On-board Autonomous Planning System

Developed under an AFRL SBIR, Orbit Logic brings its trademark configurability and flexibility to flight software with its **On-Board Autonomous Planning System (APS)**. APS is built on a modular architecture that allows planning systems to be assembled from individual planning components. These components can be quickly configured and reconfigured to meet initial and dynamic mission goals.

APS includes Specialized Autonomous Planning Agents (SAPAs) that address specific planning needs (recorder management, ground target imaging, collision avoidance, etc.) and can support SAPA-specific algorithms for each planning domain. Plans generated by multiple SAPAs are integrated by a Master Autonomous Planning Agent (MAPA) that deconflicts global resources and forwards the final plan to the onboard task executive for implementation.

Giving satellites the ability to make autonomous planning decisions allows satellites to respond much more quickly to capture opportunities that might otherwise be missed. The MAPA/SAPA architecture for onboard planning supports flexibility to plan for different kinds of opportunities, keeps the system modular and efficient enough to be used in an onboard environment, and makes the system extensible to almost any satellite planning domain.

The **On-Board Autonomous Planning Agent (APS)** operates using a rolling timeline, constantly adding or modifying the existing spacecraft command queue as new information is received in the form of events. APS planning timeline is configurable, but is envisioned as a very short timeframe (on the order of a few minutes to a few hours at most). APS can be considered a “just-in-time” planner. APS uses specialized planning agents to determine what to do over the next few minutes or hours based on the latest system state and in response to triggering events. APS can work completely independently or in conjunction with ground commands.

The MAPA/SAPA architecture and short planning timelines lend themselves to coordinated constellation planning because the individual components do not care where the event messages originate (on the same satellite, a different satellite, or the ground), and planning can be performed and re-performed as different systems react to the environment as understood from event messages on the bus. As more spacecraft need to coordinate activities to reach specific goals as a whole, a configurable and adaptable planning architecture becomes more critical. The APS architecture allows some or all of your planning to be automated onboard and enabled and configured on the fly.

APS is written in C++ using POSIX compliant standards to ensure compatibility on a broad range of operating systems including Windows, Linux, and VxWorks.

The APS architecture can be applied to reduce the cost, schedule, and risk of implementing planning systems on various platforms, while at the same time making the resulting planning systems more agile to respond to dynamic mission goals and more efficient with the use of processing resources.