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## Information Summary

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*X-31 (top) F-18 chase (lower)*

### Aerospace Careers: Avionics Communications Systems

Communications systems are a necessary part of NASA's aeronautical operations at the Dryden

Flight Research Center. Research flights cannot take place without air-to-air and air-to-ground communications.

Research pilots must be in constant radio contact with pilots in nearby "chase" aircraft, who serve as an extra pair of eyes

for added safety while observing test events on the research aircraft. Equally important is the need for research pilots to be in continuous radio contact with engineers and researchers who monitor flights in control rooms on the ground. Pilots must also talk with people in airfield control towers and with air traffic controllers who help make flying as safe as possible.

There are two basic types of avionics communications systems used in NASA aircraft. Radio communications systems allow a pilot or crewmember to speak with people in another aircraft (air-to-air) or with someone at a ground station (air-to-ground). The intercommunications system (ICS) allows a pilot or crewmember to communicate with another in the same aircraft.

Avionics communications systems at Dryden are maintained and modified by electronics technicians of the Communications, Navigation, and Video Group of the



*Aircrew use intercommunications system in the F-15 cockpit.*

Avionics Branch. This group is also the source for engineering and technical support when new radio systems need to be designed and installed in the Dryden aircraft fleet, and when aircraft modifications are planned that affect an aircraft's communications system.

## Aircraft Communications Systems

There are three types of aircraft radios used at Dryden. They are HF (high frequency), VHF (very high frequency), and UHF (ultra high frequency). Each radio is a combined transmitter-receiver (transceiver) used for air-to-air and air-to-ground communications.

High Frequency radios are used by Dryden pilots when it is necessary to communicate one thousand miles or more. HF radios can be installed in any aircraft when necessary. At Dryden they are used routinely in the SR-71s. The ability to communicate over distances of several thousand miles was a necessary feature



*SR-71 aircraft.*

for their high-flying aerial reconnaissance role during Air Force service. This same HF capability is used by NASA when the aircraft, cruising at three times the speed of sound (2100 mph), flies research missions over the entire western portion of the nation in less than 75 minutes.

VHF radios allow Dryden pilots to communicate with military and general aviation aircraft, and airport and facility personnel within an aircraft's line-of sight. This capability is needed when an aircraft is flown across country to another NASA or a military installation, a civilian airfield, or is diverted to a civilian airfield because of cross-



*Radios (left to right) ARC-164, ARC-164 UHF, ARC 182 UHF/VHF, ARC 195*

country weather conditions.

UHF radios are the "bread and butter" units used by NASA. Dryden pilots use UHF units to communicate with "chase" aircraft, control rooms monitoring a research mission, other government radio stations taking part in a research project, and all military control towers and air traffic control facilities. Dryden pilots flying to other military bases use UHF radios to communicate with those facilities on the way and during taxi, takeoff, and landing operations. Like VHF, UHF radios are also limited to line-of-sight communications.

All of Dryden's F-15, F-16, F-18, and SR-71 research aircraft carry UHF and VHF radios. This gives each aircraft the necessary communications capability regardless of where a research mission takes them.

A functioning UHF or VHF radio is required for all aircraft flying research missions, regardless of where they are flown. This includes support (chase) aircraft.



*Control Room during a research mission.*

Most radios used at Dryden are made for military aircraft. They are designed and developed to operate in extreme flight environments where temperatures and air pressures can be very high and very low.

As radios are developed and upgraded for the military services, the newer models are also obtained by NASA and installed in Dryden aircraft by the Communications Section. Among the new radios expected in the future are units with combined UHF, VHF, and global positioning satellite (GPS) functions.



*Air-to-ground communications mobile system*

## Mobile Communications Systems

The Communications, Navigation, and Video Group is also responsible for the design, fabrication, installation and maintenance of avionics and mobile communications systems used in ground support vehicles at Dryden. These vehicles are used by aircraft maintenance, project, and engineering personnel to communicate with mission control rooms, pilots, and other aircrew members during pre-flight and post-flight activities on the flight line, during research flights, and while the aircraft is being taxied to and from the runway.

Research projects occasionally require project

personnel to be at remote ground sites away from Dryden to monitor recording equipment and instrumentation during certain portions of a flight. The ground support vehicles, with their air-to-ground communications systems, are used as on-site command and control centers during these remote-area activities. An example of how they are currently used at a remote site is the collection of air pressure data from sonic booms on instruments placed at several widely separated sites on the ground. To obtain accurate data, engineers had to communicate with pilots as they flew high above them at supersonic speeds.

Ground support vehicles also provide the vital communications links with Dryden officials and other agencies during an off-site emergency such as an aircraft accident.



*Convoy command vehicle*



One of the most unique communications systems engineered and created at Dryden is the combined aircraft-mobile-portable communications system used in the Space Shuttle Convoy Command Vehicle. This vehicle is used by the NASA convoy commander and other shuttle personnel during shuttle landings at Edwards. The convoy command vehicle is a converted motor home with an intercommunications system and a radio network

that gives the NASA convoy commander voice communications with the shuttle crew, mission control, and ground support vehicles during the entire landing recovery sequence. Over this communications network, the convoy commander and other personnel inside the convoy command vehicle coordinate all of the post-flight orbiter inspection and maintenance activities, egress of the shuttle crew, and off-loading of time-critical science experiments.



*F-18  
radio  
removal*

## Maintenance

Most aircraft communications units are rugged and very reliable. They contain highly complex circuitry and generally require little maintenance.

It usually takes just a few minutes to remove a radio from an aircraft and return it to the radio shop where it can be analyzed for a malfunction.

One of the most important pieces of equipment used to troubleshoot, test, repair, align, and adjust radios is a Communications Analyzer,

which can be compared to a computerized tune-up unit in an automotive shop. This unit can check many radio functions within minutes, saving considerable time and expense.

Other specialized equipment includes signal generators, multimeters, oscilloscopes, power meters, and watt meters. Many manufacturers build special test sets for specific radios and these test sets are among the many pieces of equipment normally found in a radio shop.

## Experience

Individuals interested in working in the NASA aircraft communications field must have a broad background in aviation electronics (avionics) and in mathematics. Knowledge of aircraft structures and general shop experience would also be useful for applicants. Possessing an FCC General Radiotelephone Operators License is also helpful.

Most community colleges offer formal training in electronics, while most technical schools have courses specifically covering aviation electronics.

Formal schooling and on-the-job training in the avionics communications field is also available from the military services. On-the-job experience can also be found at commercial avionics facilities on or near most airports.



*Communications Analyzer*