Autonomous Planning System

Flight Software

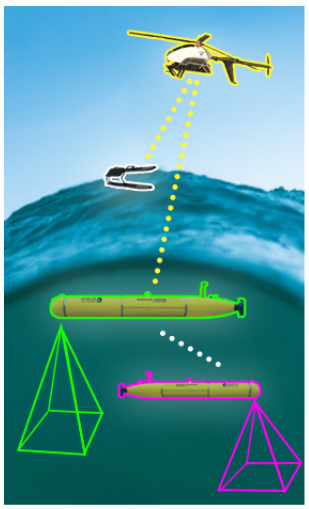
Orbit Logic's onboard **Autonomous Planning System (APS)** enables less reliance on ground stations, shorter mission timelines, and low-latency responsive tasking. APS is flexible and customizable onboard software that supports both asset-level autonomy and constellation- or swarm-level collaborative autonomy.

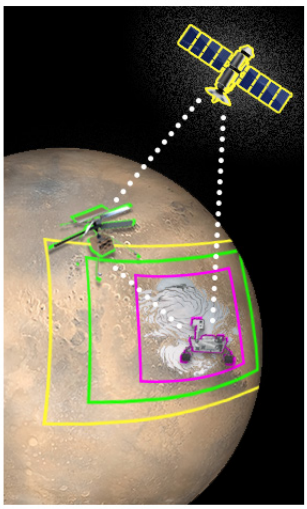
APS manages the planning, scheduling, and execution for complex missions with inter-related tasks, such as the steps in a Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) pipeline. APS can use inter-asset communication links to collaborate and spread tasking across the swarm or constellation, even when those links have low availability or capacity.

APS has a decentralized software architecture. An instance of APS can run onboard each asset in the heterogeneous swarm. On a given asset, APS employs one or more Specialized Autonomous Planning Agents (SAPAs), software modules that plan onboard activities for specialized missions or needs, depending on the host asset's capabilities and constraints. Each SAPA is dedicated to a general mission- or system-level need and issue one or more high-level activities to fulfill that need. These activities are fielded by the Master Autonomous Planning Agent (MAPA), which performs intelligent asset-wide deconfliction of the onboard resources that activity execution requires.

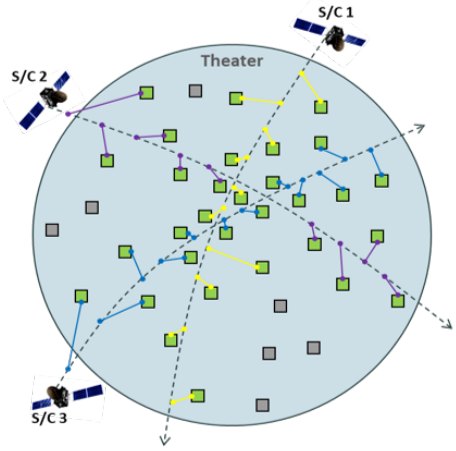
The MAPA/SAPA onboard architecture offers the flexibility to plan for different kinds of opportunities, keeps the system modular and efficient enough to be used in constrained computing environments, and makes the system extensible to almost any planning domain.

APS Enables Collaborative Autonomy in Diverse Mission Domains from Space to Sea, and Beyond





APS Constellation/Team Planning



Beyond satellite deployments, APS has been applied for autonomous patrol/detect track using unmanned underwater vehicles with the US Navy and heterogeneous Lunar and Martian exploration using rovers, rotorcraft, satellites, and astronauts-in-the-loop with NASA.

Enabling assets with the ability to perform autonomous decision-making allows them to respond much more quickly to capture opportunities that might otherwise be missed. The modular APS architecture modular architecture allows planning systems to be assembled from individual planning components and quickly configured (and reconfigured as necessary) to meet initial and dynamic mission goals.

APS operates using a rolling timeline, constantly adding or modifying the existing spacecraft command queue as new information is received in the form of dynamic and frequently ad-hoc events. APS's agents support both nominal and ad-hoc planning needs, including computing optimized plans for multiple user-specified objectives, as well as the determination of dynamic courses of action in response to triggering events. APS can work completely independently or in conjunction with ground station commanding and/or other APS-equipped autonomous agents.

APS is written in C++ using POSIX compliant standards to ensure compatibility on a broad range of operating systems including Windows, Linux, and VxWorks. APS's performance, flexibility and configurability make it a cost-effective addition to space missions - and one that can be achieved with low risk and minimal impact to schedule. APS raised its TRL level to 7 in June 2021 when deployed on-orbit aboard the YAM-3 satellite. APS has been deployed to and tested on lightweight flight hardware, including the Unibap e2100, Raspberry Pi, and Beaglebone Black platforms.