UxAS consists of a collection of modular services that interact via a common message passing architecture. Similar in design to Robot Operating System (ROS), each service subscribes to messages in the system and responds to queries. UxAS uses the open-source library ZeroMQ to connect all services to each other. The content of each message conforms to the Light-weight Message Control Protocol (LMCP) format. Software classes providing LMCP message creation, access, and serialization/deserialization are automatically generated from simple XML description documents (see the LmcpGen project). These same XML descriptions detail the exact data fields, units, and default values for each message. Since all UxAS services communicate with LMCP formatted messages, a developer can quickly determine the input/output data for each service. In a very real sense, the message traffic in the system exposes the interaction of the services that are required to achieve autonomous behavior.

Consider a simple example: the automated construction of the flight pattern to conduct surveillance of geometric lines (e.g. perimeters, roads, coasts). A “line search task” message describes the line to be imaged and the desired camera angle. Using this input description, a line search service calculates the appropriate waypoints to achieve the proper view angle. When the UAV arrives at the first waypoint corresponding to the line search task, the line search service continuously updates the desired camera pointing location to smoothly step the camera along the intended route.

In addition to surveillance pattern automation, UxAS contains services that automate route planning, coordinate behavior among multiple vehicles, connect with external software, validate mission requests, log and diagram message traffic, and optimize task ordering. In all, UxAS has approximately 30 services.

A core functionality provided by UxAS is the mechanism to calculate near-optimal task

allocation across teams of unmanned vehicles. With a collection of tasks that require servicing and a pool of vehicles available to service those tasks, UxAS is able to determine which vehicle should do which task in the proper order. This task assignment pipeline is carried out by a series of services working together in a complex sequence.