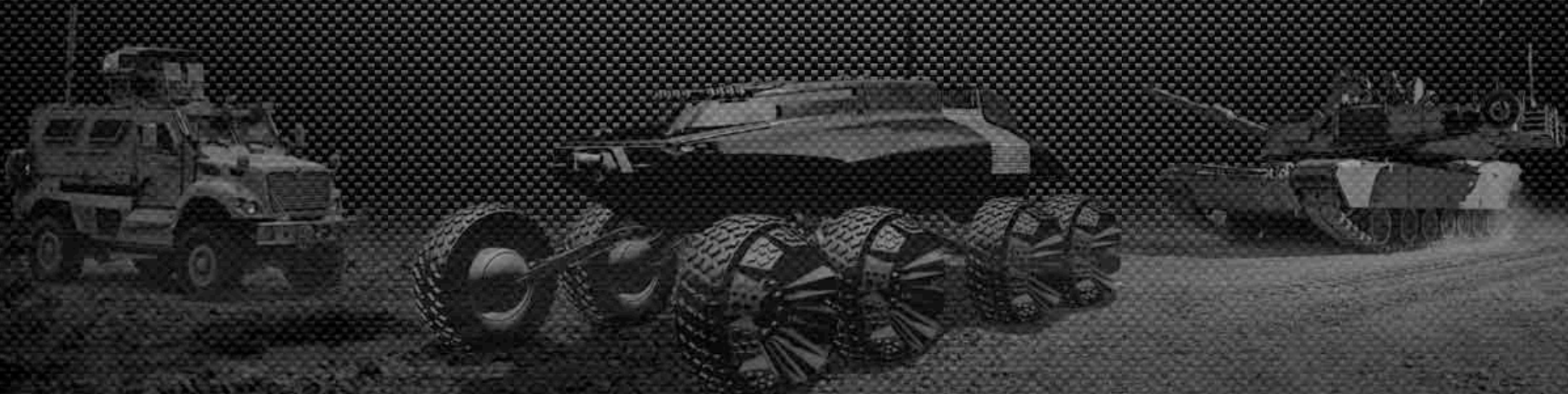# Future Ground Vehicle Robotics

Dr. Paul Rogers
Director
US Army Tank-Automotive Research
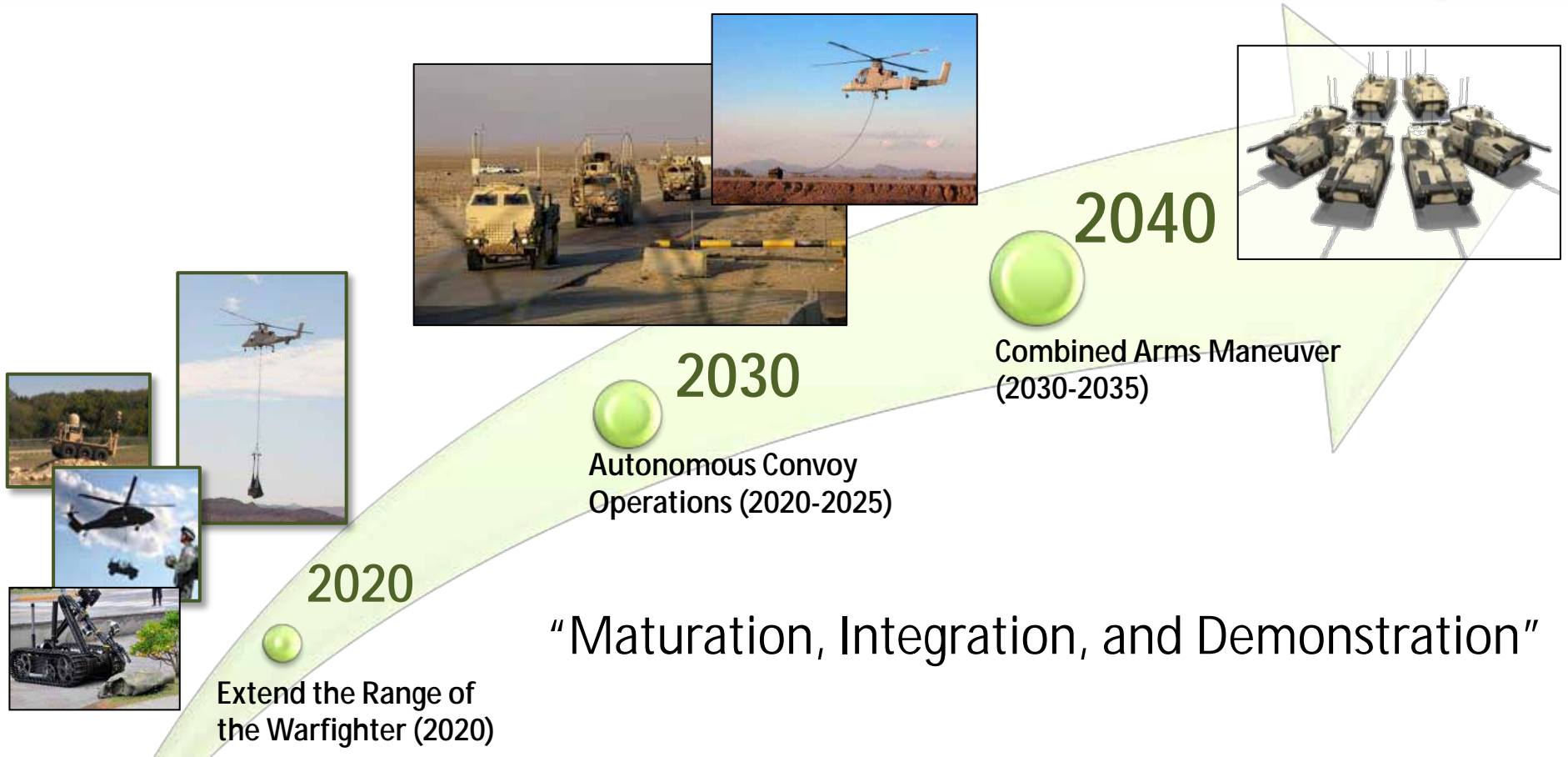**Development and Engineering Center**

15 July 2015

Army Operating Concept:
An Autonomy-Enabled Future Force
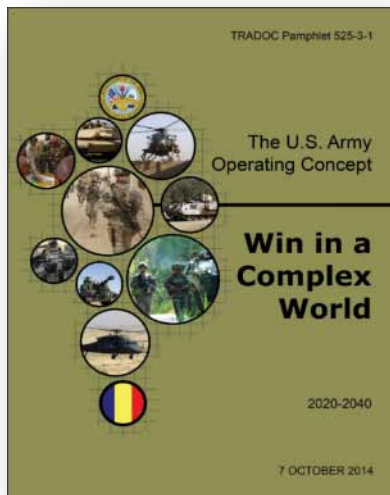
Force 2025 Maneuvers allows the Army to translate big ideas (such as, logistics demand reduction; integration of robotics and autonomy-enabled systems; and leader, Soldier, and team optimization) into concrete actions to improve the future force. (p 33)

(8) **Autonomy-enabled systems.** The application of emerging technology creates the potential for affordable, interoperable, autonomous, and semi-autonomous systems that improve the effectiveness of Soldiers and units. Autonomy-enabled systems will deploy as force multipliers at all echelons from the squad to the brigade combat teams. Future robotic technologies and unmanned ground systems (UGS) will augment Soldiers and increase unit capabilities, situational awareness, mobility, and speed of action. Artificial intelligence will enable the deployment of autonomous and semi-autonomous systems with the ability to learn. Decision aids will reduce the cognitive burden and help leaders make rapid decisions. Artificial intelligence may allow robots and automated systems to act with increased autonomy. Robotics will enable the future force by making forces more effective across wider areas, contributing to force protection, and providing increased capabilities to maintain overmatch.

Path to the Future

2040

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

2030

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

2020

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

"Maturation, Integration, and Demonstration"

Manned	←	→	Unmanned

360° Vision	Driver Warning	Driver Assist/ Active Safety	Optionally-Driven	Optionally-Manned	Unmanned

Human-Machine Interface
(HMI)

Human-Robot Interface
(HRI)

Applications for Autonomy-Enabled Systems

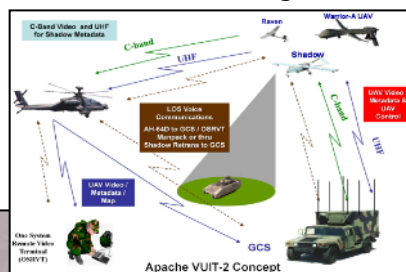**"Unmanned Systems as Members of the Unit"**

Reduce the Burden
- Robotic follower
- Optionally-manned vehicles
- Logistics re-supply
- Mundane tasks

Mitigate Risk
- Capabilities for C-IED
- Capabilities for CBRNE
- Active Safety Technologies
- Pilot Decision Aides

Manned - Unmanned Teaming

Prevent Surprise
- Unmanned Wingman
- All-terrain Surveillance
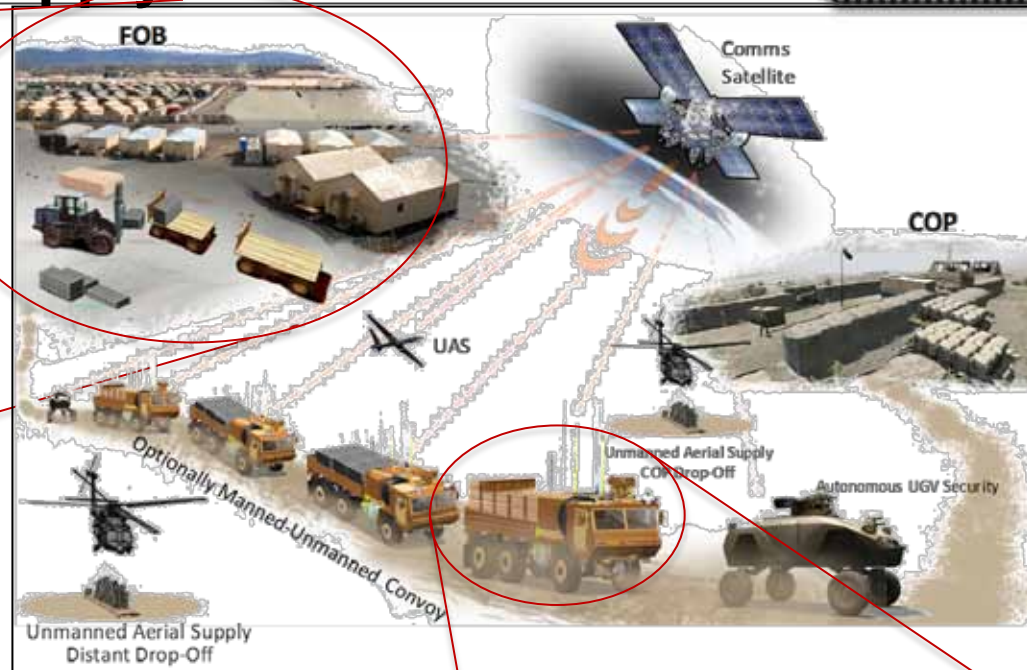- 360 Situational Awareness

Extend the Reach
- Single-user multi-robotic control
- UAV/UGV collaboration & control
- Extended range unmanned operations

"Operationalize" Autonomy-Enabled systems through Experimentation and Concept Development
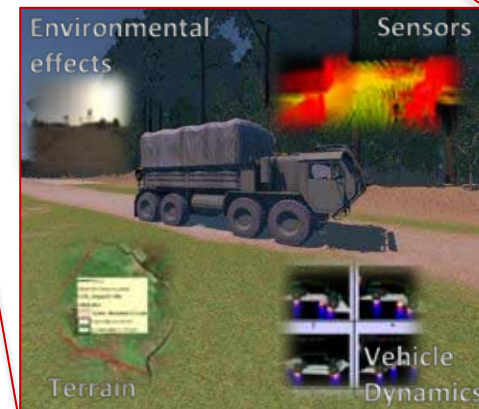
Autonomous Ground Resupply

Near-Term Challenges:

- Development of Open Robotics Architecture
- Advanced Autonomous Behaviors and Software Development Tools
- Incorporating modeling and simulation into the design, development, and testing of unmanned ground systems
- User Acceptance

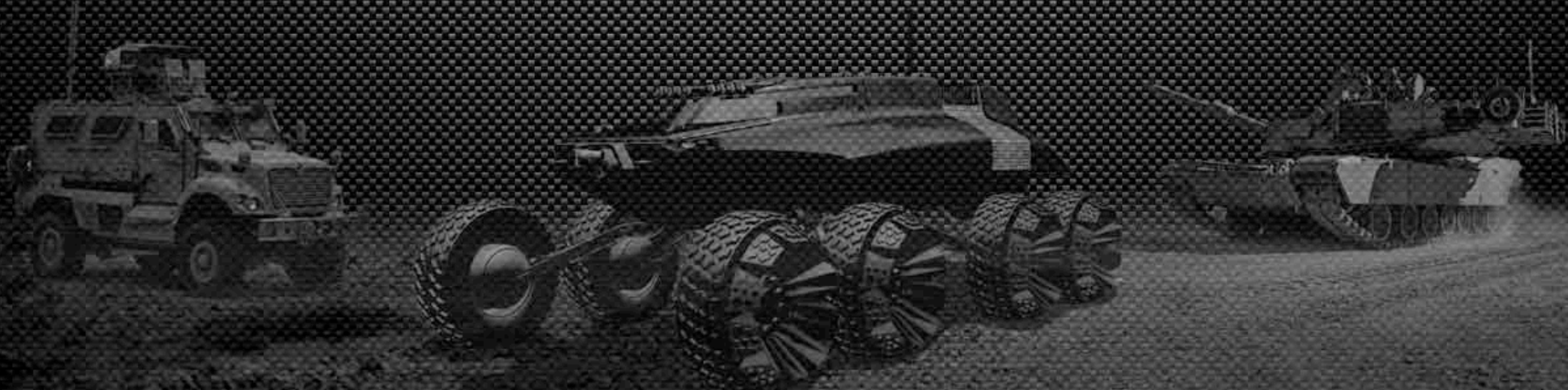**Bringing the state of the art in autonomy-enabled sustainment into Army operations today**

QUESTIONS?