

Military Robot Development

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Some Downsides to Robots on Battlefield

- More complexity might mean less reliability
- More complexity makes service and support more difficult
- Sensors may transmit energy that may be detectable
 - Active sensors: LIDAR, RADAR
 - Passive sensors: FLIR, vision, acoustic
- Not as autonomous as a soldier
- No “common sense”

So there better be darn good reasons

- Safer standoff distance
- Riskier missions
 - Get closer
 - Check for non-combatants
 - Shoot second
 - Commander sign off
- Longer missions
- Soldier comfort not design criterion
- Soldier protection not needed

Unmanned systems will be an important disruption in combat

Arguments

- Comms will be disrupted->they will be more autonomous
- Sensors can be spotted->passive sensor techniques will mature
- No common sense->neither do missiles, use appropriately
- Technology isn't ready->the only way to make it ready is to build

Things We Could Improve

- Best value criteria, not lowest cost
 - Delivery of similar product in past
 - Multi-generation design
 - User feedback
- Recognize that field needs nurturing
- Multi-generation product lines are more likely to succeed than one shot development efforts
- Commit to quantity predictions for programs

Think in Generations

- Innovate, develop, test
- Roll out to select units
- Test, upgrade, purchase, repeat
- Help technologies and systems cross “valley of death”
- Keep production lines running

If you are not fielding, you are failing
-General Rick Lynch

Things that have improved

- Futures Command
 - New way of doing business
 - Focus on the future and how tech can be applied
 - More tightly coupled
 - CFTs, IPTs
 - Colocation, tightly coupled to ASA(ALT) PEOs
- New Contracting Mechanisms
 - 804 Middle Tier Acquisition
 - Industry Consortiums with OTA contracts
- Robot Programs of Record
 - Programs of Record (POR)
 - More in development

Culture for Tech Development

- Hard technical discussions early
- Ideas come from everywhere in the community
- Best tech input comes from most close to tech not top of hierarchy
- Best decision comes from leaders with access to differing input
- Healthy competition of ideas is good
- Leaders should change their minds upon reflection or when presented with new data
- Never shoot the technical messenger

Family of Robotic Systems*

* Subject to size, weight, and power realities

- Army needs commonality in robots to
 - Reduce sustaining costs
 - Help ATEC certification
 - Helps small companies compete
 - Reuse technology between programs and platforms
 - Must respect “secret sauce” intellectual property
- Commonality **MUST NOT**
 - Stifle innovations, so
 - Exceptions can be made for good reasons
 - Exceptions may dictate future direction
 - Inhibit performance ie add too much latency

Candidate Standards

- Ubuntu Linux
- Robot Operating System (ROS 2)
- Robot Operating System – M (ROS-M)
- Inter Operability Profiles (IOP)
- Ethernet or USB-C

“A Rising Tide Floats All Boats”

Robot Operating System (ROS) Improvements Needed

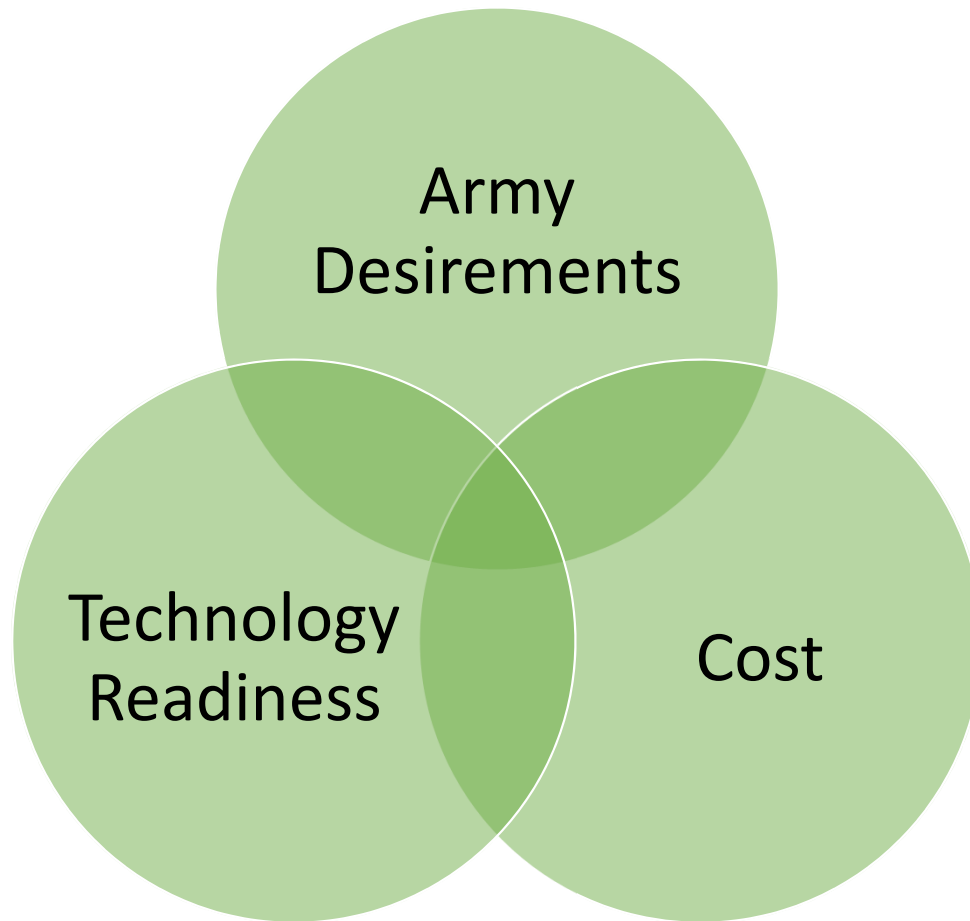
- ROS 2 for all projects
- More modularity
- Embedded system support
- Cross compiling infrastructure

“While ROS 1 is invaluable in R&D and prototyping activities, it can’t reasonably be taken through the QA process that is applied to products that include, for example, safety-critical systems. Based on that feedback we are designing and developing ROS 2 in such a way that it will be amenable to approval for use in such applications.” - Open Robotics CEO

Drive By Wire

- Steer by Wire
- Shift by Wire (Park by Wire)
- Brake by Wire
- Accelerate by Wire (Electronic Throttle)

- Turret by Wire
- Automatic Loading



Aided by Commercial Technology

- RCV off-road autonomy
 - Self driving cars on-road autonomy
- Small UAS
 - Hobby drones
- Mobility
 - Personal transportation
- Dispersed Logistics
 - Delivery drones

Great Opportunities

- Unique capability
 - Short Range Recon (SRR) drone
 - Soldier Borne Sensor (SBS)
 - Small Unmanned Ground Vehicles – (SUGVs)
- Cognitive load reducing behaviors
 - Automatically cue potential items of interest
 - Turret auto-tracking
- Labor intensive and unchanging
 - Loading ammo
- Riskier missions
 - Robot Combat Vehicle
 - Engineers Breaching Robot
 - CBRNE Detect

This is a great time for robotics in general
and military robots in particular