

Communications Description

NASA DFRC Ikhana Local Area
UAS COA Application Attachment

NASA Dryden Flight Research Center (DFRC) has procured from General Atomics – Aeronautical Systems Incorporated, an MQ-9 Reaper aircraft and a Ground Control Station (GCS). DFRC has assigned the number “NASA 870” to the aircraft and renamed it “Ikhana” (pronounced ee-kah-nah, a Native American word from the Choctaw Nation meaning intelligent, conscious, or aware).

This attachment covers the communication between the Ikhana pilot in a GCS and the aircraft for command/control and telemetry. Attachment NASA Ikhana Local Area - Communication and Lost Communication Description describes the communication between the Ikhana pilot and ATC.

The Ikhana aircraft and General Atomics and NASA GCSs have standard General Atomics MQ-9 command, control, and telemetry communications devices. The General Atomics GCS is a standard General Atomics configured GCS. However, NASA DFRC has made modifications to the standard General Atomics GCS intercom system to provide capabilities necessary for NASA research missions in its Ikhana GCS.

(b) (3) (A), (b) (3) (B)



2. **ATC Communication** – Ikhana uses the standard MQ-9 ATC communication systems to communicate with ATC with the addition of telephones as a backup method.
 - 2.1. **GCS Pilot** – The GCS is designed to provide instantaneous, or near instantaneous two-way communication with ATC at all times and provides a backup method of communication using telephones.
 - 2.1.1. **GCS UHF/VHF transmitter** – The GCS contains a standard UHF/VHF radio for communication with ATC near the GCS for instantaneous 2 way communication with ATC, the airborne chase/observer, and ground

chase/observer. For flights conducted from the NASA GCS at Edwards, AFB the ATC facility near the GCS would be Edwards, AFB ATC. For flights conducted from the General Atomics GCS at Gray Butte Field Airport the ATC facility nearest would be High Desert TRACON (Joshua Approach).

- 2.1.2. **Airborne Relay Through the Aircraft** – The GCS and Ikhana aircraft contain the standard MQ-9 capabilities to use the aircraft as an airborne relay for ATC communications. This system uses a single ARC-210 UHF/VHF radio in the aircraft to talk to ATC where ever the aircraft may be. This system is in-flight tunable and has Guard capabilities. Because this is a single radio in the aircraft, the pilot can talk/monitor 1 radio frequency at a time.
- 2.1.3. **Telephone** – The pilot in the GCS can use telephones located in the GCS as a backup method for communicating with ATC if other radio methods are not operating. In a lost link situation, the pilot will notify the appropriate ATC supervisor that the aircraft is lost link via telephones. When the aircraft is lost link, all communications with ATC will be through the telephone.
- 2.2. **Airborne chase pilot and observer** – The GCS pilot will communicate with the airborne chase pilot and observer using the GCS UHF/VHF or aircraft airborne relay capability.
- 2.3. **Ground Observer Personnel** – For operations where ground observers are necessary, the GCS pilot will communicate with the ground observer using the GCS UHF/VHF radio capability or hardwire intercom.
3. **Modified Ikhana Ground Control Station (GCS)** – Communication capabilities additional to the standard General Atomics GCS communications have been built into the Ikhana GCS by NASA DFRC. These capabilities can be divided into intercom and data communications capabilities.
 - 3.1. **Intercom** – It is critical during all NASA flight operations that the personnel involved have appropriate intercom capabilities to perform missions safely. The Ikhana GCS has been modified by NASA DFRC to provide the appropriate intercom and voice recording capabilities to do this. This includes the capability to record limited voice communications. The intercom system is designed to provide multiple voice “loops” so that Ikhana GCS personnel can efficiently communicate in time critical and non-time critical modes without causing an unacceptable workload burden. All intercom stations have the ability to control the loops they are listening to, as well as the loop they are talking on. An intercom system administrator sets up the default system configuration of loops,

permissions, and recording attributes. The system configuration can be modified in real time to enable/disable loops, and permissions as necessary.

3.1.1. **Flight Crew Intercom** – Using the intercom system, the crew has direct control to isolate their communications between themselves, or to listen/join into communications between other personnel in the GCS. This capability is be limited by the loop and permissions configuration under the control of the intercom system administrator. Other personnel in the Ikhana GCS can not force communications with the crew without crew consent and approval.

3.1.2. **Other Ikhana GCS Personnel Intercom** – Using the intercom system, other personnel in the Ikhana GCS have the ability to listen/join into communications between other personnel in the Ikhana GCS. This capability is be limited by the loop and permissions configuration under the control of the intercom system administrator.

3.1.3. **Ground Support Personnel Intercom** – Using the intercom system, the pilots and other personnel in the Ikhana GCS have the ability to communicate with aircraft ground support personnel working on the aircraft. This capability is be limited by the loop and permissions configuration under the control of the intercom system administrator.

3.2. **Research/Science Data Communication** – The Ikhana GCS also has the ability to communicate aircraft systems and research/science data from the aircraft to various locations inside and outside the Ikhana GCS. This modification is unlikely to be utilized for Local Area maintenance missions.

3.2.1. **Inside the Ikhana GCS** – NASA DFRC has augmented the standard MQ-9 data communications systems to provide appropriate information to each workstation in the GCS. These modifications are modeled on traditional DFRC control room systems, were designed and implemented with standard DFRC configuration control, inspection, and Information Technology (IT) computer security oversight.

3.2.2. **Outside the Ikhana GCS** - NASA DFRC has augmented the standard MQ-9 data communications systems to provide appropriate information to researchers/scientists and other personnel outside of the GCS. These modifications are designed and implemented with standard DFRC configuration control, inspection, and Information Technology (IT) computer security oversight.