Autonomous Systems Test and Evaluation Requirements Study: A Roadmap to Robust Testing of Autonomous Systems

Tracy Sheppard

Director of Automotive

US Army Aberdeen Test Center

15 August 2012

Army Proven
Battle Ready

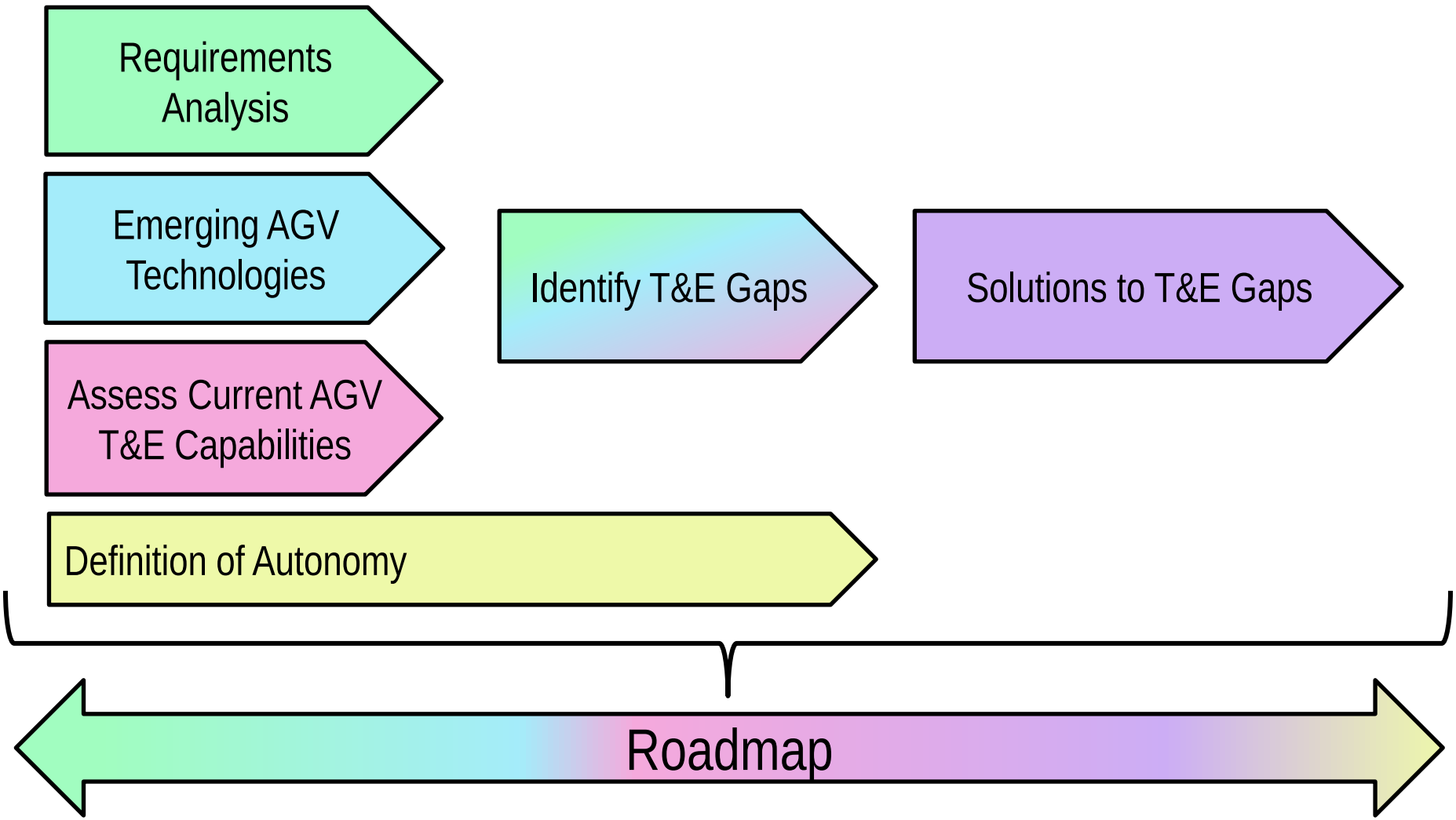
Overview

- ASTERS
  - Purpose
  - Methodology
  - Path Forward
- Aberdeen Test Center
  - Test History
  - Test Capabilities
  - Future Capabilities

ASTERS Study Objectives

- Assess
  - the current state of emerging autonomous ground vehicle (AGV) technologies
  - emerging AGV requirements from the armed services
  - and current test (DT/OT) and evaluation capabilities
- **Recommend** a prioritized set of tools and capabilities to close identified and validated capability gaps to meet the evolving test and evaluation demands of current and future systems
- **Produce** a T&E roadmap to guide future T&E investments and ensure that required test technology, test procedures, and evaluation tools are in place when needed

Study Status



Deliverable Status

January 2013 – Roadmap & Final Report

November 2012 – Solutions to T&E Gaps

August 2012 – Definitions of Autonomy

August 2012 – Prioritized T&E Gaps

May 2012 – T&E Capabilities

May 2012 – Requirements List

May 2012 – Updated TRL List

September 2011 – Terms of Reference

ATC UGV Test History

- Number of UGV tests executed at ATC since 2008: 33
- Number of Tests Executed 2011-2012: 15
- Number of tests executed offsite since 2008: 10

	Test Hours	TIRs
Fielding	3111	2857
R&D	1073	1013

- Testing Systems with Autonomous Capabilities for Fielding
  - RMDS, SANDI, WorkHorse

ATC Current Capabilities
SUGV Course

- Interim Course
  - Future plans for multi-acre test site
- Instrumentation
  - RF Monitoring
  - RFID tracking

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ATC Current Capabilities
UGV Course

Phase I

Phase IV

Phase II

Phase III

Phase II Alt

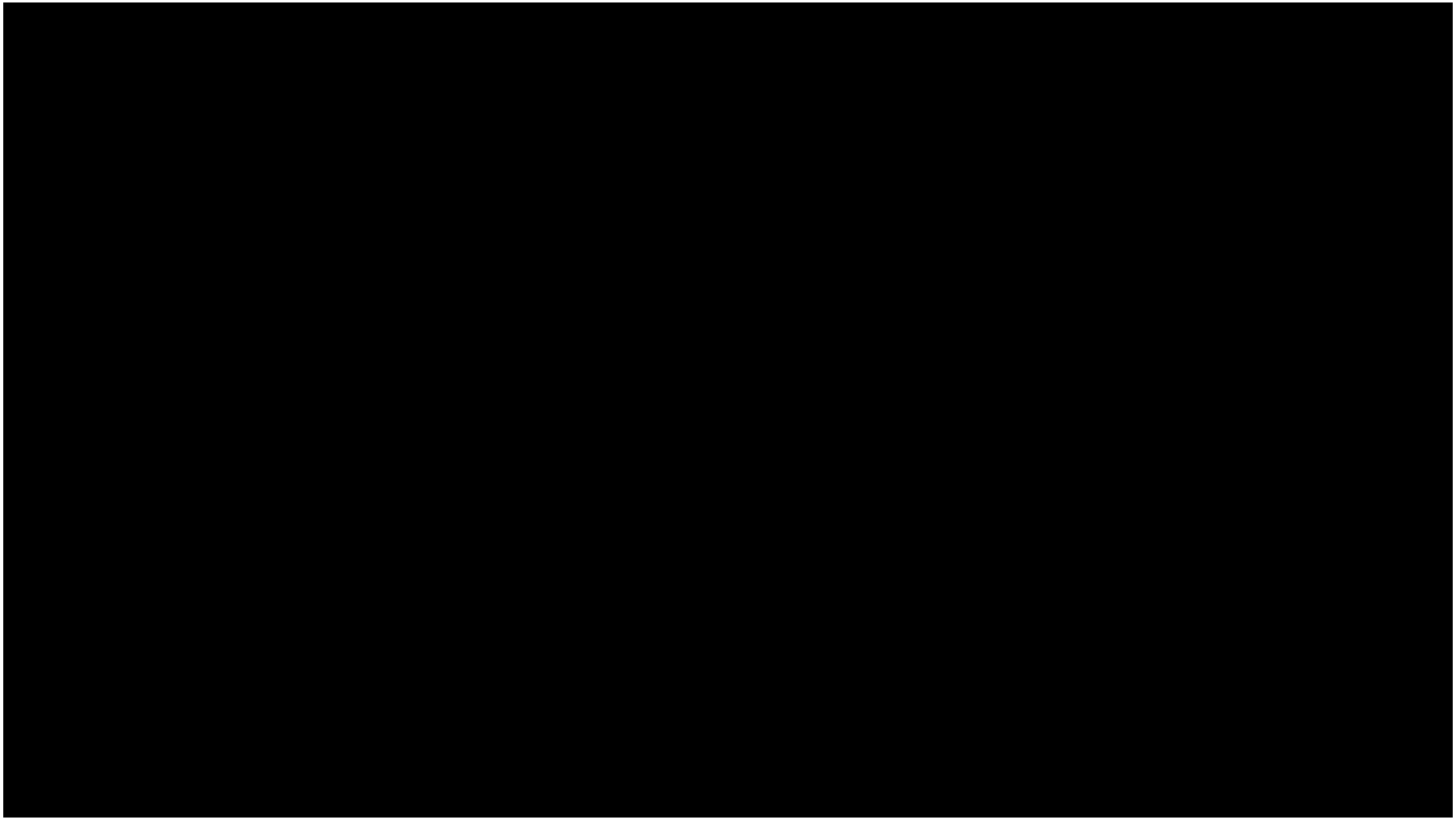
ATC Future Capabilities
UGV Course

- Obstacles

Fog	Rain	"Vehicles"
"Mannequins"	Fences	Stationary Obstacles

- RF Monitoring
  - Potential for induced RF environments; SoS testing
- Video Monitoring
  - Motion activated cameras: record 2 ahead and 2 behind
  - Night recording capability

ATC Current Capabilities



Video

Questions?

Tracy Sheppard

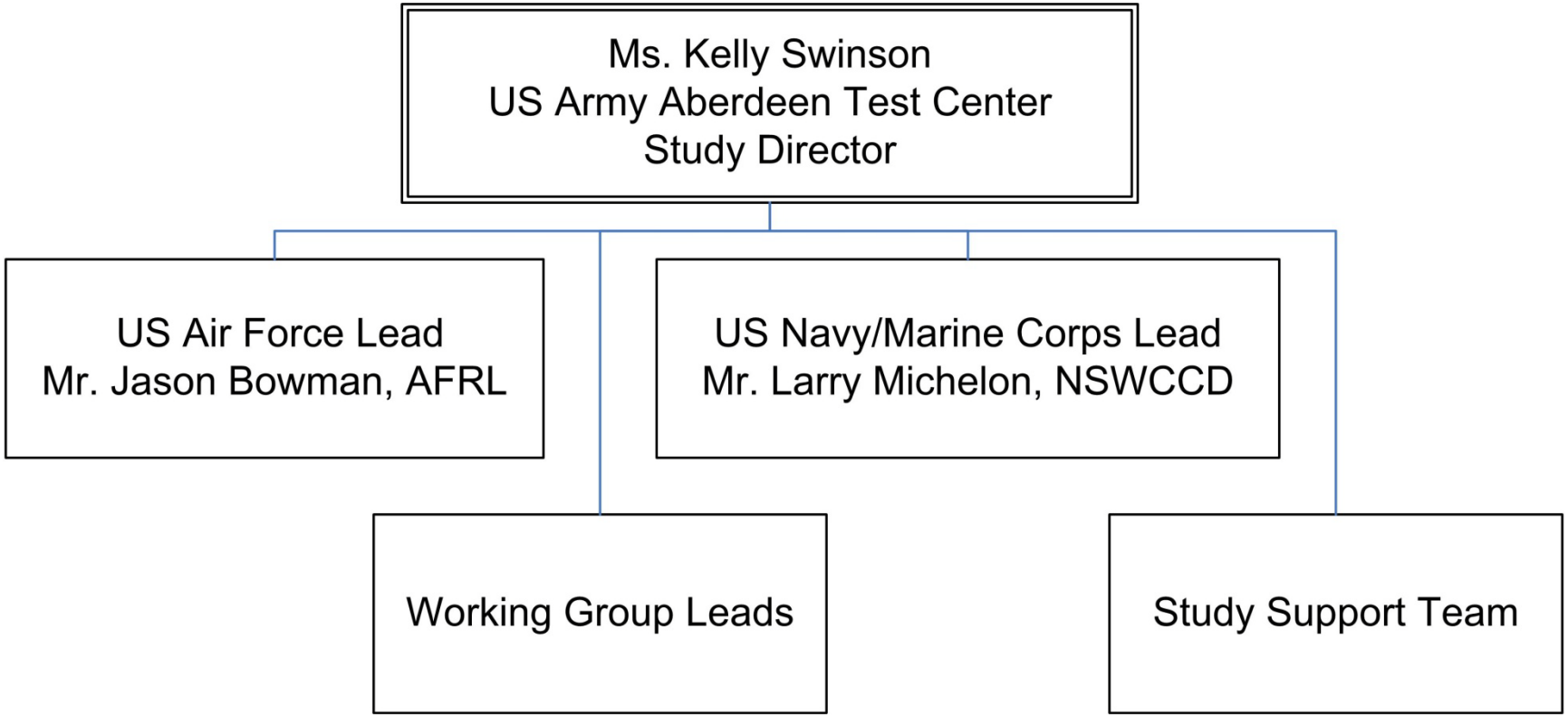
tracy.v.sheppard.civ@mail.mil

Kelly Swinson

- Lt. Combat & Unmanned Systems Branch
- Combat Vehicles Division
- Automotive Directorate
- US Army Aberdeen Test Center
- OFFICE: (410) 278-4735
- BB: (443) 876-2945
- kelly.k.swinson.civ@mail.mil

BACK UP SLIDES

Study Team


Ms. Kelly Swinson
US Army Aberdeen Test Center
Study Director
US Air Force Lead
Mr. Jason Bowman, AFRL
US Navy/Marine Corps Lead
Mr. Larry Michelon, NSWCCD
Working Group Leads
Study Support Team

Methodology/Working Groups

PHASE	METHODOLOGY	WORKING GROUP
1	Requirements Analysis	RWG
2	Requirements Development	RWG, TEWG
3	Emerging AGV Technologies	TWG
4	Define Autonomy	CWG
5	Assess Current AGV T&E Capabilities	TEWG
6	Identify AGV T&E Gaps	TEWG
7	Solutions to T&E Gaps	TWG
8	Develop a Road Map	CWG

Methodology/Working Groups

RWG = Requirements Working Group
Key Players = Joint Ground Robotics Integration Team (JGRIT)
Members of JGRIT include: Army Schoolhouses, SPAWAR, USMC Warfighting Lab, Army Medical Research, ONR, JGRE, RS JPO, Army Maneuver Battle Lab

TEWG = Test and Evaluation Working Group
Key Players = ATEC, MCOTEA, RS JPO, MARCORSYSCOM, NAVEODTECHDIV

TWG = Technology Working Group
Key Players = ONR, AFRL, ARL, TARDEC

CWG = Core Working Group
Members = Kelly Swinson (study director), Mr. Jason Bowman (Air Force Service Lead), Mr. Larry Michelon (*pronounced Mishelon*, Navy Service Lead)

The autonomy definition is being developed by TARDEC. They are modifying current definitions to be applicable to T&E and also aid the acquisition community as a whole. They have traditionally worked with other service research laboratories and continue to do so on the definition.

All system requirements documents go through the service approval process up to the AROC, MROC, NROC, AFROC level.

All documents within the study will go through the CWG for concurrence, then to each service's OTICC (OSD Test Investment Coordinating Committee) representative, and finally the CTEIP PM (Mr. Gerry Christeson).

Requirements Analysis

- Methodology

All draft and final CDDs and CPDs were reviewed for technical clarity. Use cases were selected that fit within the JCAs.

JCA	Battle Space Awareness	Logistics	Protection	Force Support
Near Term	SUGV	AMAS/S-MET	AMDS	Medical Systems
Far Term	Nano Bots	AMAS	MDARS	Medical

- Deliverable

A sortable spreadsheet was developed with the selected use cases. This spreadsheet contains the requirements from the use cases as well as DoD's ability to test the requirement, the location of the test capability and a brief description.

Emerging AGV Technologies

- Methodology

A survey was sent out to the members of the JGRE Robotics Technology Consortium. The information collected will allow the study team to create a timeline of needed test capabilities. If a system technology or enabling technology isn't going to be ready for 10 years the capability to test that will not be needed before then.

- Deliverable

A timeline of AGV technology and AGV enabling technologies.

Define Autonomy

- Methodology

A working definition will be developed to aid the T&E community in understanding independence of the system under test and the capabilities within it's mission context. There are currently more than five definitions of autonomy, but this definition will be the most relatable to T&E.

- Deliverable

A working definition of autonomy will be developed. This definition will remain "working" until fully autonomous systems are realized.

Assess Current AGV T&E Capabilities

- Methodology

A survey was developed and sent out to the MRTFBs who have conducted testing on unmanned or autonomous ground systems. If alternate facilities are known to have capabilities that will support the T&E of ground systems those facilities will also be queried.

- Deliverable

A sortable spreadsheet was developed with the selected use cases. This spreadsheet contains the requirements from the use cases as well as DoD's ability to test the requirement, the location of the test capability and a brief description.

Identify T&E Gaps

- Methodology

Feasible solutions to the T&E gaps will be identified in the form of range infrastructure, M&S, test procedures, instrumentation, personnel, and data analysis/evaluation tools.

- Deliverable

A test capability development roadmap will be drafted with the recommended solutions.

Solutions to T&E Gaps

- Methodology

Feasible solutions to the T&E gaps will be identified in the form of range infrastructure, M&S, test procedures, instrumentation, personnel, and data analysis/evaluation tools.

- Deliverable

A test capability development roadmap will be drafted with the recommended solutions.