

United States National Aeronautics and Space Administration (NASA) use of international standards for UAVs

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In this paper I will describe the evolution and adoption of international standards in the operation of sensor packages carried on NASA Uninhabited Aerial Vehicles (UAV). I was the architect and chief software engineer for communication on each of these UAVs.

I will begin by briefly discussing the environment utilized on the solar powered AeroVironment Pathfinder in the late 1990s. It utilized a simple 900 MHz Line Of Sight (LOS) communication link, with Secure Shell (SSH) sensor command and control (C&C).

The next system I will discuss is the AeroVironment Pathfinder+, also solar powered. Here a tracking WiFi antennae, capable of 2.4 Mb/s data rate up to a 25 mile range, was used.

Both of these systems operated from the Pacific Missile Range Facility, Kauai, Hawaii.

The third UAV system I will discuss is the General Atomics Altus (a significantly modified Predator A) This system had the first over the horizon (OTH) C&C. Inmarsat geosynchronous satellites, at 64 Kb/s, provided the capability.

Next, the General Atomics Altair (Pre production A/F Predator B) will be discussed. This marked the early introduction of Open Geospatial Consortium (OGC) standards usage, the Web Map Service (WMS). It also marked the first use of commercial geosynchronous Ku satellites for OTH C&C.

The fifth system I will discuss is the operational General Atomics Ikhana (Air Force Predator B). This system also has OTH C&C via geosynchronous commercial Ku satellites at 3 Mb/s, but marks a major embracement of numerous OGC services, including the Sensor Planning Service (SPS), WMS, Web Coverage Service (WCS), and Web Notification Service (WNS).

Additionally, this was the first integration with the NASA EO1 satellite SPS, and the tasking by the Northrop Grumman/Washington University, Saint Louis OGC Web Processing Service (WPS) wrapper on a Smoke Plume/Fire Model.

Lastly I will discuss the ongoing effort building a standards based sensor web on the Northrop Grumman Global Hawk, connecting all 11 onboard instruments through a PostGIS database backend. The ground segment has a whole suite of services, primarily defined by the OGC, layered on top of a PostGIS database mirrored from the one aboard the aircraft.

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