

Control Station Description

NASA DFRC 2007 Fire Mission
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).

As delivered from General Atomics, the GCS control station contained only the standard MQ-9 Pilot/Sensor Operator (PSO) workstation and supporting electrical equipment. See Figure 1 for an illustration of the PSO workstation. After receipt of the GCS, NASA DFRC modified the GCS to add additional data display and analysis stations to support NASA research missions. NASA DFRC has not modified the standard MQ-9 PSO workstation as provided by General Atomics.

TYPICAL PSO WORKSTATION

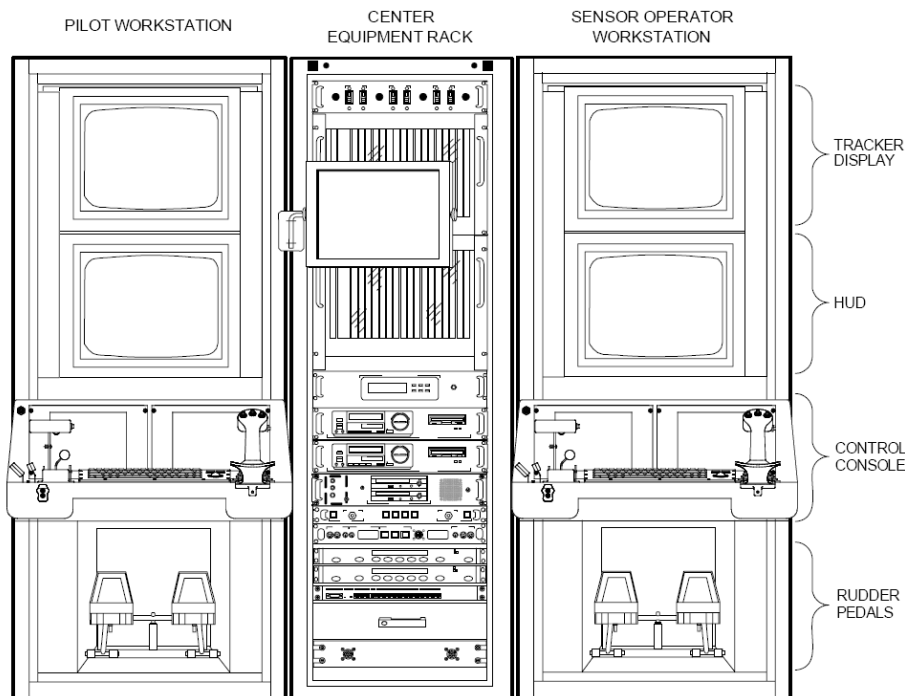


Figure 1 Typical PSO Workstation

1. **Control Station General Description** – The Ikhana Control Station components make up the Launch and Recovery Element (LRE), and the Mission Control Element (MCE) of a standard MQ-9 operation. The Ikhana control station has the following elements; the GCS itself, the line of sight (LOS) antenna enclosure, and the mobile SatCom ground station. NASA DFRC has created the LOS antenna enclosure because of the physical distances between the DFRC GCS site and the Edwards AFB runways.

- 1.1. **Ground Control Station (GCS)** – The GCS was purchased from General Atomics and is designed to be deployable via truck and/or aircraft. It was purchased with a standard MQ-9 pilot/sensor operator (PSO) workstation and supporting electrical equipment installed. The GCS has been modified by NASA to include additional data display and analysis workstations. The GCS is designed and is configured with redundant power supplies. The GCS also contains telephone and computer communications capabilities.

- 1.1.1. **PSO Workstation** – The GCS contains a standard General Atomics PSO workstation with supporting equipment. The supporting equipment includes power distribution, uninterruptible power supply (UPS) batteries, SatCom Link Manager Assembly (LMA), and environmental conditioning equipment (heater/air conditioners).

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- 1.1.2. **Additional Data Display and Analysis Workstations** – These include 6 multifunction engineering workstations, an upgraded intercom system, and large flat panel displays for situational awareness.

- 1.2. **LOS Antenna Enclosure** – An antenna enclosure is required by NASA because of the long distance between the hangars/buildings of the Dryden Flight Research Center from the Edwards AFB runways. The antenna enclosure is built to support 2 standard MQ-9 portable ground data terminals (PGDT's) with redundant power supplies, automatic power switching between power supplies, heating/air conditioning for the electronics, and monitoring capability from the GCS. The enclosure is commonly referred to as the "PGDT trailer", or the semi-mobile UAS radiation facility (SMURF). Command/telemetry switching between the 2 PGDT's is controlled within the GCS. The enclosure is designed to be deployable and transportable via truck or aircraft, during operations will normally be positioned very close to the Ikhana aircraft. Additionally, a internet camera system is installed to allow personnel in the GCS to directly observe activities around the aircraft. The antenna enclosure and GCS use fiberoptic links for communication of commands and telemetry.

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- 1.3. **Mobile SatCom Ground Station** – Located near the GCS is a 4.5 meter Ku satellite ground station terminal with dish. It is directly controlled by personnel within the GCS. See Figure 2.



Figure 2 Mobile 4.5 meter Ku SatCom Dish