

MOSAIC Hub

Command & Control for multi-domain operations



Overview

MOSAIC Hub is a multi-domain Command & Control (C2) software suite developed by Space Applications Services providing an all-in-one cloud-based or stand-alone solution for multi-robot mission planning, monitoring, control, data management and post-processing analysis.

MOSAIC Hub is an asset-agnostic suite offering the possibility to integrate different unmanned platforms, sensors, effectors, payloads and related operational systems. Through its intuitive web-based user interface, it is possible to generate mission plans automatically via high-level goals and validate complex missions involving multiple agents or assets. Flexible and configurable dashboards allow users to monitor mission execution in real time, gather information on asset status, visualize detections and issue commands whenever needed.

Dedicated MOSAIC Agents, mountable onboard robots, provide on-board decision autonomy, extending the capability to adapt a predefined plan in case of deviations. A configurable data recording module offers the option to analyze the mission data.


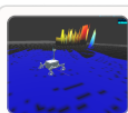






Configurable Framework

At the core of this architecture is a highly configurable asset interface, designed to support the seamless integration of different platforms, sensors, effectors and mission systems within the MOSAIC Framework.







This interface can be tailored to the specific capabilities of each system through modular components such as mission executors, data connectors and interoperability layers.

Together, these elements define how assets communicate, execute missions and expose their functionalities to the system.




User Interfaces

-  **2D World Map**
2D world map used to display the GPS and orientation of each robot.
-  **Elevation Map**
Display Local data of the robots such as elevation maps or point clouds and their URDF model.
-  **Mission Planning**
Configure and execute planning process for a multi-agent mission and display progress.
-  **Telemetry Visualization**
Display time-series telemetries received from robots.
-  **Heatmap Visualization**
AI Powered ISR & Threat Detection visualized on a 2D Map with Safe Zone Identification.
-  **Commands**
Send commands to a robot using the graphical user interface.
-  **Streaming**
Visualise live and replay of RTSP video streams from each robot.
-  **Images**
Display live and history of images received from each robot.

Technologies

-  React
-  SocketIO
-  TypeScript/Node.js
-  PostGIS
-  PDDL
-  ROS2

Interface

-  REST API
-  KAFKA
-  Interoperability library

Protocols

-  HTTPS
-  DDS
-  WebSocket

MOSAIC Hub at a glance

With advanced planning algorithms and real-time monitoring, MOSAIC Hub optimizes task allocation across heterogeneous assets, including unmanned systems, sensors, payloads and effectors, and provides instant insights into assets' status and missions' progress. Streamlining operations, it automates complex mission planning and enables data-driven AI-Assisted decision-making. The intuitive interface ensures easy navigation and effective supervision, enhancing overall mission success.

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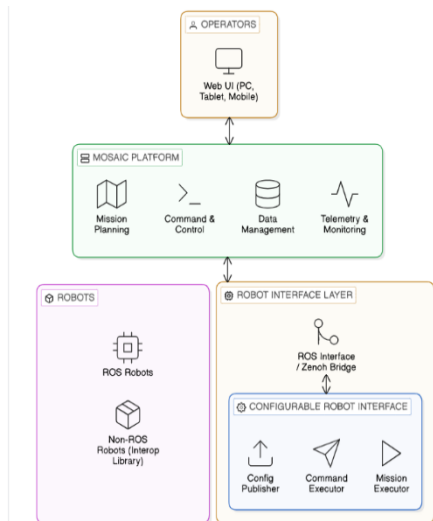


Command & Data Interfaces

The MOSAIC Hub is designed to serve as an intermediary, facilitating seamless communication and control between multiple assets, operators and external systems.

Client connectivity – Operators can access MOSAIC Hub from any device using web browser, displaying both historical and real time data from all assets. The REST API efficiently serves and record data history, while the WebSocket Service ensures real time data exchange.

Robot connectivity – MOSAIC Hub is natively compatible with ROS1/2 robots, enabling robust communication with configurable settings. An optional Zenoh Bridge can be used to abstract the underlying ROS/DDS communication layer, simplifying connectivity and scalability across distributed systems. Even non-ROS robots can be integrated through a custom C++ Interoperability library. Wireless communications with software based QoS is also provided together with communications hardware – Satellite, SDR Mesh, Wi-Fi etc.



Automated Mission Planning

An AI goal based automated mission planning module generates spatial-temporal sequence of tasks, actions and paths optimally for a multi-robot fleet. The task planner is based on Planning Domain Definition Language (PDDL), with specific extensions to generate an optimized mission plan. Operators can efficiently orchestrate missions, set task priorities, track progress and establish coordinated actions among multiple robots.

Database

MOSAIC Hub securely stores user, asset, mission and configuration data, using PostGIS for geospatial data management and supporting real-time access, replay and post-mission analysis.

Cloud / On-Premises Deployment

MOSAIC Hub can be deployed as a cloud-based, on-premises, standalone or tactical application, tailored to specific operational, security and deployment requirements.

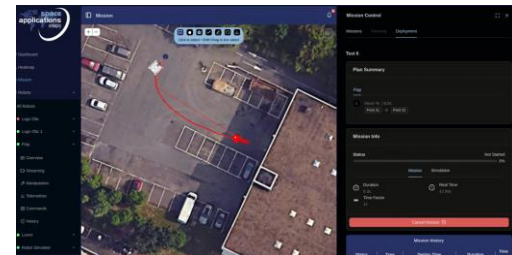
Use Cases

MOSAIC Hub supports operations requiring coordination of multiple assets, sensors and data sources in real time, including

- C-UAS - detection, coordination
- route clearance and perimeter surveillance
- ISR
- maritime operations

It is actively used for mine and explosive threat mapping, fusing data from multiple platforms and sensors into geo-referenced threat maps to support safer area assessment and follow-on operations.

USER INTERFACES



Mission planning UI - With its advanced mission planning capabilities, users can effortlessly create and customize missions for a generic fleet of robots.



Mission Monitoring UI – MOSAIC UI incorporates robust monitoring features, providing real-time updates on the status and performance of each robot.



Full C4I – MOSAIC Hub can provide mesh - Software Defined Radio (SDR), satellite communications and other wireless communications integrated solutions.

Join MOSAIC Hub community

As an agnostic multi-agent planner and monitoring tool, MOSAIC Hub offers flexibility, allowing to seamlessly integrate and manage diverse sensor, effector and platform types. By means of MOSAIC Hub you gain independence from any vendor lock-in, built to use STANAG Standards for interoperability, enabling easy scalability and adaptability. With its robust features and compatibility, MOSAIC Hub simplifies operations, enhances coordination, and improve overall efficiency.

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