



ARMY ROBOTICS TECHNOLOGY ***Evolution of Autonomy***

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Motivations for High Levels of Autonomy in Military systems

If realized correctly:

- **Increased survivability**
- **Increased span of control (one on many)**
- **Reduced communication data rate**
- **Reduced supervisory workload**
- **New operational flexibility (stay behind or die in place missions)**

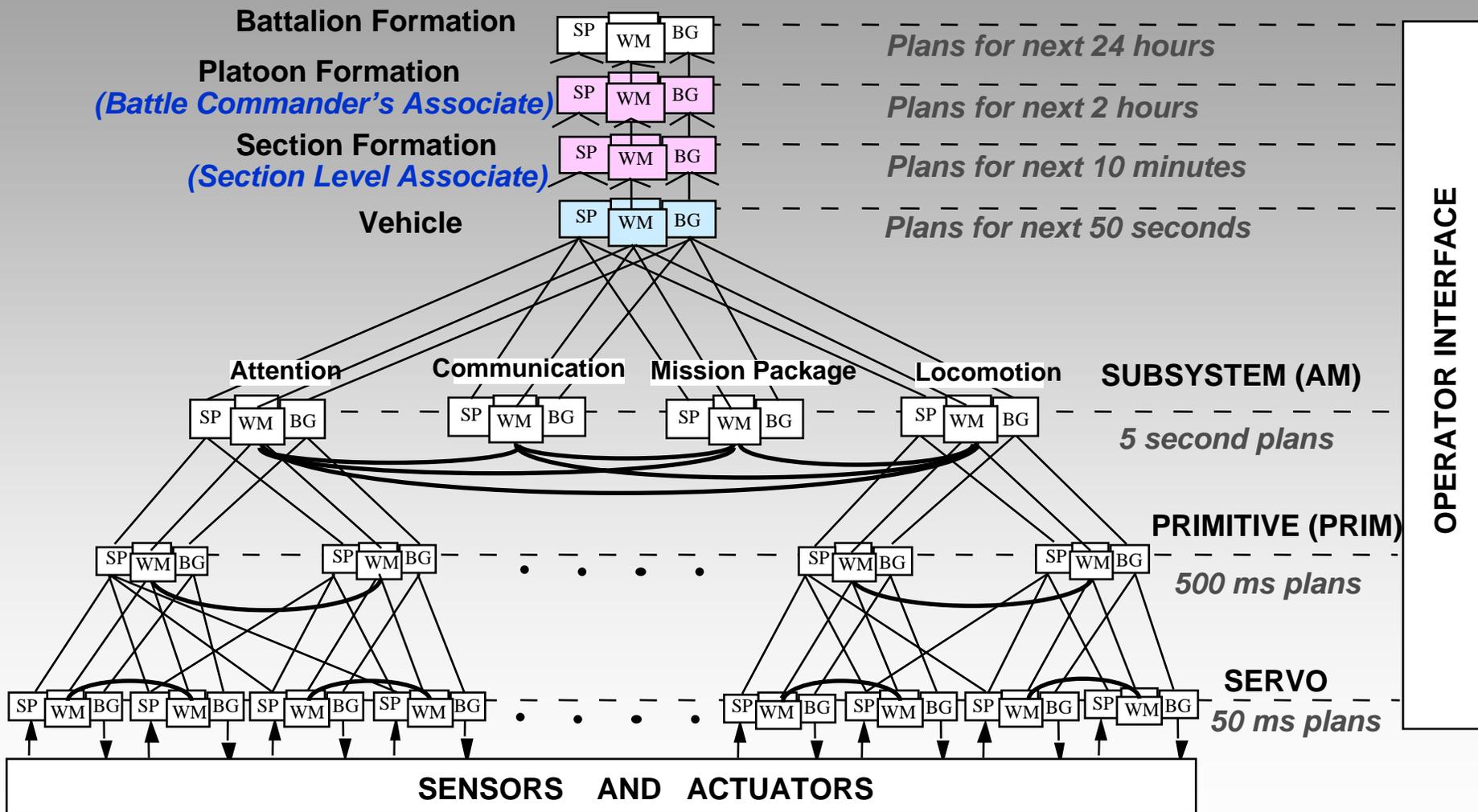


Autonomy must be considered in the context of:

- **Mission scenario**
 - Domain complexity
 - Problem structure
 - A priori knowledge of:
 - Terrain
 - Disposition of forces
 - Nav references
 - Type of mission
 - Mission complexity
 - Uniqueness
 - Consequences of success – failure
 - Countermeasures
- **System capability**
- **Alternatives**



DEMO III 4-D/RCS REFERENCE ARCHITECTURE





Autonomous Mobility Technology Maturity Assessment

Preliminary Insights



Location	Complete runs	Total Runs	% Complete
FTIG	156	181	86.2
Tooele	168	177	94.9
U-FTIG	264	288	91.7
Total	588	646	91.0



XUV Autonomous Operation						
	Distance (km)			Time (hr)		
Location	Total	Autonomous	% Autonomous	Total	Autonomous	% Autonomous
FTIG	203.4	188.1	92.5	39.6	33.1	83.5
Tooele	203.8	199.3	97.8	34.3	31.9	92.9
U-FTIG	152.7	149.1	97.6	25.6	22.8	89.1
Total	559.9	536.5	95.8	99.5	87.7	88.2

Operator Interventions Required During Autonomous Operation					
Course	Freq	Mean distance between interventions (km)	Mean time between Interventions (Minutes)	Mean intervention duration (Minutes)	Mean intervention distance (m)
FTIG	173	1.2	13.7	2.3	88.4
Tooele	48	4.2	42.9	3.0	93.2
U-FTIG	106	1.4	14.5	1.6	34.2
Total	327	1.7	18.3	2.2.	71.5

U.S. Army RDE Command

Robotics Technology Roadmap
Presentation to
RDECOM Board of Directors



Charles Shoemaker
Robotics IPT Technology Manager



RDE Command Robotics IPT Mission/Task

Develop an innovative, affordable, and integrated portfolio of robotics technology (air, ground, unattended sensors, ...) programs and demonstrations that will:

- **Assess and guide the execution, integration, and transition of robotics programs and transition of robotics related and feeder technology programs.**
- **Support development of robotic ground systems, air systems, control systems for Current, Stryker and Future Forces.**
- **Leverage national and international technical expertise.**
- **Develop gap-filler programs.**

MEMBERS: AMRDEC, ARDEC, ARL/ARO, CERDEC, TARDEC, NSC, PEO-STRI, ATEC, DOE, NGIC/MSIC, TRADOC, RDECOM/SOSI



Robotics & Transformation

Unmanned Systems Seamlessly Integrated into the Future Force



UAV
Class IV

Manned Unmanned
Teaming



FCS Increment I UA
Unmanned Systems*
(for one UA)

UAV Class I	54
UAV Class III	14/56
SUGV	81
MULE	54
ARV-A(L)	27
UGS	157

*Source AMSAA Systems Book, 3.0

UA (X)

UAV
Class III

UA (II)

UAV
Class II

UA (I)

UAV
Class I

UA (I)

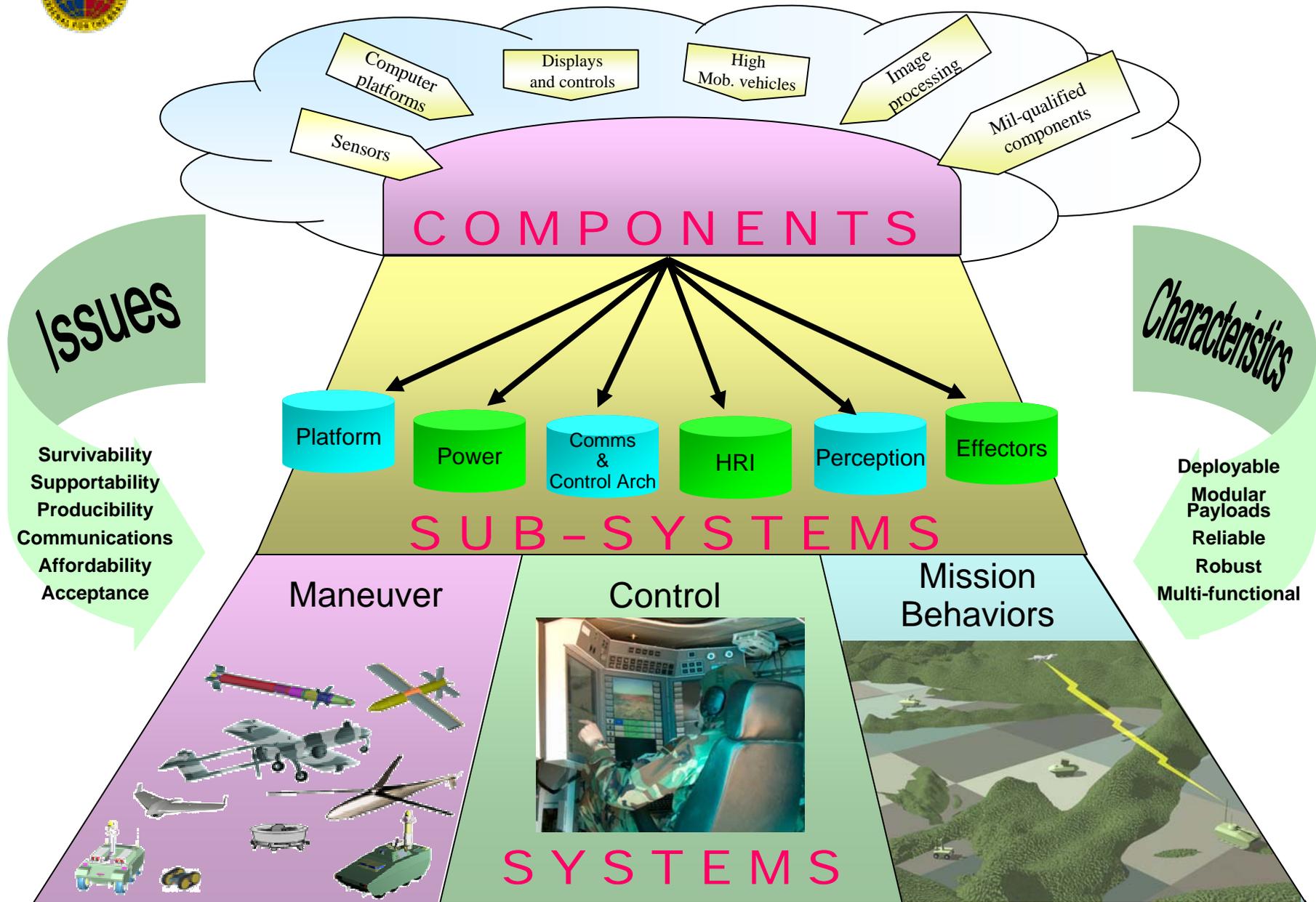
MULEs

SUGVs

ARVs



Robotics Systems of Systems Integration





Robotics IPT

Accomplishments/Way Ahead

Accomplishments (FY03)

- **Stood-up IPT**
 - Improved coordination/cooperation among IPT organizations
 - Relevant STOs & ATDs identified
 - Integrated TRADOC roadmap efforts into ONE Robotics Roadmap
- Briefed draft Roadmap to RDECOM BOD, WTC, and CG AMC
- Met with LSI/LTI to develop strategy for synchronizing objectives/deliverables with OF
- SOSI International tapped to serve as agent to integrate international activities
- Briefed JFCOM futures cell (Alpha Team)
- ARL Robotics Project Office added task order to Robotics CTA addressing OFW robotics functionality

Way Ahead (FY04)

- Develop Robotics Roadmap Investment Strategy
- Identify maximum leverage transition opportunities key to OFW
- Formalize transition plans, identify deliverables, integrate in Robotics Roadmap
- Examine existing programs with regard to their impact upon Future Force
- Examine key systems issues, e.g., architectures, interfaces, scalability, & integration
- Examine resources available
- Evaluate new and existing STO's and ATD's in light of above factors
- Develop Roadmap implementation strategy for review and action by BOD