MOSAIC
Mobile Standoff Autonomous Indoor Capabilities Challenge.

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Call for Submissions

Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Prize Challenge

Update #1: MoSAIC Prize Challenge Phase 1 submission deadline is extended to October 4, 2021 at 4:59pm (ET) / 11:59pm (Israel time).

1. Background

1.1. **Challenge Overview:** The U.S. Department of Defense (DoD) Irregular Warfare Technical Support Directorate (IWTSD) and the Israel Ministry of Defense's Directorate of Defense Research and Development (DDR&D) are executing the Mobile Standoff Autonomous Indoor Capabilities (MoSAIC) Prize Challenge to reward companies, innovators, and researchers from around the globe with novel technological solutions that enable military and law enforcement teams to **conduct indoor missions from outdoors**. The IWTSD and DDR&D are particularly interested in discovering disruptive software and hardware solutions from verticals outside the defense sector that could solve some of the unique and complicated problems inherent to remote autonomous maneuver in complex, congested and contested indoor environments. MoSAIC will be executed in two phases, the first is an on-line challenge where submitters will be required to provide a description of their technology and other information per an on-line questionnaire. A judging panel of government subject matter experts will select the submitters that best meet the requirements and invite them to further demonstrate their solutions either virtually in an on-line simulation or physically in a representative field environment in Israel.

1.2. **Definition of "Indoor":** For the purpose of the MoSAIC Challenge, "indoor" includes any bounded space consisting of a floor, sides and overhead and covers both above ground facilities (e.g., homes, warehouses, structures), as well as underground spaces (tunnels, bunkers, underground municipal infrastructure).

1.3. **The Problem:**

1.3.1. Military and law enforcement teams face unique challenges and increased risk when opening indoors. Due to limited abilities to perform remote reconnaissance of indoor spaces, operators often lack complete or even any

situational awareness of indoor environments prior to entry to include the interior layout; existence and locations of enemy combatants; presence of potential non-combatants; and other unknown threats such as improvised explosives devices (IEDs), booby traps, obstacles and hidden areas (e.g., rooms, entrances, underground shafts).

1.3.2. As such, it is desirable that robotic systems will enter an enclosed space first and ideally conduct the entire enclosed space mission remotely and autonomously; however, existing aerial and ground robotic platforms are not optimized for, and often not fully functional in indoor environments. Enclosed spaces present unique communications, mobility and other challenges that significantly limit the ability of robotic platforms to perform even basic missions.

2. The MoSAIC Challenge

2.1. The IWTSD and DDR&D are seeking to identify cutting edge hardware and software solutions to address some of the challenging and longstanding technological gaps concerning remote autonomous indoor maneuver. It is evident that there will be no single technological solution but rather a toolbox of scalable, layered, modular, and multi-functional capabilities to enable operators to remotely and autonomously perform the full range of indoor missions.

2.2. Accordingly, the MoSAIC Challenge will be executed as five distinct "Mini-Challenges," focusing on the fundamental technological building blocks of autonomous maneuver, to include:

2.2.1. **Indoor Navigation:** Software and algorithms that enable accurate navigation (the ability to move from point A to B) and localization in unknown indoor environments without any special infrastructure (i.e. the ability to operate without GPS). It is desired that solutions will be highly accurate, rapid (i.e. the shortest path between two points while avoiding obstacles), robust (i.e. work in a wide range of scenarios and environments), and do not require dedicated communications infrastructure.

2.2.2. **Indoor Mapping:** Software and algorithm-based solutions to autonomously explore previously unknown indoor spaces and construct maps or floor plans (2D\3D) of the explored environment completely, accurately, and in real-

time. This includes the ability to recognize and accurately map entrances including potentially hidden entrances/spaces.

2.2.3. **Human/Object Tagging:** Software and algorithms that can automatically and accurately detect, recognize and classify between humans, animals and other objects of interest in different lighting and visibility conditions. It is desired that solutions will be capable of recognizing and distinguishing between solid entrances (e.g. doors and windows) vs. a traversable entrance (e.g. curtain or temporary sheet) and recognizing the indicators of potential hidden rooms and shafts to underground areas.

2.2.4. **Tactical Robotic Systems:** Ground and aerial platforms that are capable of maneuvering accurately and effectively in complex indoor environments with multiple levels (above and below ground); constrictive spaces; and twists, turns and blind corners. Solutions should be capable of overcoming or avoiding (as needed) obstacles and barriers on the ceilings, walls and ground to achieve a mission. It is also desired that platforms are capable of maneuvering within constricted areas (e.g. under or behind furniture, gaps in walls or ceilings, etc.) and through confined spaces and around obstacles in order to reach an area of interest. It is highly desired, but not required, that solutions will be capable of maneuvering autonomously and without the need for special communications infrastructure.

2.2.5. **Human Presence Detection:** Man-portable sense-through-wall solutions to detect, confirm, classify and monitor stationary and moving persons in an enclosed area of interest at a standoff distance. It is highly desired that solutions will be capable of providing as much information as possible about the detections to include the location(s) within the enclosed area. The solution should be capable of sensing through a variety of materials and detections should have a low false alarm rate.

3. **Challenge Format**

3.1. The Challenge will consist of three consecutive phases:

3.1.1. Phase 1: On-Line Application & Selection.

3.1.2. Phase 2: Virtual/Physical Test Bed.

3.1.3. Phase 3: Conference and Award Ceremony.

4. Phase 1: On-Line Application & Selection

4.1. In Phase 1, submitters will be required to provide descriptions of their technology/solution and other information per the on-line questionnaire.

4.2. **The on-line application process** will be conducted through the MoSAIC website as follows:

4.2.1. **Preliminary questionnaire** - Submitters will provide brief information regarding their technology/solution and contact details through the MoSAIC website (https://apply.mosaichallenge.com).

4.2.2. **Full questionnaire**:

4.2.2.1. Submitters who submitted the preliminary questionnaire will receive an invitation to provide full information regarding their technology/solution including detailed description, team members, and supportive materials.

4.2.2.2. During this phase, submitters will have to choose and specify which of the challenge categories they seek to address.

4.2.2.3. Submitters will be able to select more than one category if applicable.

4.3. Application Guidance for Phase 1 is available online in the MoSAIC website.

4.4. Phase 1 Questionnaire must be FULLY completed and submitted in English before October 4, 2021 at 11:59 PM (Israel time) / 4:59 PM (ET) .

4.5. Applications will be evaluated according to their compatibility with the MoSAIC criteria listed above in paragraph 2 by an international multi-disciplinary group of qualified and relevant government subject matter experts, program managers, and operators.

4.6. Submissions that best meet the criteria will be selected to participate in Phase 2.

5. Phase 2: Virtual/Physical Test Bed:

5.1. Submitters that best meet the requirements will be invited to further demonstrate their solution either virtually in an on-line simulated environment or physically in a representative field environment in Israel:

5.1.1. Virtual Track: Demonstrate novel software and algorithms in an on-line simulated indoor scenario.

5.1.2. Physical Track: Demonstrate platform-based solutions in a representative field environment in Israel. Throughout the demonstration, the system will be subjected to Global Navigation Satellite System interference. Local infrastructure such as cellular base stations or WIFI hotspots will not be subject to RF interference.

5.2. Submitters may participate in both the virtual and physical tracks according to their addressed challenges and at evaluators discretion.

5.3. Additional information will be provided to teams that were selected to participate in Phase 2.

6. Phase 3: Final Event in Israel:

6.1. All participants who took part in Phase 2 (either virtual or physical track) will be invited to participate with an international audience representing governments, investors and end users at a final conference in Israel.

6.2. The winners from each of the five categories will be recognized and awarded prizes.

7. **Miscellaneous**:

7.1. The application for the challenge is free and is open for companies, and individuals.

7.2. The challenge is unclassified.

8. Key Events/Dates

Event	Date	Comments
Challenge Launch	June 24, 2021, 10am (IST)	Registration Opens
MoSAIC Information Session Webinar # 1	July 7, 2021, 7PM (IST) / 9AM (PST)	On-line
MoSAIC Information Session Webinar # 2	July 21, 2021, 11AM (IST) / 9AM (GMT) / 4PM (SGT)	On-line
MoSAIC Information Session Webinar # 3	August 11, 2021, 7PM (IST) / 9AM (PST)	On-line

Event	Date	Comments
MoSAIC Information Session Webinar # 4	September 2, 2021, 11AM (IST) / 9AM (GMT) / 4PM (SGT)	On-line
Phase 1 - On-line Submissions Deadline	October 4, 2021, 11:59PM (IST) / 4:59PM (ET)	Application period ends
Phase 1 - Results Notifications & Invitations to phase 2	November 19, 2021	On-line
Phase 2 - Virtual Test Bed Information Session Webinar #1	December 1, 2021, 7PM (IST) / 9AM (PST)	On-line
Phase 2 - Virtual Test Bed Information Session Webinar #2	December 15, 2021, 11AM (IST)/ 9AM (GMT) / 4PM (SGT)	On-line
Phase 2 - Virtual Test Bed Execution	January 24 to February 1, 2022	On-line
Phase 2 - Physical Test Bed Information Session Webinar #1	February 7, 2022, 7PM (IST) / 9AM (PST)	On-line
Phase 2 - Physical Test Bed Information Session Webinar #2	February 10, 2022, 11AM (IST) / 9AM (GMT) / 4PM (SGT)	On-line
Phase 2 - Physical Test Bed - Live Demo in Israel	April 4-6, 2022	In Israel
Final Conference and Award Ceremony	April 7, 2022	In Israel
Merage Institute Innovation Bridge Executive Leadership Program in California	May 2022	Newport Beach, California, USA

9. Selection Process

9.1. The MoSAIC Challenge judging team for all phases of the Challenge will consist of a multi-disciplinary group of qualified and relevant government subject matter experts, program managers, and operators.

9.2. Submissions that are timely and in compliance with the requirements will be judged in accordance with the evaluation criteria.

10. Intellectual Property

10.1. All submitter generated data should be delivered in accordance with the 10 U.S.C. 2374a - "Prizes for advanced technology achievements." The government shall use any information marked by the contestant as "restricted" in the submission for evaluation purposes only and shall not disclose, directly or indirectly, such information to any person including potential evaluators, unless that person has been authorized by the head of the agency, his or her designee, or the Contracting Officer to receive such information.

11. Updates

11.1. All updates will be posted on the MoSAIC Prize Challenge website (https://mosaichallenge.com/updates/).

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