



uSMET: A Versatile Robot for On-road and  
Off-road Applications (Phase II)

# Technical Abstract

DoD SBIR Phase II Project

## ABSTRACT

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This proposal builds on the M-Vision's SBIR Phase I effort under contract W56HZV-21-C [uSMET: A Versatile Robot for On-road and Off-road Applications]. In Phase I, M-Vision designed, fabricated and tested a minimum viable product (MVP) that met the following specifications of ARMY SBIR topic A20-132: a mechanism weighing less than 20 kg and suitable for one man to easily pack, lift and transport by hand; a mechanical design to support more than 20 kg of additional weight while negotiating a less than 80 cm narrow (door) opening or trail; a robot that is dynamically stabilized and which travels in excess of 5 m/s top speed on flat terrain; and a capability of at least a 15 mile range of operation and more than 100 ft maximum tele-operations distance. Testing was performed on paved surfaces, grassy terrain, and standard nature trails. A video highlight of the Phase I effort is viewable at <https://www.m-visioninc.com/>. In Phase II, M-Vision and its partners (subcontractors) propose to further enhance uSMET. This enhancement will yield: a native mechanism weight close to 30 kg; a design that will support up to 150 kg of additional weight while negotiating an opening/trail of 50 cm width; a robot top speed in excess of 8 m/s in off-road environments while remaining dynamically stabilized; a range of operation of more than 20 miles with scalable tele-operations over a 2 miles radius; capability to follow the soldier; and ability to operate with or without an operator (unmanned) on-board while avoiding obstacles and negotiating narrow urban or off-road terrain.

M-Vision will test uSMET with end users and other U.S. Army stakeholders during Phase II, and has received a commitment letter from U.S. Army Ground Vehicle Robotics (CCDC-GVSC-GVR) – the Army's flagship ground robotics R&D organization – to support these tests. M-Vision will also explore commercial applications of uSMET in precision agriculture. M-Vision has secured \$400,000 matching funds for this proposed project, and if funded will execute a \$1.5MM project over the proposal 24 months - \$1.1MM from Army SBIR and the remainder from Accelerate Blue Fund (ABF) plus the State of Michigan's Emerging Technology Fund (ETF). It is M-Vision's goal at the end of Phase II to have uSMET ready for test and evaluation against requirements in a number of focused Army uses cases, as well as in precision agriculture use cases, that will be identified during this proposed 24 month project.

## APPLICATIONS

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The uSMET platform would be able to fulfill several major battlefield roles for the Army. Most importantly, it could provide reliable last-mile resupply for units in a combat zone, bringing ammunition, medical kits, and other urgently needed consumables to soldiers in action, without requiring soldiers to make the dangerous journey back to their supply base (e.g., rally point) under enemy fire. Since the uSMET is a compact, high-speed platform, capable of autonomously navigating to a requested destination, it could easily travel concealed by local terrain - thus rendering itself less vulnerable to enemy fire even when traveling over open terrain with limited cover, compared to a more conventional car-sized robotic mule. Alternatively, swarms of uSMETs could be used to resupply artillery units with ammunition in situations where a traditional artillery resupply vehicle may be unable to navigate rugged terrain, find itself vulnerable to enemy fire, or may draw unwanted attention to a concealed artillery position. Robots returning from the combat zone, having delivered their supplies, could be used for casevac missions – uSMET can carry individual wounded soldiers back to a secure position for immediate medical treatment. It would not have to rely on being paired with additional transport devices, reducing the logistical load on units that use it for casevac missions. uSMET is compatible with a wide variety of payloads, as it carries a standard modular mounting system, namely, Picatinny rails. This can be combined with custom mounting bracketry for types of cargo, such as artillery shells. The uSMET could be adapted to carry external attachments, including real-time acoustic gunshot detection systems, smoke/fog generators, or radio frequency interference devices – thus serving as a versatile platform that is an asset for dismounted soldiers deep in the battlefield. A fleet of uSMETs equipped with portable radios could serve as nodes in a retransmission network, providing reliable communication for units deployed in dense urban or mountainous areas, where the complex environment limits radio communication range.

Commercially, uSMET can be used in precision agriculture. The robot can be paired with a number of inspection and delivery subsystems to provide just-in-time and just-enough input to large scale farms. This will reduce the cost of farming as well as result in less use of scant resources such as water and harmful chemicals such as pesticides. When uSMET is integrated with a harvesting subsystem, the robot can help address the severe labor shortage in these labor-intensive farms. The robot's scalability in platform height, width, weight and its ability to carry a variety of payloads makes it widely suitable for use in fruit and vegetable farms. Its ability to assume a wide three-point stable configuration is invaluable when operating on the sides of mountains and hills, a common environment for farming perishable food in Europe (e.g., Germany).