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Press Release: Orbit Logic Advances Onboard Autonomous Planning for Robotic Swarms in Microgravity Environments

GREENBELT, MD (April 26, 2023) – Orbit Logic has been awarded a Phase I Small Business Technology Transfer (STTR) contract sponsored by NASA to develop the Microgravity Environment Autonomy for Robotic Satellites (MEARS) solution. The University of Dayton Research Institute (UDRI) is our research partner on this effort. MEARS will merge robotic asset onboard sensing/perception, autonomous planning/response, and robust inter-asset communication strategies – into a high-reliability architecture compatible with the ROS 2 and Space ROS open software projects.

Orbit Logic's mature Autonomous Planning System (APS) supports asset-level resource planning and decentralized planning of mission-level goals for teams of heterogeneous, networked assets. The project team at UDRI has developed a suite of flight/motion control, energy management, trajectory planning and stochastic navigation planning technologies (with 3 granted and pending patents) in their Real-Time Adaptable Autonomy Kernel (RT-AAK) during the past years, which can be flexibly built and deployed to a variety of CPU, GPU and FPGA-based processors on flight-like computing platforms. The UDRI team will employ advanced online learning-enabled model predictive control (MPC), originally developed for an Energy Optimizer and eVTOL (electrical vertical takeoff and landing) vehicles in multiple projects, to achieve effective autonomy and AI/ML capabilities. APS and RT-AAK are modular, layered solutions that when integrated together will be highly enabling for a broad set of space robotic applications (but with relevance to terrestrial robotic applications as well). The scenario we are focused on for initial architecture development involves the challenging case of a collaborative heterogeneous robotic team operating in microgravity environments such as asteroid fields, composed of many initially unknown and highly dynamic objects of interest that must be simultaneously investigated and avoided. UDRI's Autonomous Systems Testbed in the Power and Energy Division, with real-time distributed hardware-in-the-loop and high-fidelity dynamics simulation capabilities, will be adapted and used for prototype verification and validation.

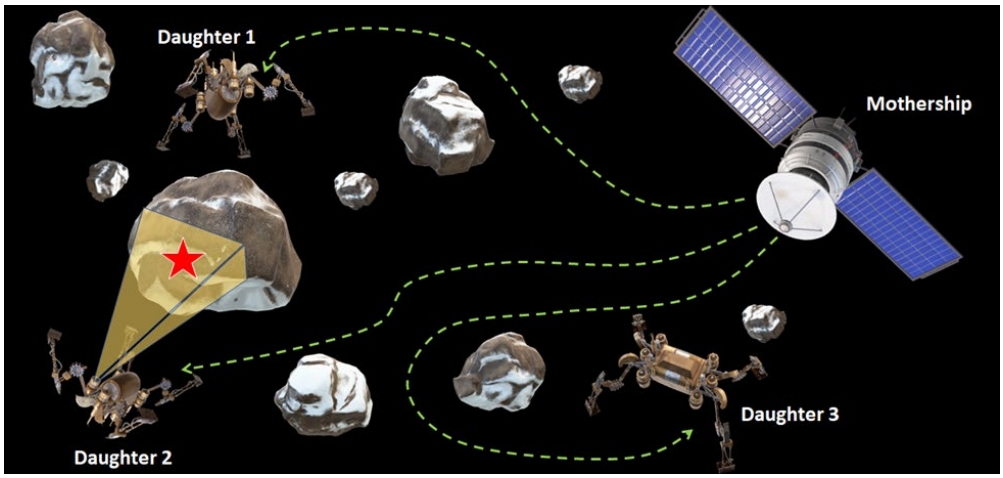

Figure 1: MEARS will enable collaborative robotic exploration of microgravity environments.

APS is a powerful technology that can be leveraged for autonomous planning in *any* domain. The breadth of its applications proves its flexibility; in addition to the autonomous robotic capabilities being developed in this effort, Orbit Logic has utilized APS for the autonomous operation of heterogeneous constellations of Low Earth Orbit (LEO) satellites[1] with DARPA and AFRL, heterogeneous teams of unmanned underwater/surface/aerial vehicles (UUVs/USVs/UAVs) with the Navy[2], heterogeneous swarms of rovers, satellites, and atmospheric vehicles for robotic Mars exploration[3], heterogeneous robotic swarms with astronauts-in-the-loop for Lunar exploration[4], and mission-adaptive formation flying control of satellite clusters[5], with NASA.

About Orbit Logic, a Boecore Company

Orbit Logic (www.orbitlogic.com) specializes in mission planning and scheduling solutions for aerospace and geospatial intelligence. Orbit Logic's operationally proven COTS products create better plans faster with fewer resources for all mission phases. Orbit Logic services are available to configure, customize, and integrate Orbit Logic's mobile, web-based, desktop, and flight software applications to provide turn-key operational solutions that leverage the latest available technologies to meet customer goals and exceed their expectations.

[1] Orbit Logic's Autonomous Planning System for the DARPA Blackjack Pitboss Program
http://orbitlogic.com/uploads/5/7/8/8/57881343/20200206%20Blackjack%20Press%20Release%20Final.pdf
[2] Orbit Logic's Navy Phase II SBIR, Robust Cooperative Autonomy with Minimal Information Exchange (MinAu)
http://orbitlogic.com/uploads/5/7/8/8/57881343/20190709%20MinAu%20Navy%20Phase%20II%20Press%20Release%20Final.pdf
[3]Orbit Logic's NASA STTR, Mars/Interplanetary Swarm Design and Evaluation Framework (MISDEF)
http://orbitlogic.com/uploads/5/7/8/8/57881343/20200416%20MISDEF%20Phase%20I%20Press%20Release.pdf
[4] Orbit Logic's Intelligent Navigation, Planning, and Awareness for Swarm Systems (IN-PASS) solution
http://www.orbitlogic.com/uploads/docs/20210208%20IN-PASS%20Phase%20I%20Press%20Release.pdf
[5] Orbit Logic's On-board Swarm Control for Autonomy and Responsiveness (OSCAR) solution
http://www.orbitlogic.com/uploads/docs/20210713%20OSCAR%20Phase%20I%20Press%20Release.pdf