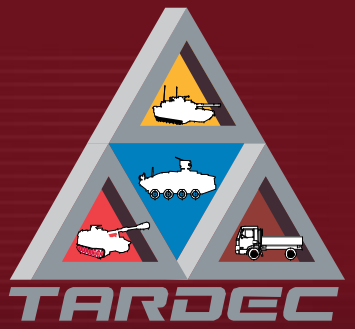


DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Proposed FY09 ATO-D: Improved Mobility and Operational Performance through Autonomous Technologies (IMOPAT)

Jeff Koshko, Intelligent Ground Systems
Jeffrey.koshko@us.army.mil, 586-753-2600

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
09 APR 2008	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Proposed FY09 ATO-D: Improved Mobility and Operational Performance through Autonomous Technologies (IMOPAT)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) **Joff Koshko**	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000**	8. PERFORMING ORGANIZATION REPORT NUMBER **18807**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S) **TACOM/TARDEC**
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) **18807**

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

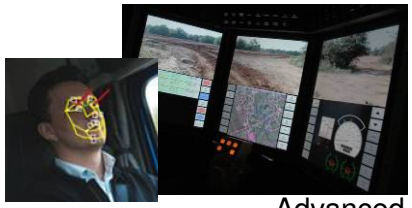
15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**SAR**	**16**	

D.TAR.2009.04 Improved Mobility and Operational Performance through Autonomous Technologies (IMOPAT)

UNCLASSIFIED

360/90 Day/Night
Near-field Sensor Coverage



Soldier Monitoring
& State

Advanced
Crew Stations

Integration Platform
With IV System

Integrate, Enhance, Demonstrate
360 LSA/Assist-Mob/Soldier Monitor & State
to Maximize Soldier-System
360 LSA and Mobility Capabilities
(Secure Mobility)

Schedule & Cost

MILESTONES	FY09	FY10	FY11	FY12
M&S and Field Experiments				
Local 360 SA		4	5	6
- Task Analysis				
- Integrate Detection Algorithms				
- Integrate Digital Recording				
- Integrate Dismount System				
Improved Mobility		4	5	6
- Soldier Task Balancing				
- Assisted Mobility				
Solider Monitor/State CS System		4	5	6
- Sensor Integration				
- Algorithm Integration				
- Integration Technique				
Total (TARDEC, NVESD, ARL-HRED, NSRDEC)				

Purpose

Enable indirect vision (IV) based Soldier–systems (manned/unmanned/Soldier) to move quickly and safely while maintaining 360 local situational awareness (LSA) to enhance operational performance.

Product

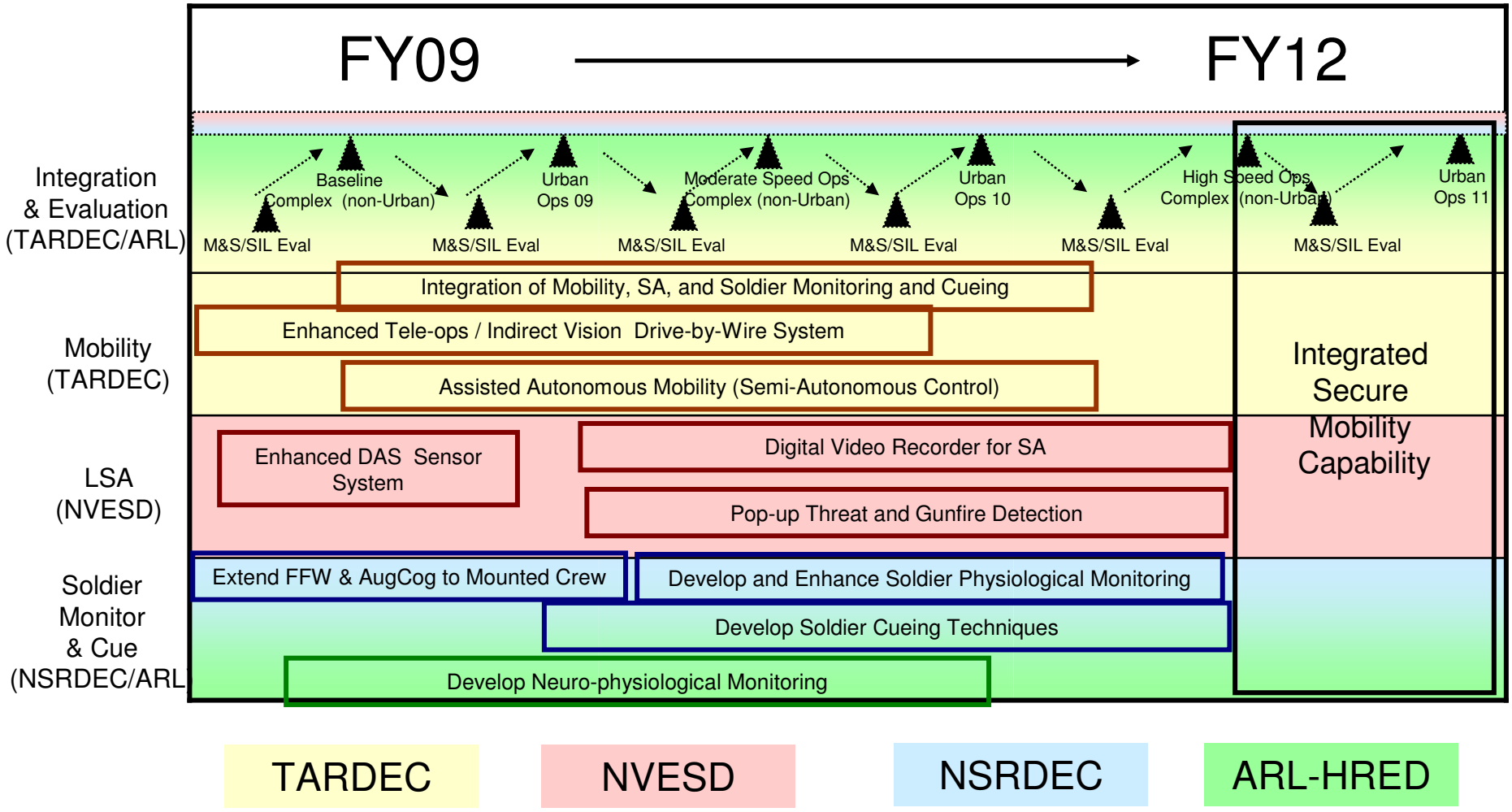
- *Advanced Crew Stations integrated with 360/90 Day/Night LSA, Assisted Mobility, and Soldier Monitoring / State technologies to improve Soldier performance*
- *Quantitative understanding (performance levels) of future indirect vision operations for the movement and security of Soldier-systems at a platoon and below level when utilizing:*
  - *Assisted mobility*
  - *LSA system with aided target cueing*
  - *Digital video recording of 360/90 with intelligent tagging*
  - *Soldier monitoring and state based crew station (CS) design*

Payoff

- *Improvement in Vehicle & Soldier Survivability, Vehicle Lethality/Self-Defense & Control along with Greater Survivability/Lethality for Dismount Soldiers*
- *Two Mounted Soldier ability to maintain 360 LSA with IV*
- *One Mounted Soldier ability to move vehicle (manned or unmanned) quickly and safely with IV*
- *Data and Information to feed programmatic decisions*
- *Risk reduction for FCS*

Development Plan and Progression

UNCLASSIFIED



Partners / Responsibilities

UNCLASSIFIED

TARDEC

- Develop Enhanced Indirect Vision Drive / Tele-operation Systems
- Develop Assisted Autonomy Systems
- Develop Warfighter Machine Interfaces
- Integrate and Evaluate
  - Vehicle LSA Systems (NVESD)
  - Soldier Monitoring & State Classification Systems (NSRDEC/ARL-HRED)
  - Assisted Mobility (Other TARDEC Programs)
  - Dismount LSA Systems (NSRDEC)
- Perform SIL and Vehicle/Field Experiments

ARL-HRED

- Define and Develop Experimentation Plans
- Work with TARDEC on Indirect Vision Drive and Assisted Autonomy Systems
- Provide HFE Support for Systems Development and Integration
- Develop Information Flow Requirements and Algorithms for Mobility and LSA
- Work with NSRDEC on Soldier Monitoring and Workload Management Systems

NVESD

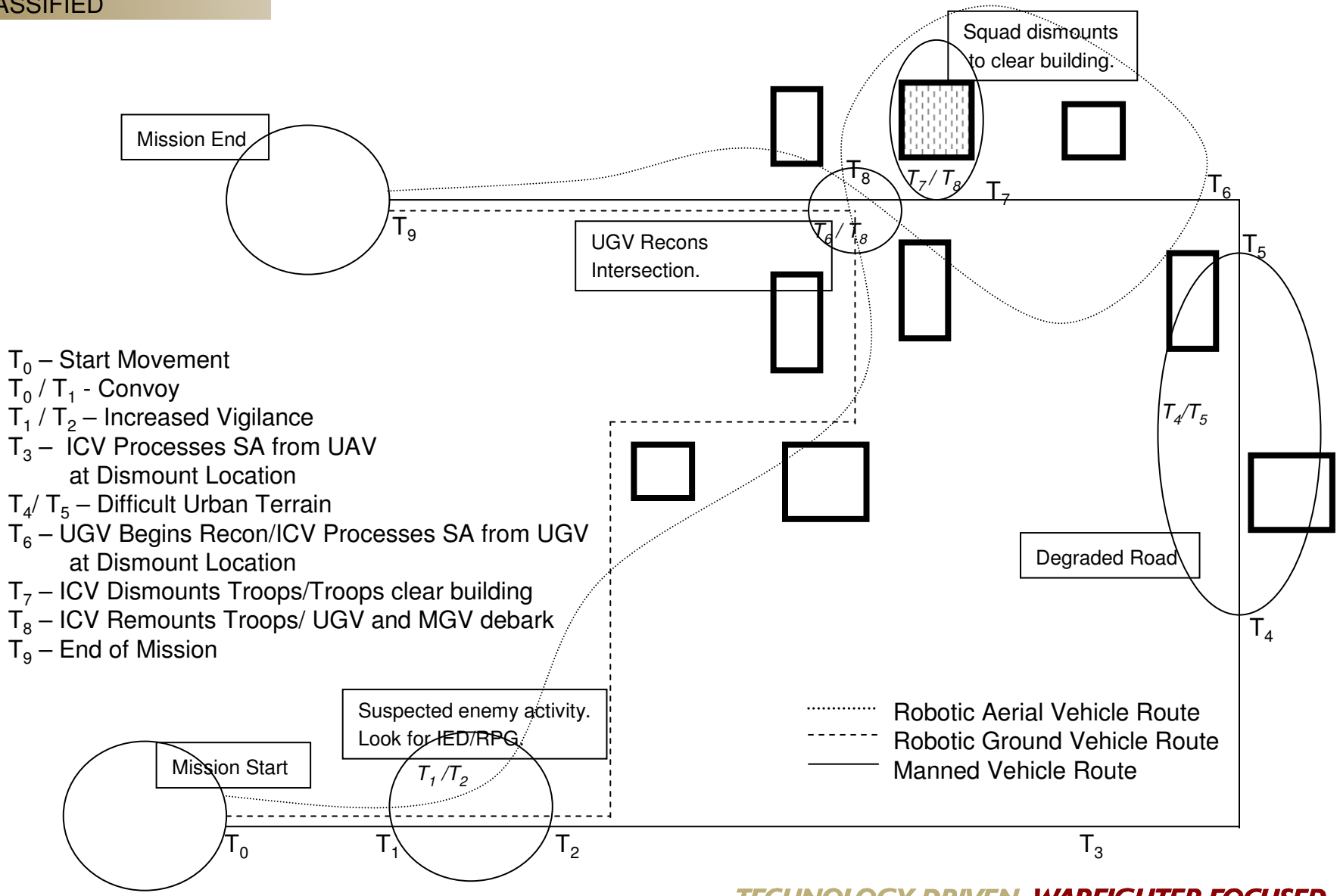
- Enhance DAS Sensor Systems / Threat Detection Algorithms
  - Pop-Up Targeting and Gun-Fire Detection (before/during/after shot)
- Develop Digital Vehicle LSA Recording and Cueing System

NSRDEC

- Enhance and Transition Mid-Maturity Dismount Soldier Monitoring Systems from Augmented Cognition Program
- Develop/Enhance Low-Maturity Soldier Monitoring System
- Work with ARL-HRED on Soldier Monitoring Systems
- Develop Dismount LSA System

Urban Engineering Evaluation Test Scenario

UNCLASSIFIED



Evolution of TARDEC's Intelligent Ground Systems Programs

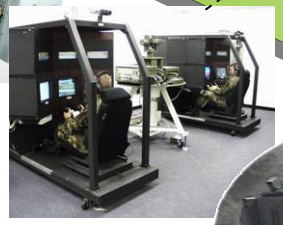
UNCLASSIFIED

FY93

FY96

Crewman's Associate Baseline SMI

System Integration (Lab)



FY98

Demo III Semi-Autonomous Development

IVES STO Field Experiment

FY00

Crew integration and Automation (CAT) Robotic Follower (RF) ATDs Warfighter Experiment Fort Bliss

FY03

CAT and RF ATDs RDECOM-UAMBL Experiment

FY06

Near Autonomous Unmanned Systems ATO

Robotics Collaboration ATO

FY08

Safe Unmanned Operations in Urban Environments

Improved Mobility & Operational Performance through Autonomous Technologies

TECHNOLOGY DRIVEN. WARFIGHTER FOCUS

Testbed Platforms

Manned Platform

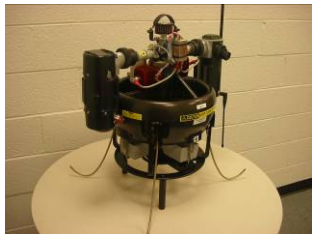
Crew-integration and Automation Testbed (CAT)

Unmanned Platforms

Crusher

eXperimental Unmanned Vehicle (XUV)

Talon

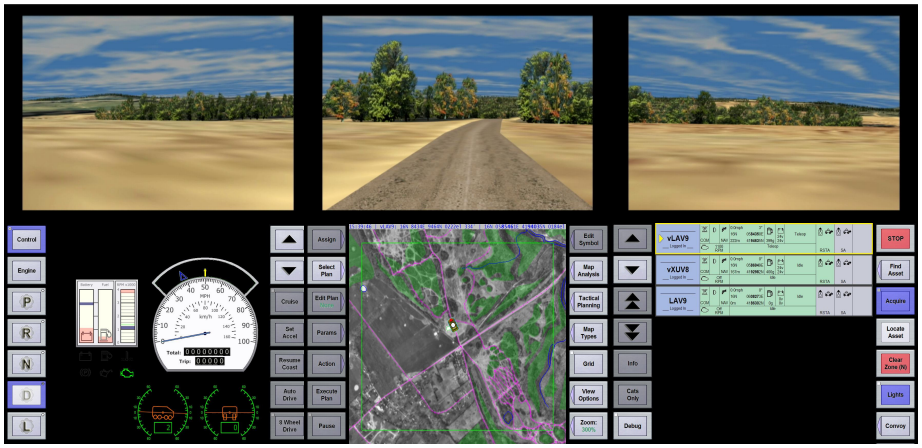


gMAV

CAT Crewstations

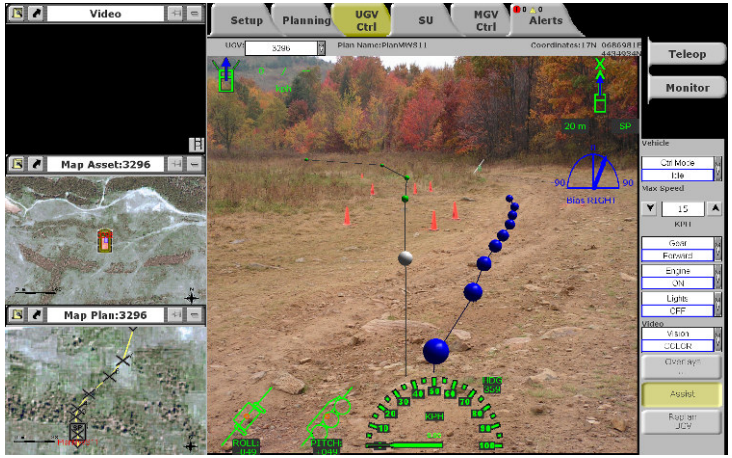
UNCLASSIFIED

Common Crew Surrogate



Warfighter Machine Interfaces

Mission Module Workstation



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Modeling and Simulation System Integration Labs

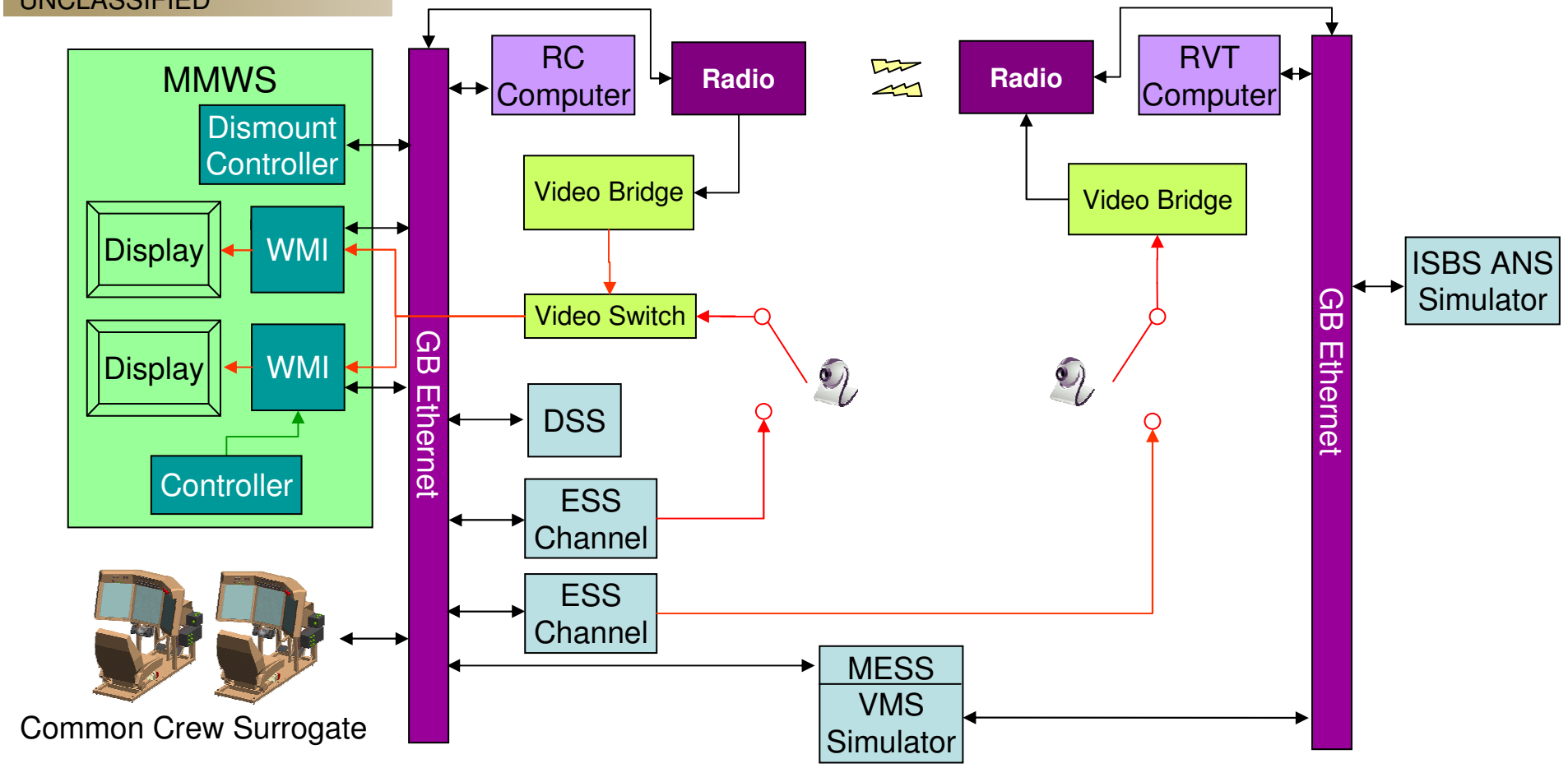
UNCLASSIFIED

Motion Based Simulation

System Integration Lab

Technology Feeder HW Architecture

UNCLASSIFIED



= Video Equipment
= Shuttle PC
= cPCI SBC
= Network
= Other

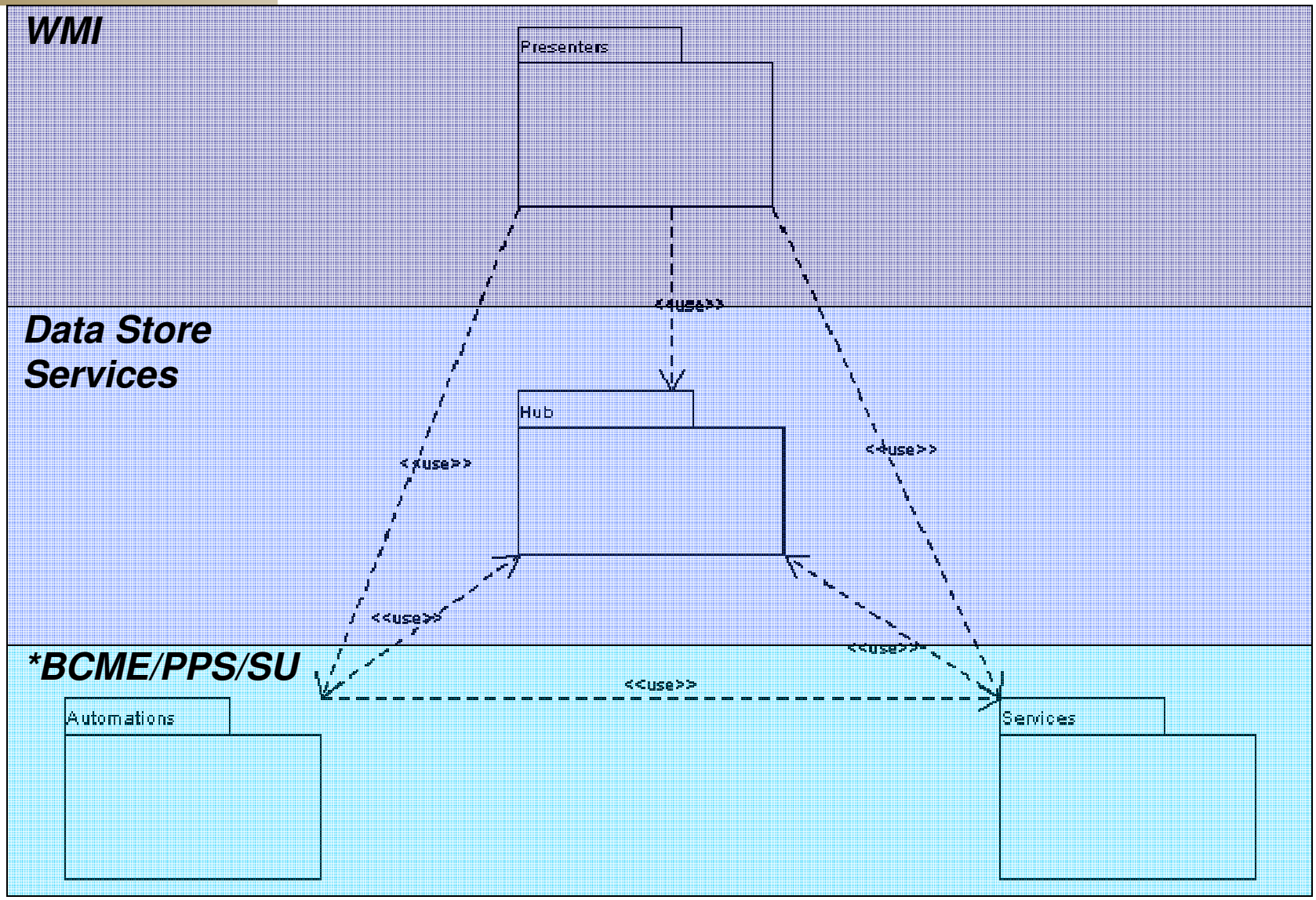
= Video
= TCP/IP
= USB
= Wireless

WMI = Warfighter Machine Interface
MMWS = Mission Module Workstation
ISBS = Intelligent System Behavior Simulator
DSS = Decision Support System
ESS = Embedded Simulation System

MESS = Master Embedded Simulation System
ICS = Integrated Computer System
VTI = Vetronics Technology Integration
ANS = Autonomous Navigation System
VMS = Vehicle Management System

Technology Feeder
SW Service Architecture

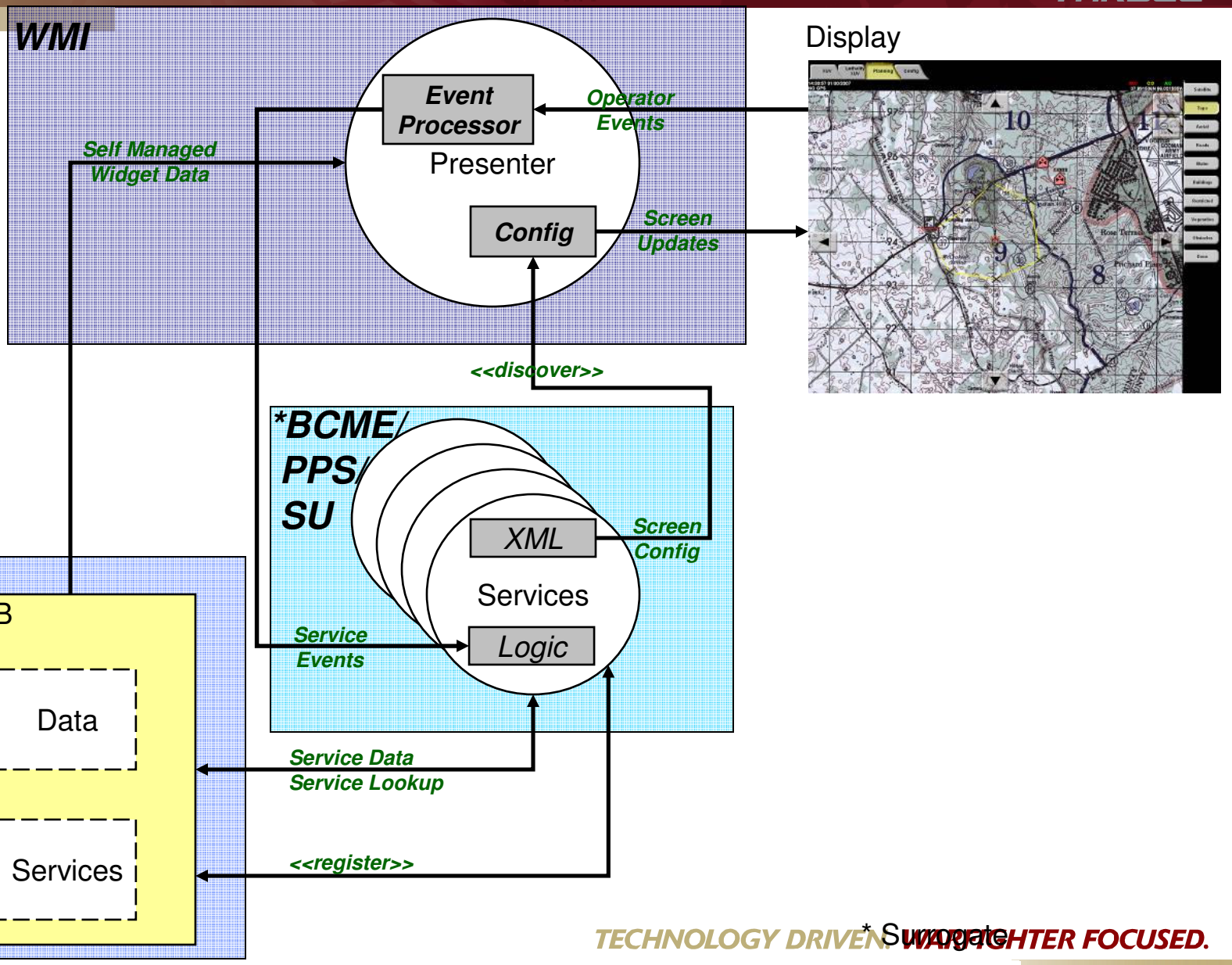
UNCLASSIFIED



*surrogate

Technology Feeder
SW Service Architecture

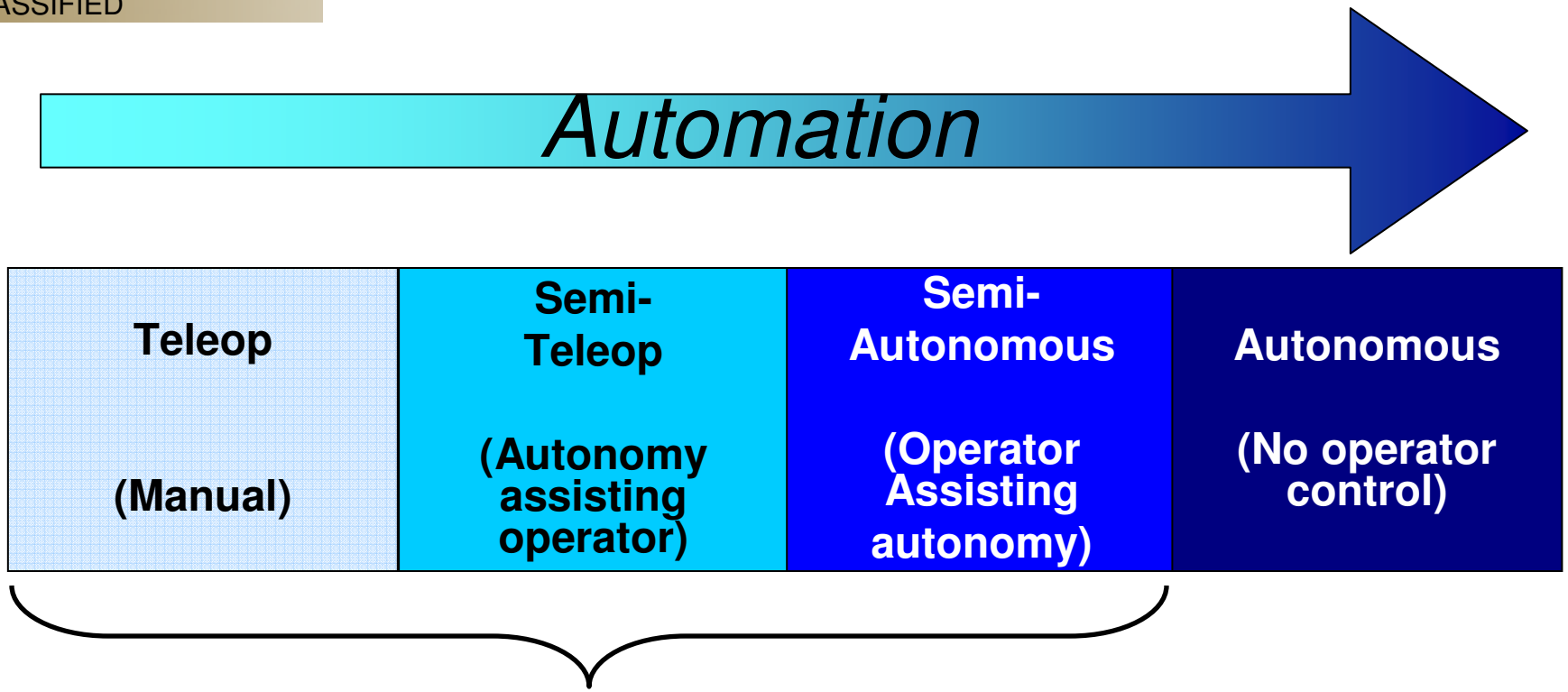
UNCLASSIFIED



* Surrogate

Technology Feeders
Mobility Autonomy

UNCLASSIFIED



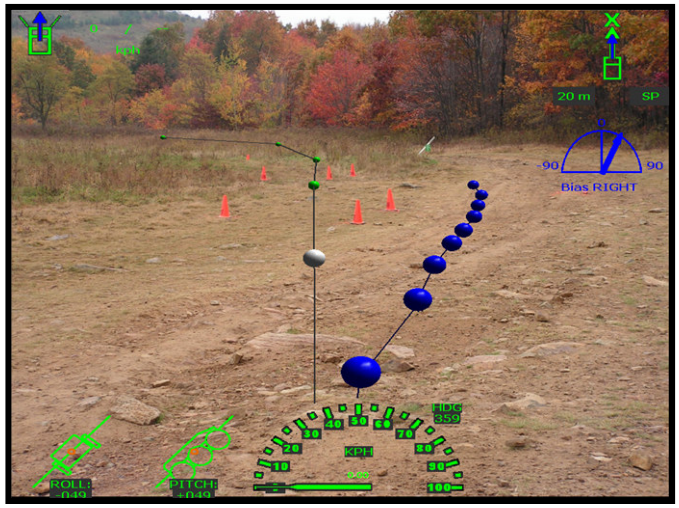
Focus: Reduce operator intervention time and workload through:

- Increased SA/SU
- Technology Integration
- Advanced WMI
- *Leverage as much as possible from FCS to support RC objectives*

Technology Feeders
Mobility Autonomy

FY 07 (RC ATO)

- Bias
- Speed Adjust
- Obstacle Overlays
- Apriori Overlays



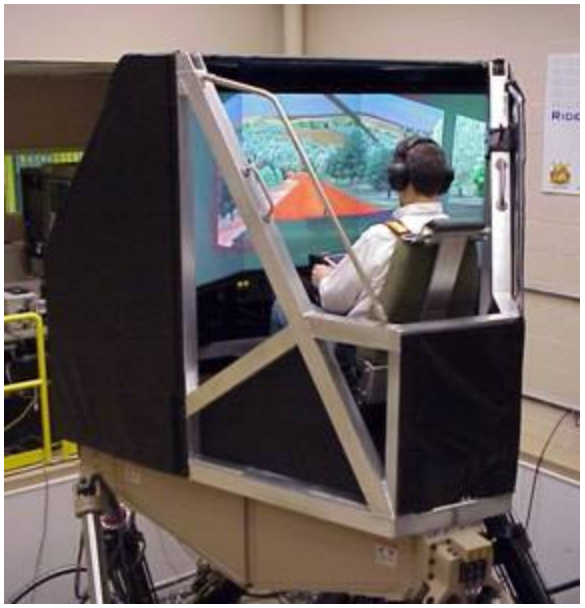
FY 08 (RC ATO)

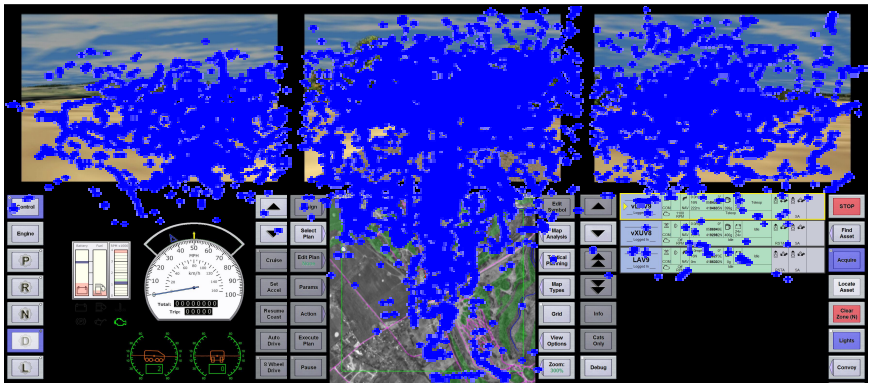
- Aggressiveness
- Steerable Waypoint
- Confidence
- Long Range
- Safety Push / Clear Map
- Obstacles Map Aid
- Wonder Women

Eye Tracking Pilot Experiment

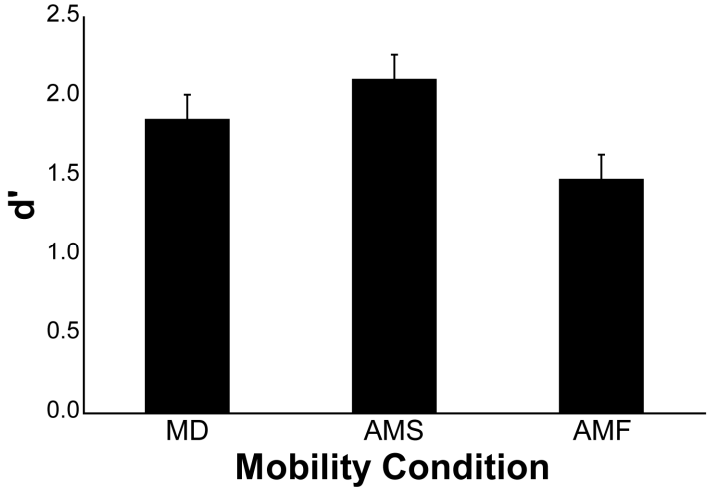
2006 Pilot Experiment (TARDEC)

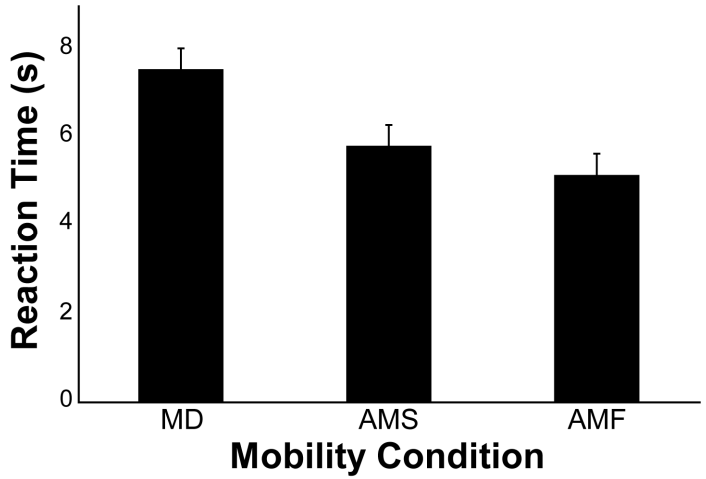
Tracked participants eye-movements and performance in full 6-DOF motion base simulator while executing supervisory control.

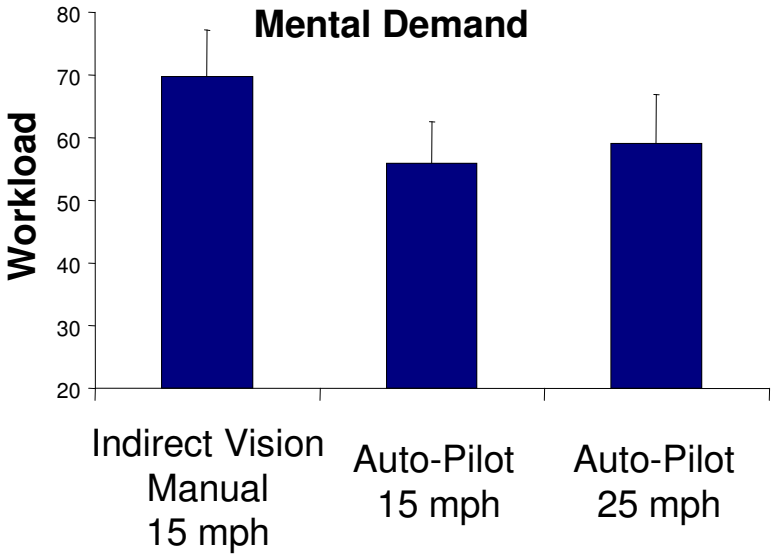




Local Area 360 SA – Identification Accuracy and Response Time





Planning on Move During Convoy Ops

Condition	Plan on Move (%)
Auto-Pilot 25 mph	49.5
Auto-Pilot 15 mph	54.0
Indirect Vision Manual 15 mph	18.0