

## On-Orbit Autonomy

The Autopilot application suite provides for semi-autonomous clustered spacecraft guidance and control. Autopilot is comprised of a Cluster Flight Manager, Orbit Maintenance Service, Maneuver Planning Service, and Module Maneuvering Service applications. Some of the key capabilities of the Autopilot suite are spacecraft orbit safely together - whether flying in formation or merely in proximity, provides services that individual spacecraft cannot accomplish on their own, integrates with existing mission technology, such as command and data handling, and scheduled for a manifested mission in 2021. As previously mentioned, Autopilot seamlessly integrates into existing technologies and products. Autopilot can operate on NASA's Core Flight Executive (cFE), ZMQ, and ROS-2/M messaging systems. Autopilot also integrates with Emergent's Gear, Navigator, Guardian, and Commander suite products. Autopilot's current capabilities allow for semi-autonomous clustered spacecraft guidance and control, but when used in conjunction with Emergent's product suites, allows its capabilities to further expand to including fault response capabilities as well as autonomous mission planning response capabilities.

## Modules/Components

### Cluster Flight Management

- Maintains an inventory of members with their states, control modes, and target geometry.
- Schedules periodic activities in a sequence. Able to change compute nodes for efficient and robust operation.

### Orbit Maintenance Service

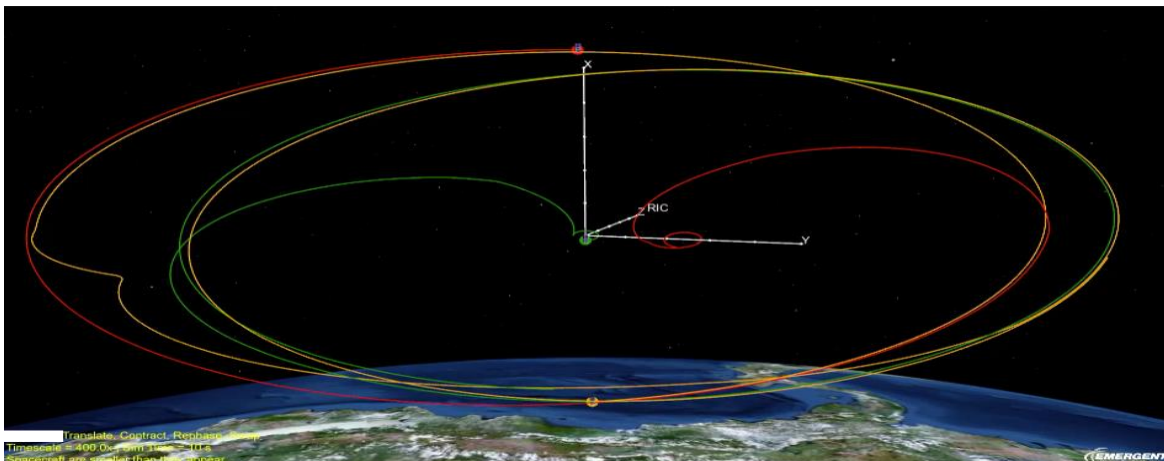
- Closes the guidance and navigation loop to enable station keeping and geometry reconfiguration.
- Monitors members with appropriate control modes.
- Maintains safe flight by predicting collisions.

### Maneuver Planning Service

- Solves maneuver plans that coordinate multiple members.
- Flexible algorithm optimizes maneuvers for all orbit scenarios in a mission.
- Validates constraints in a high-fidelity environment.

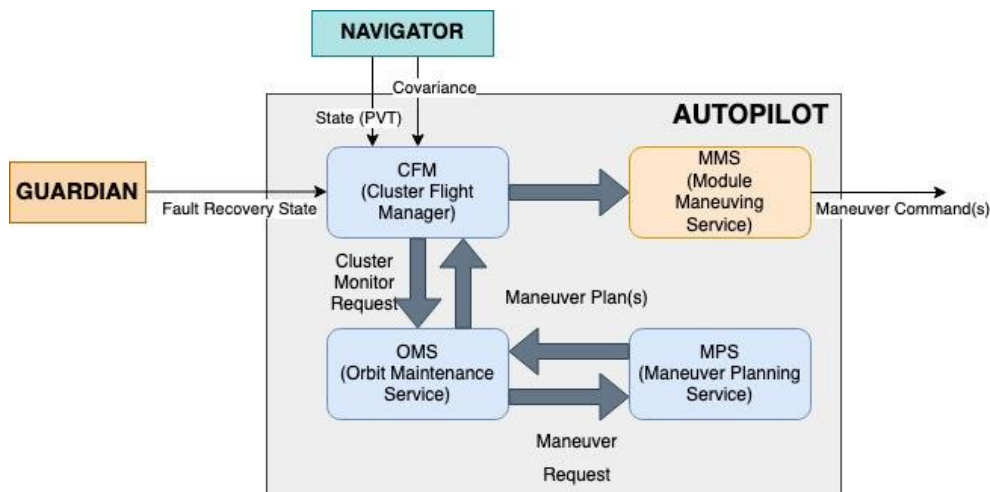
### Module Maneuvering Service

- Translate maneuver plans from the Cluster Flight Management software to be sent to the space vehicle as maneuver commands. Additionally, this service also monitors the vehicle maneuver status to be reported back to the Cluster Flight Manager.



## Specifications

- Linux based OS - Ubuntu
- Runs on x86 and ARM processors
- Developed in C++ and MATLAB Coder for Linux
- Current development in Docker running Ubuntu 20.04 LTS
- Integrates with Gear product (v1.2.2) Navigator product (recommended) (v1.0)



## About Emergent

Emergent Space Technologies, Inc. research, develops, integrates, and tests advanced systems and software solutions for civil, military and commercial space missions. We are industry leaders in the development of flight software for multi-spacecraft missions, including constellations, formations and clusters of small satellites. Our core competencies are systems engineering, integration and test; guidance, navigation and control; orbital mechanics; positioning, navigation and timing; advanced modeling and simulation; and SW architecture, design, development and test. Our domain expertise and experience, combined with our knowledge of current and emerging technology, make Emergent the team of choice in the aerospace industry.