

The mission scenario of first US - Asian Demonstration and Assessment of Micro Aerial Vehicle (MAV) and Unmanned Ground Vehicle (UGV) Technologies is a mixture of operational and developmental flight test maneuvers and mission tasks that are combined to create a unique and challenging demonstration environment for the prototype MAV systems. The objective of the competition is to demonstrate how combinations of MAV and UGV systems controlled by a team of human operators can effectively conduct a simulated hostage rescue mission.

The concept of the operation is for MAV systems to perform reconnaissance tasks to identify and locate obstacles, mines, hostage location and terrorist guard teams. Additional tasks include stationary hovering, landing on rooftops to perform perch and stare operations, and use of chemical sensors to detect simulated chemical explosive mines. The MAVs develop the rescue teams' situational awareness through a combination of autonomous geo-location and manual imagery analysis. MAVs use digital communication links to direct UGVs to clear an ingress route of mines used by a human commando team to conduct the hostage rescue. UGV tasks include precision navigation, simulated mine disarm, radio relay, and video transmission. The entire operation from first launch to hostage rescue must be completed in 40 minutes or less.

Teams will launch their MAV systems from a launch point approximately one kilometer from the hostage site adjacent to the controlling ground station. The MAVs will fly using a combination of manual and autonomous control along potential ingress routes searching for mines. When mines are detected, the location will be passed to a UGV which moves forward and disarms the mine. This task is repeated until the entire route is cleared. Once in the vicinity of the hostage building, the MAVs will evade detection by patrolling terrorist guards and use a combination of electro-optic and acoustic sensing to determine in which room the hostages are located. During the same time period, the commando team will move along the cleared route into a covered strike position and wait for the team to decide which room contains the hostages. Once the decision on location has been made, the commando team will conduct the rescue.

Mission success requires a combination of technical capability and tactical skill which will push the limits of both the robotic systems and the human operators. The sensing capabilities of MAVs are limited which makes detection of 15cm mines difficult. The one kilometer distance between the ground station and the hostage building challenges the endurance of vertical takeoff and landing MAVs. The use of perch and stare to conserve power offers an effective tradeoff to offset the range/endurance limitations, but the flight and position control required to perch safely is highly demanding and the limited time available to identify the proper position makes this a difficult task. The chemical sensing method of mine detection pushes the limits of MAV performance, onboard processing capability

and power budgets. Lastly, the use of multiple MAVs to complete various aspects of the challenge, creates the need for MAV deconfliction schemes based on flight profile and phase of the mission.

The MAV 08 event will clearly identify the cutting edge of MAV research in an operational/developmental test environment. The rewards for successful demonstration are funding to advance solutions with promise to the next level in the developmental cycle. The diversity of tasks and complexity of the challenge require that teams attempt higher risk solutions which offers the prospect of a breakthrough rather than incremental change. The organizers and sponsors wish teams success as they compete in this historic demonstration of MAV technology.