UAS Control and Command Interoperability Experiment

Call for Participation (CFP)

Version 1.03 - 07 December 2021

Table of Contents

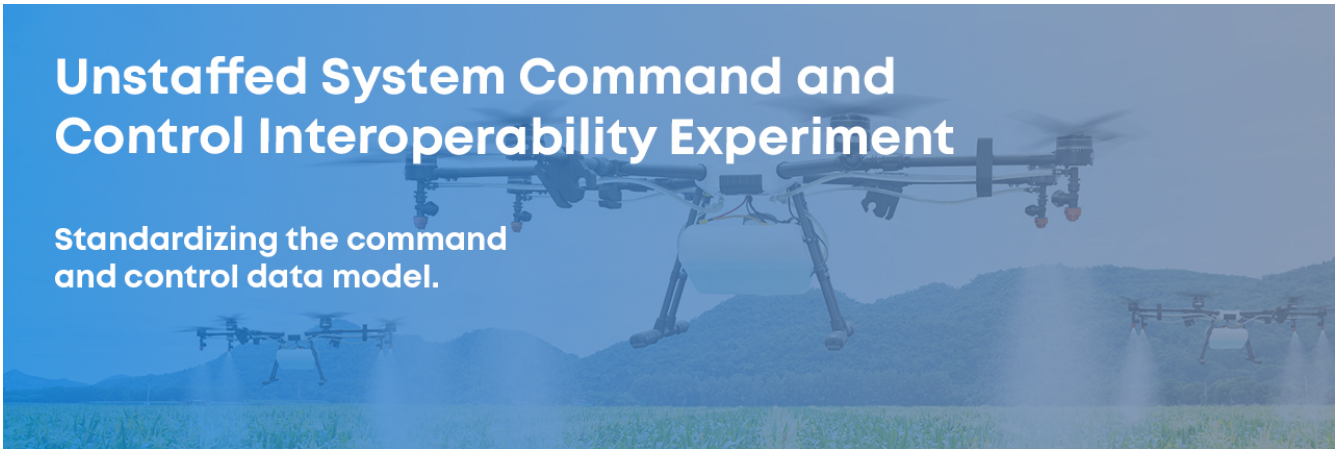
Chapter 1. Introduction

The Open Geospatial Consortium (OGC) is releasing this ***Call for Participation*** (CFP) to solicit proposals for the **Command and Control** data model for **Uninhabited Systems (UxS) Command and Control (C&C) Interoperability Experiment (IE)**. This IE will test the suitability of a C&C data model for UxSs in a real-world environment.

The goal of this IE is to assess whether the data model is suitable for multi domain, multi heterogenous vehicle use and demonstrate exchange of command and control information.

This IE is based on a data model developed by Kongsberg Geospatial and partners under the Standards-based UxS Interoperability Test-bed (SUIT). The IE will consider those other standards and specifications which were used in the SUIT work as well as other Command and Control practices from the aviation community.

IE participants will produce an OGC Engineering Report that summarizes the activities of the IE, describes the suitability of the tested data model for more broad use, and provides a description of gaps and further necessary experimentation, if any. The outcome of this IE may result in the charter of an OGC Standards Working Group to advance a UxS C&C Standard.



1.1. OGC Innovation Program Initiative

This unfunded initiative is being conducted under the OGC Innovation Program. This program provides a collaborative agile process for solving geospatial challenges. Organizations (sponsors and technology implementers) come together to solve problems, produce prototypes, develop demonstrations, provide best practices, and advance the future of standards. Since 1999 more than 100 initiatives have taken place.

1.2. Contact

Answers to this Call are collected with the OGC Innovation Program contact form. Alternatively, they can be sent to innovation@ogc.org.

The response of the OGC Members taking part in previous OGC initiatives should include the proposed scope. It may propose additional experiments. We invite others to provide short technical capacity descriptions and background.

Chapter 2. Participants and observer organizations

This IE will be open to the general public. Participants will be required to make a resource commitment. Individuals from non-OGC organizations will be allowed in the IE as Observers only. All OGC members may also register as Observers.

Participants and Observers will join the founding organizations of the IE. Founding organizations are:

- Kongsberg Geospatial
- NASA
- SensorUp
- University of Calgary

2.1. Observer caveats

Official IE Observers will be granted access to the IE project on the OGC Portal. Observer status allows the member or non-member to monitor progress of the given IE, have access to the IE e-mail reflector, access documents as they are posted to the IE folder on the portal, contribute software and/or data to the effort, and so forth. Observer status does not allow the Member or non-member to attend the IE Kickoff meeting, formally comment on documents, or otherwise disrupt the execution of the IE. Interoperability Engineering Reports from the IE will be made available to all OGC members at the end of the IE for review and comment.

Chapter 3. Scope of the IE

3.1. Objectives

The objectives of the UxS C&C IE include:

- Assess the submitted C&C data model for suitability for information exchange between planning and operating systems;
- Test two or more independent implementations of all or part of the data model using DDS and one or more other protocols (e.g., MQTT, AMQP, IWG1);
    - If MQTT or AMQP protocol will be used, it is suggested that the data encoding will be JSON and conforming to DDS Consolidated JSON Syntax Version 1.0 (https://www.omg.org/spec/DDS-JSON)
    - XML encoding may be considered
- Evaluate process for data creation, verification, transfer, and consumption in the command and control process chain; and
- Prepare an OGC Engineering Report that presents the IE results and identify whether a new standardization effort should begin or whether further research is necessary.

3.2. Background

This IE will build on a data model developed by Kongsberg Geospatial and partners under the Standards-based UxS Interoperability Test-bed (SUIT). SUIT is a command and control application agnostic to the autopilot system as well as the communication protocols. The typical commercial UxSs have software interfaces that are proprietary. SUIT's goal is to provide a standardized command and control data model (telemetry, mission data, other suggested by participants) and interfaces allowing swapping in and out of data with UxS.

Prepare an OGC Engineering Report that presents the IE results and identify whether further research is necessary.

This IE will consider two significant issues: is the data model suitable for use in the scenarios and what additional content is needed in the data model?

3.3. Experiments

Each Experiment will be performed with the consideration of multiple vehicles operating in the same area across multiple domains.

The IE plans to perform the following experiments:

- Experiment #1: Decode and translate recorded telemetry from real or simulated vehicle
- Experiment #2: Provision command and control data to one or more real or simulated vehicles
- Experiment #3: Provision command and control of one or more real or simulated payloads

- Other Experiments proposed by Participants

Chapter 4. Technical Approach

4.1. Experiment #1

The methodology involves:

- Identify available telemetry data and uses of those data, primarily from a literature review.
- Acquisition of sample dataset(s) and/or instructions provided for the IE.
- Use the data model specified in the IDL to decode the information. Telemetry information is broadcasted using OMG DDS (and may be broadcast using MQTT, AMQP, IWG1, others suggested by participants), however the participants may translate it into the protocol of their choice.
- Assess whether exchange data was properly loaded into the system.
- Assess security requirements for authentication and data exchange in anticipation of further research in a new experiment.

4.2. Experiment #2

The methodology involves:

- Provisioning of command and control exchange data to operational vehicle systems (or simulations thereof).
- A proposed list of commands to exchange include:
  - Query mission
  - Report mission
  - Start mission [optional]
  - Pause mission [optional]
  - Resume mission [optional]
  - Loiter at a particular geographic location [optional]
- Assess whether exchange data was properly loaded into the system.

4.3. Experiment #3

The methodology involves:

- Provisioning of command and control exchange data to operational payload systems (or simulations thereof).
- A proposed list of commands to exchange include:
  - Start streaming
  - Stop streaming
  - Command the gimbal to look at a particular geographic location

- Assess whether exchange data was properly loaded into the system.
- Participants may use existing encoding Standards for imagery and motion imagery such as those from OGC and MISB.

Chapter 5. Deliverables

The documentation listed below will be considered the deliverables for the project.

5.1. Documentation

- The results of the experiments will be documented in one or more Engineering Reports. The results of the experiments will not identify specific participants if those participants wish to remain anonymous. All Project collaboration will use OGC resources, such as GitLab, GitHub, the OGC Portal, and other relevant means.
- Data model currently planned to be provided and delivered include the following:
  - data model will be provided as OMG IDL,
  - data model will be provided as JSON samples,
  - Participants are encouraged to share their own source data and data models.
- Kongsberg Geospatial can provide, subject to license agreement, and for the purpose of this IE only, an implementation of OMG DDS.

5.2. Demonstration

- The developed documents will be made available on the OGC portal.
- An optional live demonstration.

Chapter 6. Schedule (Tantative)

Table 1. Master Schedule

Milestone	Event	Date
Startup	OGC Architecture Board approval of Activity Plan	September 2021
	Press Release / Call for Participants	October 2021
Execution	Planned kickoff date (execution start date)	December 2021
	IE Execution	Dec. 2021-Mar. 2022
	Planned end date	April 2022
Wrap-up and Reporting	Demonstration by Webinar	May/June 2022
	Final document submission	June 2022

Execution period can be extended as needed pending experiment progress.

Chapter 7. Resources

The following resources will be available.

Table 2. Resources

Item	Description
Web Resources	OGC will provide a project workspace on the OGC Portal.
Staffing	Each initiating and participating organization will provide adequate staff resources to support their defined responsibilities for the duration of the IE.
Hardware	Participants will provide hardware as needed to support the IE.
Software	Participants will provide software as needed to support the IE.
Other Resources	Participants in the IE are self-funded. All expenses incurred in carrying out the IE will be assumed by the participating agencies within their regular line-of-business.

Chapter 8. References

- https://archive.eol.ucar.edu/raf/Software/iwgadts/IWG1_Def.html
- https://interussplatform.org/
- https://github.com/interuss/dss
- https://www.ogc.org/standards/puck