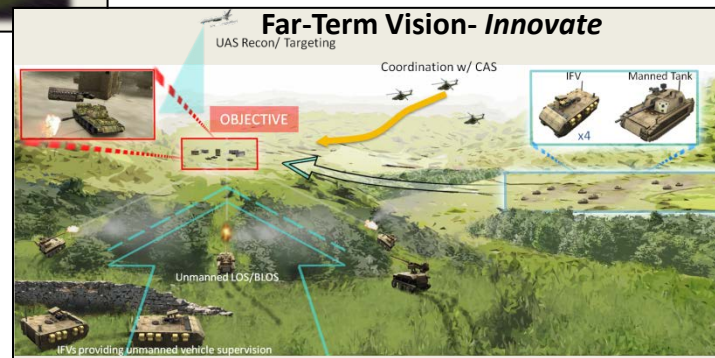


Source for All Listed Objectives:
TRADOC Pam 525-3-1, Army Operating Concept, Appendix C-2.

Far-Term Objectives:

Technologies will **enable manned and unmanned teaming in both air and ground maneuver** though investments in scalable sensors, scalable teaming, **Soldier-robot communication**, and shared understanding through advancements in machine learning.

Far-Term Vision- Innovate





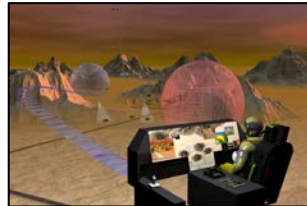
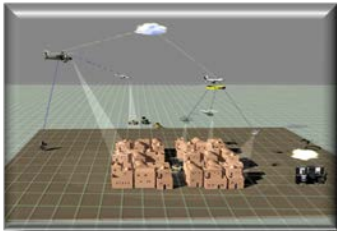
Strategic Capability Progression



“Maturation, Integration, and Demonstration”

Synergistic Unmanned-Manned Intelligent Teaming (SUMIT) (2020-2025)

**Unmanned Air Systems
Autonomy (2020)**



2020

**Extend the Reach of the
Warfighter (2020)**



**Autonomous Convoy
Operations (2020-2025)**



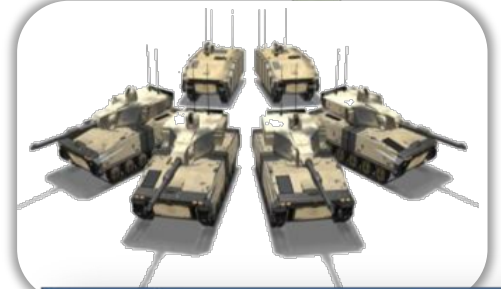
2030

**Dynamic Force & Mission
Autonomy (2030-2040+)**



2040

**Combined Arms Maneuver
(2030-2035)**



**Active Safety
Driver Assist
Appliqué Kits (2015)**



2015

Victory Starts Here!

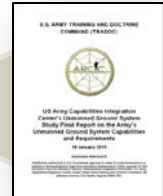


The “Devil’s in the Details:” The RAS Strategy’s Critical Appendices



Appendix A. References

Annex 1 to Appendix A. U.S. Army Capabilities and Integration Center’s Unmanned Ground System Study Final Report on the Army’s Unmanned Ground System Capabilities and Requirements January 2015



Appendix B. Classified Threat Assessment

SECRET

Appendix C. Joint Vision, Experimentation, Science and Technology Efforts



Appendix D. Near Term Technology and Projected DOTMLPF-P Requirements

2016-2020

Appendix E. Mid Term Technology and Projected DOTMLPF-P Requirements

2021-2025

Appendix F. Far Term Technology and Projected DOTMLPF-P Requirements

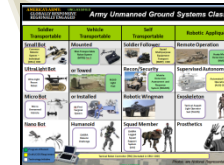
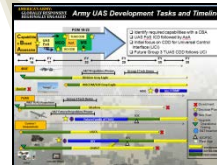
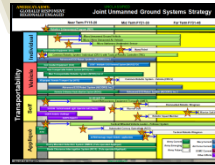
2026-2045



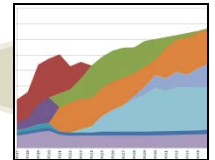
The “Devil’s in the Details:” The RAS Strategy’s Critical Appendices



Appendix G. Current RAS Program Acquisitions Prioritization and Insertion Timelines



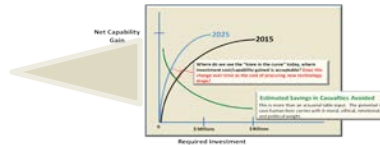
Appendix H. Material Cost Estimation for Robotic and Autonomous Systems Programming



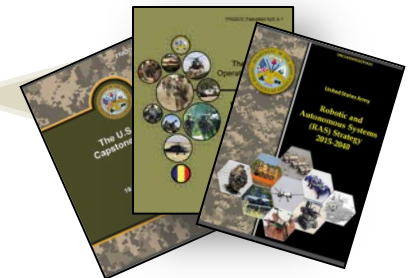
Appendix I. Proposed Acquisitions Strategy



Appendix J. Risk Mitigation



Appendix K. Campaign of Learning – RAS Strategy Training for Leaders





Robotics Strategy Development Timeline

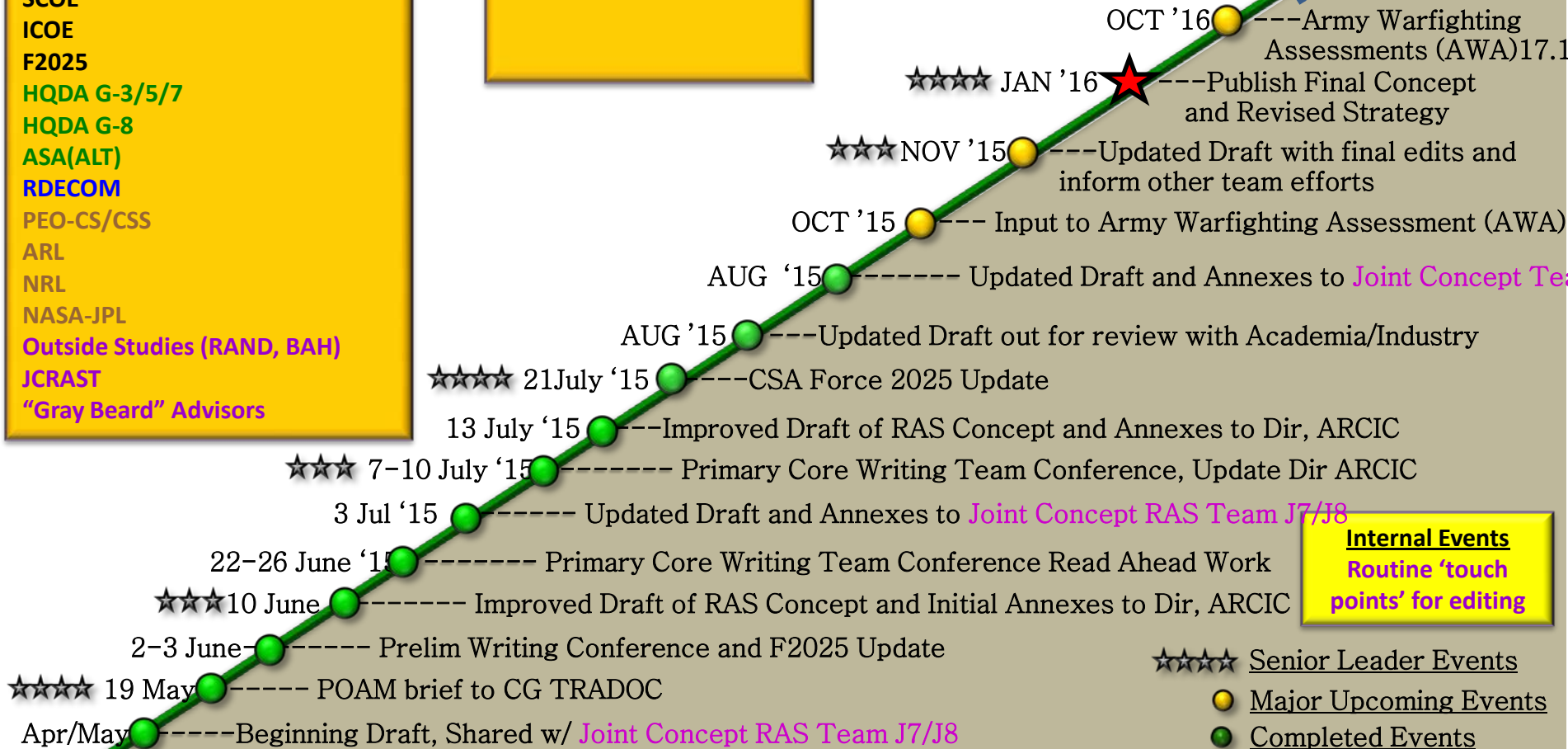
Development Participants:

ARCIC
MCOE
TRADOC G-2
MSCoE
SCOE
ICOE
F2025
HQDA G-3/5/7
HQDA G-8
ASA(ALT)
RDECOM
PEO-CS/CSS
ARL
NRL
NASA-JPL
Outside Studies (RAND, BAH)
JCRAS
"Gray Beard" Advisors

External Events:

NIE 16.1
NIE 16.2
AEWE Spirals
JCRAS Efforts

Implementation



Internal Events
Routine 'touch points' for editing



Summary



- ❑ RAS provide the Army with differential advantages over adversaries and this Strategy will seek to exploit these capabilities

- ❑ The Army Robotics and Autonomous Systems Strategy will:
 - ✓ Provides near, mid, and far-term capabilities with realistic and feasible objectives
 - ✓ Focus near-term capabilities to enable the Soldier
 - ✓ Focus mid-term capabilities to improve the unit capabilities and manned-unmanned teaming
 - ✓ Scope far-term capabilities to improve operations and achieve transformative capabilities
 - ✓ Prioritize rapid fielding of mature robotic technologies into the hands of the Warfighter

- ❑ Army Warfighting Assessments will inform RAS development efforts