Follow the leader: US Army unmanned ground vehicle programmes

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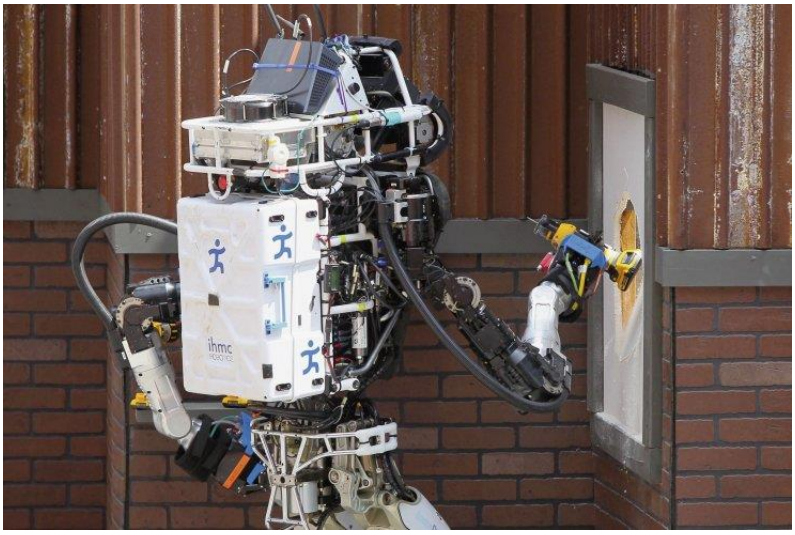
In the 2001 National Defense Authorization Act, Congress set an objective of increasing the number of remote-controlled and unmanned systems in service with the US Army. The goal was that by 2015 a third of operational ground combat vehicles would be unmanned. However, this goal was not met. *Scott Alexander* reports

Although in the air domain the capabilities of unmanned aircraft have been widely demonstrated and flagship procurement programmes such as the MQ-25 Stingray unmanned aerial vehicle (UAV) are advancing, development and widespread deployment of unmanned ground vehicles (UGVs) have not followed suit.

Despite funding increases in the fiscal year 2018 (FY 2018), FY 2019, and FY 2020 budgets, UGVs have been underused by the US military outside of explosive ordinance disposal (EOD) missions. US Department of Defense (DoD) UGV funding has been consistently below 5% of total unmanned systems spending so, as a result, cutting edge UGV technology has been developed by companies building systems for consumer markets.



The Running Man robot of team IHMC Robotics cuts through drywall during the 2015 DARPA Robotics Challenge. This platform is based on the Boston Dynamics Atlas robot. (US Navy)

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Developing such technology in the consumer domain means that military acquisition processes, which are too inflexible for iterative and incremental development cycles, can be avoided. As a result, a rival industry to traditional military manufacturers has emerged, which is made up of companies with the intellectual capital and financial means to develop

advanced unmanned capabilities for the global market. This rival industry could be considered as a threat to the United States' third offset strategy, which highlights developing technologies as vital to not only enable the US to win a war but also to provide it with the capability to deter one.

Three factors have affected the DoD's involvement in the UGV environment during the past two decades.

First is the use of unmanned systems against improvised explosive devices (IEDs) during the Iraq and Afghanistan campaigns. Although unmanned systems proved to be effective against IEDs, no overarching acquisition strategy was formed. Instead, the US employed an ad hoc approach to quickly procure commercial-off-the-shelf (COTS) systems and then integrate them into the existing force structure to fill capability gaps.

These gaps existed because the DoD's flagship Future Combat System (FCS) UGV programme focused on developing large unmanned ground platforms for use in more traditional theatres. Such large platforms were operationally unnecessary in Middle Eastern theatres so the US shifted its procurement strategy to acquire UGVs to meet its urgent requirements outside of traditional acquisition programmes.

Second, fiscal restraints due to sequestration and the 2011 Budgetary Control Act pushed systems purchasing away from unnecessary lengthy and costly large acquisition programmes. This led to the cancellation of the few FCS projects that were under way as well as the Brigade Combat Team Modernization programme, the successor to the FCS programme.

Third, after its operational requirements in the Middle East were met, the US shifted its focus towards the Asia-Pacific region where it faced a more conventional state-based military threat.

The resulting effect of these factors for the US Army is a lack of deployable UGVs outside of EOD operations. Moreover, with little harvestable content from the USD18 billion spent on the FCS, there are few UGVs capable of meeting the current or future operational requirements of a shifting international security environment in which the US is striving to counter the emerging military capabilities of near-peer competitors such as China.

Meanwhile, the commercial market for robotics and unmanned systems has flourished. Global spending on robotics and UAVs reached USD116 billion last year, with a compound annual growth rate (CAGR) of up to 20%, pushing spending to a predicted USD210 billion by 2022. The commercial UGV market is also growing strongly, being valued at USD2.35 billion last year with a five-year CAGR of 15%.

There is a high level of research and development (R&D) investment in the commercial sector. For example, in the autonomous car industry innovation is vital, so companies regularly reinvest 10–15% of revenue into R&D. Indeed, Tesla spent 12% of its revenues on R&D in 2017. Meanwhile, in the military sector, the largest military UGV developer,

Northrop Grumman, with 8.14% of the total contracted global military UGV market share (USD134 million in 2018), invested only 2.5% in the same year.

Moreover, R&D in the information and communications sector is dwarfing that of military manufacturers and the sector is dominating software development, such as machine learning and artificial intelligence (AI). For example, Microsoft is leading the way in developing AI object recognition and cognitive services and spent USD14.7 billion or 13.3% of revenue on R&D last year. Additionally, Intel spent USD13.5 billion or 19% of revenue in the same year; and Alphabet, a world leader in autonomous vehicle technology with its Waymo self-driving concept, spent USD16.6 billion or 15% of revenue in 2017. Against this backdrop, the DoD is playing catch up to develop its own programmes of record after almost a decade of COTS purchases and is entering into a technological arms race with some of the world's largest and most research-driven companies.

As a result, there is a widening capability gap between commercial and military systems. For example, Starship Technologies has developed a small, wheeled UGV capable of autonomous driving and traversing cityscapes to deliver takeaway food. However, comparative military technology remains within the realm of tethered, remotely operated, or very basic 'follow me' autonomy.

Moreover, systems such as the wirelessly controlled 6×6 Hunter WOLF large, wheeled logistics UGV, in development for the US Army's Squad Multipurpose Equipment Transport (SMET) programme do not have adequate funding, resources, or agile development cycles to compete with commercial offerings.