Appendix A4: Software Requirements Specification

The Software Requirements Specification shall contain: [SWE-049] [SWE-109]

1. System overview.

*ICAROUS is a decision making module that enables the robust integration of mission specific software modules and highly assured core software modules for building safety-centric autonomous unmanned aircraft applications. The set of core software modules include formally verified algorithms that (1) detect, monitor and control conformance to safety criteria; (2) avoid stationary obstacle and maintain a safe distance from other users of the airspace; (3) compute resolution and recovery maneuvers, autonomously executed by the autopilot, when safety criteria are violated or about to be violated.*

*Maria Consiglio from the Safety Critical Avionics Systems branch is the PI. Cesar Munoz from the same branch is the technical lead. Swee Balachandran from the National Institute of Aerospace will be performing research, development and code integration activities.*

*Flight testing will be conducted inside NASA facilities. Code development and Software in the loop simulations will be carried on at the National Institute of Aerospace and NASA facilities.*

*Relevant documents – LMS-CP-7150.5 Class D Software Appendices A1, A2, A3, A4, A5 and C*

1. Functional requirements and data requirements

*The fundamental requirement underlying this research effort is:*

*“ICAROUS should enable the safe operation of unmanned aircraft in the national airspace”*

*The above fundamental research requirement translates into several key high level functional requirements:*

* *ICAROUS shall prevent the aircraft from violating geofence constraints.*
* *ICAROUS shall mitigate the risk due to collision with other traffic.*
* *ICAROUS shall ensure that the aircraft does not stray away from the intended mission due to external disturbances.*

*This document will be updated with additional requirements identified as the research evolves.*

*MAVLink protocol is used for data transfer to and from ICAROUS.*

1. \*Required states and modes.

*Three modes of operation for ICAROUS are required.*

* *Active mode – ICAROUS monitors all the flight data and interferes with necessary resolutions to avoid conflicts or mitigate risk.*
* *Passive mode – ICAROUS monitors and logs relevant events but does not interfere with autopilot operations.*
* *Pass through mode – ICAROUS simply passes data packet from a ground station to the autopilot and vice versa.*

1. \*External interface requirements.

* *Any external component that needs to communicate with ICAROUS must implement MAVLink protocol.*
* *Relevant custom MAVLink message definitions if necessary must be defined a priori.*
* *Inputs to ICAROUS must be sent to the COM threads UDP socket input port.*

1. \*Adaptation requirements (data used to adapt a program to a given installation site or to given conditions in its operational environment).

NA

1. \*Performance and timing requirements.

*Not available right now.*

1. \*Security and privacy requirements.

*Not available right now.*

1. \*Environment requirements

*See Appendix A1.d for engineering requirements.*

1. \*Design and implementation constraints

NA

1. \*Personnel-related requirements

NA

1. \*Training-related requirements

NA

1. \*Packaging requirements

NA

1. \*Testing requirements that drive software design decisions

NA

1. Bidirectional traceability between this document’s requirements and any higher level parent requirements documents.

NA