

Ground Robotics Market Analysis

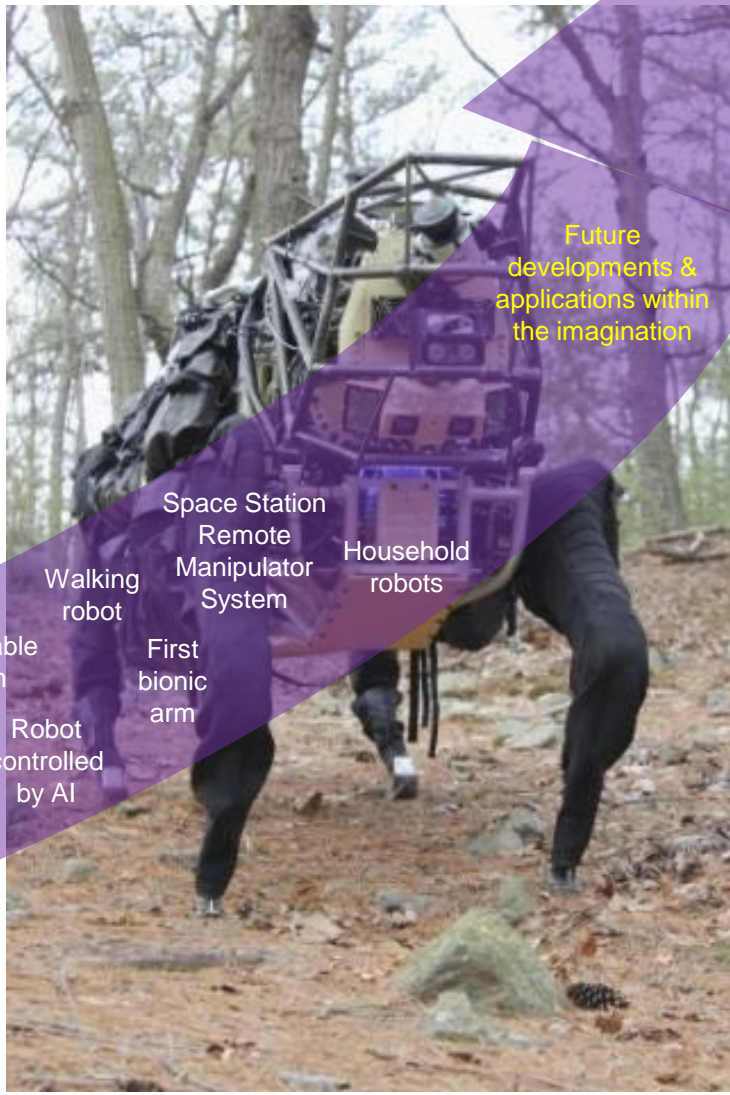
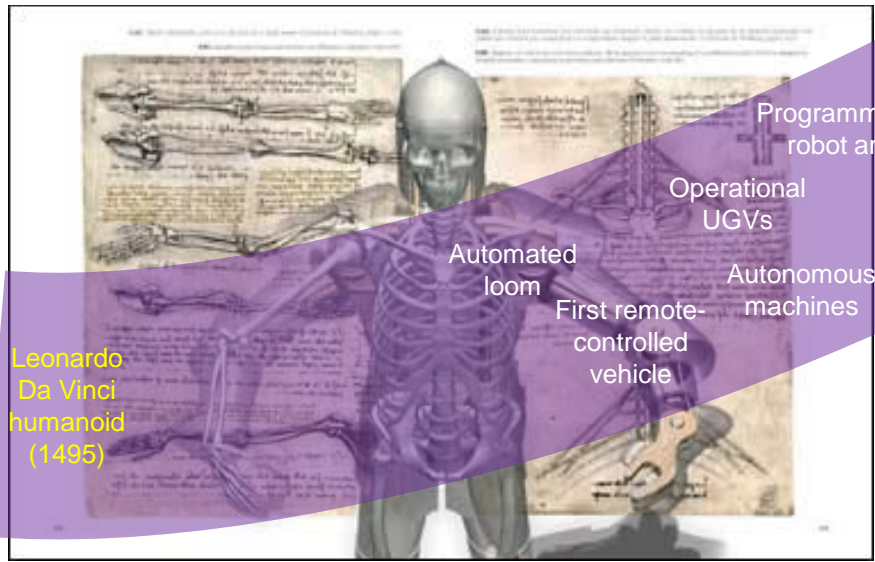
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Robotics progressing - 520 years and counting



Future developments & applications within the imagination

Automated loom

First remote-controlled vehicle

Operational UGVs

Autonomous machines

Programmable robot arm

Robot controlled by AI

First bionic arm

Walking robot

Space Station Remote Manipulator System

Household robots

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Market Drivers

Near Term Market Environment

Unmanned Ground Vehicles (UGVs)

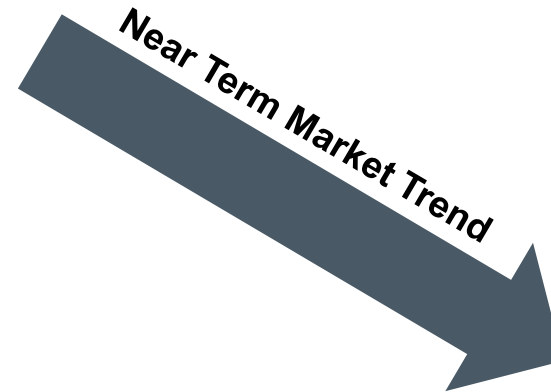
Over the last two years, major negative changes to the market:

In the USA:

- Draw down from Iraq and Afghanistan
- Defense funding constraints
- Changes in priority
- Programs cancelled
- Policy to reset / upgrade

Globally:

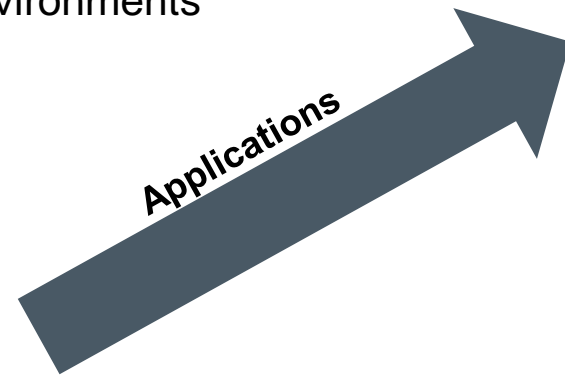
- Funding constraints
- Prioritization
- Slower than anticipated indigenous developments



Functional Segments

UGVs

- Intelligence surveillance and reconnaissance
- Mine & NBC detecting and counter-IED
- Inspection and intervention operations in hostile environments
- Hazardous material detection
- Explosive ordnance disposal
- Under-vehicle inspection and reconnaissance
- Special Weapons & Tactics (SWAT)
- Transportation across multiple terrain types
- Commercial applications developing

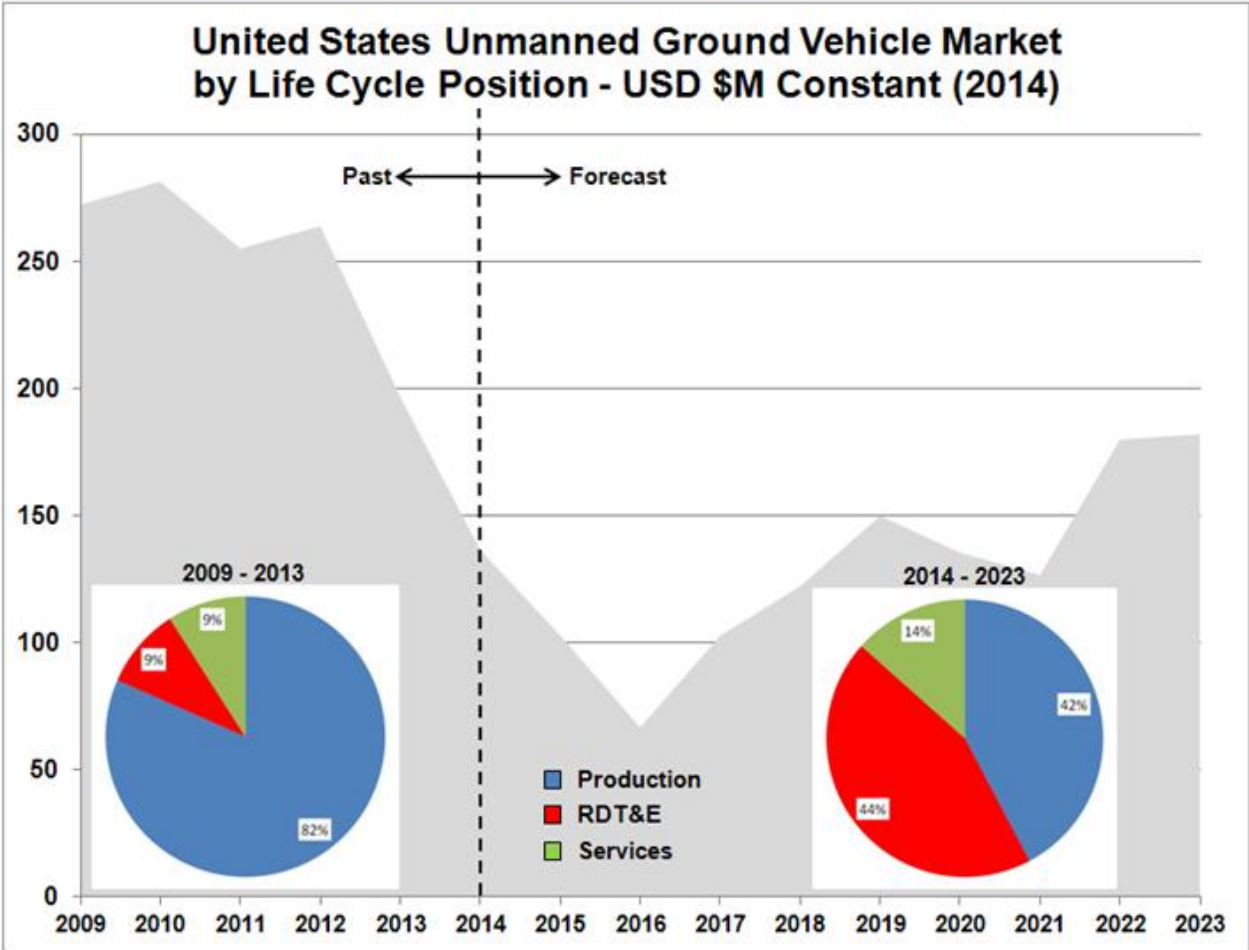


Source: IHS

Forecast Market

United States End-Users

UGV Market



Source: IHS

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United States Forces

UGV Planning

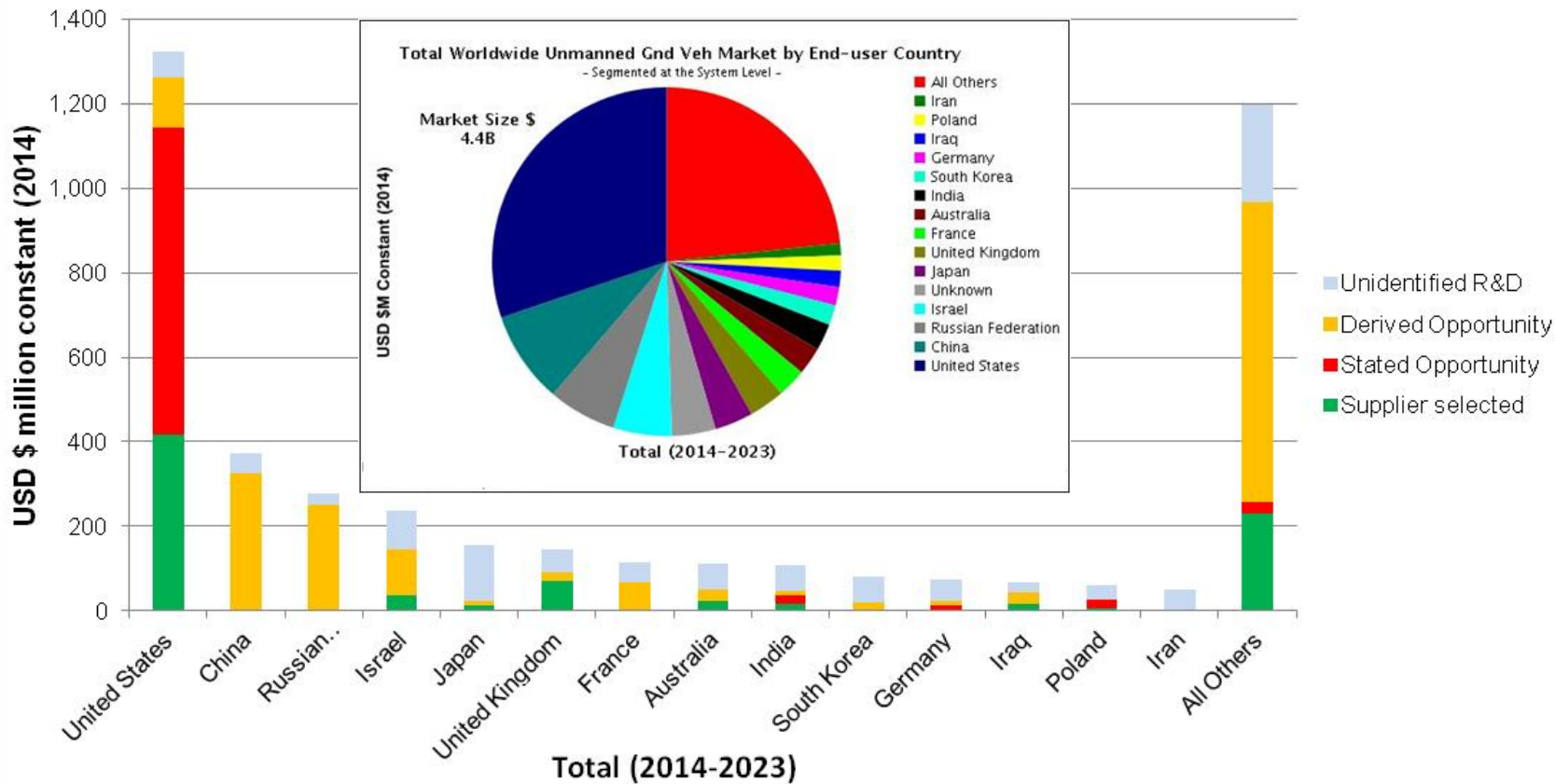
- Army plans to refurbish about 60 percent (1,477 UGVs) of total
- A bridge before eventual replacement
- MTRS Increment 2
- Tactical Unmanned Ground Vehicle (TUGV) program
- Common Robotic System (Individual) (CRS-I)
- Advanced Explosive Ordnance Disposal Robotic System (AEODRS) family
- Logistical support studies

Source: IHS

Global Opportunities

UGV Market

Total Worldwide UGV Market Opportunities



Source: IHS

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Developing Global Potential

Research & Development Capabilities

UGV Current Status

ESTABLISHED / SIGNIFICANT
Canada
France
Germany
Ireland
Israel
Slovakia
United Kingdom
United States

GROWING / MINOR
Denmark
Jordan
Netherlands
Norway
Singapore
Sweden
Switzerland
Thailand
Turkey

GROWING / SIGNIFICANT
Australia
China
Croatia
India
Italy
Japan
Poland
Russian Federation
South Korea
Spain

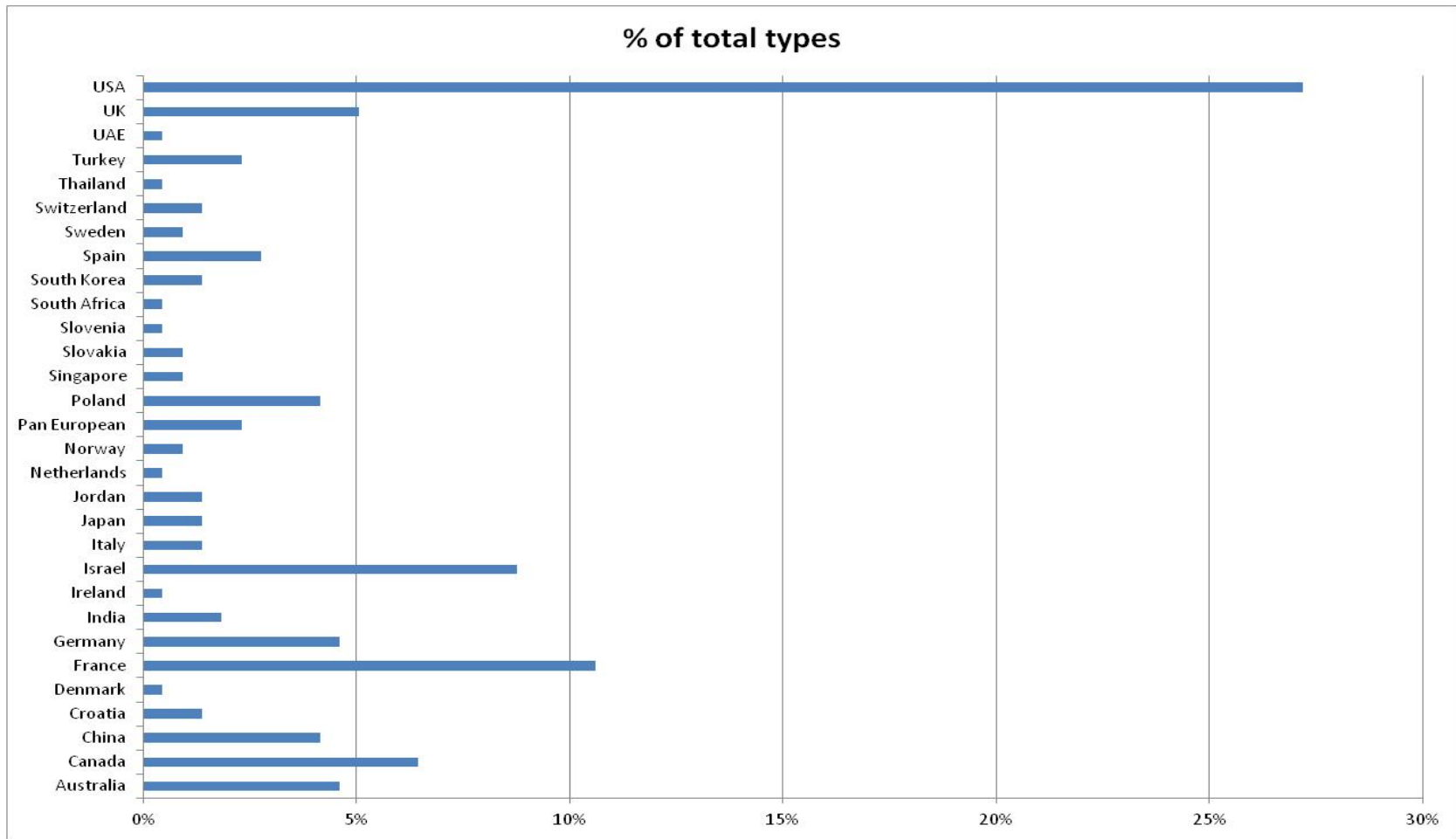
POTENTIAL ASSEMBLY	
Argentina	Mexico
Armenia	North Korea
Austria	Pakistan
Azerbaijan	Portugal
Brazil	Serbia
Czech Republic	South Africa
Greece	Taiwan
Iceland	Ukraine
Indonesia	United Arab Emirates
Iran	Venezuela
Malaysia	Vietnam

Source: IHS

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Current Design Capabilities

Types of UGV by country



Source: IHS

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UGV Capability Growth - examples

China & the Russian Federation

CHINA

- ❖ UGVs used for well over a decade
- ❖ Detection and Control Technology Institution of CASIC's Ninth Institute
- ❖ China North Industries Group Corporation (NORINCO Group) new Beijing facility
 - Mountain Quadruped Bionic Mobile Platform
 - Battle Robot
 - Crew Task Support Unmanned Mobile Platform (CTSUMP)
- ❖ Institute of Automation of the Chinese Academy of Sciences, Beijing
 - Four-legged Robot for Optimal Gait (FROG) technology demonstrator
- ❖ NORINCO proposing collaborative agreements with foreign research groups
- ❖ China North Vehicle Research Institute - China's position "at least five years to catch up [compared to US]"



RUSSIAN FEDERATION

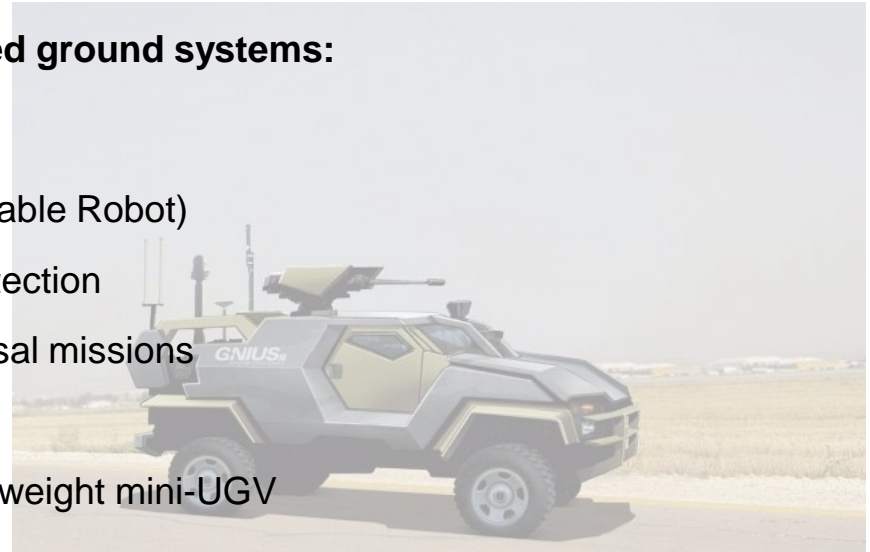
- ❖ Switching from acquisition to developing / producing indigenous unmanned systems
- ❖ Creating a road map for military robotics for the period up to 2030

UGV Capability Growth - examples

Israel

❖ A leading and growing presence in unmanned ground systems:

- Gurdium and AvantGuard large UGVs
- Mini and Maxi-VIPeR (Versatile, Intelligent, Portable Robot)
- EL/M-2190 for military and commercial mine detection
- Keter Paz mini-tractor for bomb and mine disposal missions
- Hornet Mk 5 small tracked EOD Robot
- Eye-Drive an observation and surveillance, lightweight mini-UGV
- MTGR shoulder-carried UGV



❖ Continuing Middle-East tension is a catalyst for procurement and development

Future Trends / Conclusions

Future UGV Trends

Demand / supply

Drivers:

- **UXV offer extended mission endurance / can operate within hostile environments**
- **UGV market largely conflict driven and dependent upon its nature**
- **Continuing / increasing threat from IEDs**
- **UGVs increasing their role as force enablers**
- **Global fleet replacement – but timing difficult to predict**

Supply :

- **USA retains key position**
- **But increasing global capability**

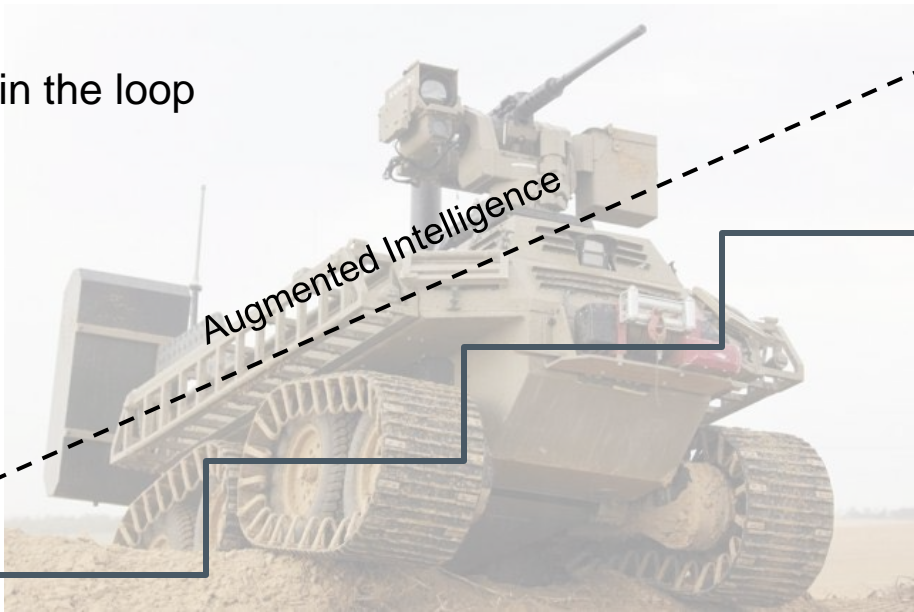
Design:

- **Effectiveness, efficiency, affordability, commonality, interoperability and integration**
- **Modular and easily re-configured for multiple missions**
- **Increasing automation**

Autonomy

Increasing levels of automation

- People always in the loop



High Automation

None

- Decisions are made by the commander - not by the system

Conclusions

UGVs

- The US UGV market is currently in consolidation mode
- Over the next 10 years in the US, R&D outweighs production, reset/upgrade bridging
- The USA will continue to lead development and market direction
- Moving towards fewer, more modular designs
- Large potential global market for replacements
- Increasing applications for UGVs – military, dual-use and civil
- China and the Russian Federation developing their capabilities
- Israel one of the leading developers with extensive active use ongoing
- Levels of automation increasing
- Unit price reduction pressure
- Robotics progressing - 520 years and counting – *the future is in the imagination*

Questions?

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