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Information Summary

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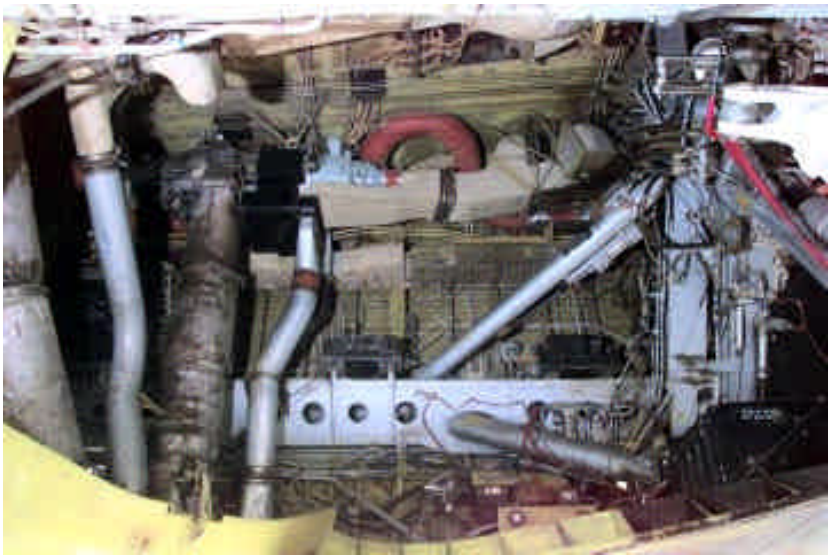
Aerospace Careers: Fluid System Lab

The Fluid System Lab is a specialized facility that supports every research and support aircraft flown at NASA's Dryden Flight Research Center.

The mission of the Fluid System Lab is simple: design, manufacture, modify, and repair all aircraft fuel, pneumatic (nitrogen), and hydraulic (fluid) plumbing systems on aircraft and in ground support equipment in support of all flight operations carried out at the center.

What are Fluid Systems?

Fuel, hydraulic, and pneumatic systems in an aircraft are composed of many feet of metal and rubberized hoses, tubing, lines, pumps, and related valves and regulators. These systems furnish pressurized fuel, hydraulic fluids, and nitrogen throughout the aircraft to operate the engines, the flight controls, the landing gear, and other vital components. Lines carrying pressurized nitrogen also provide measurements of altitude, attitude, and air speed to cockpit instruments and also to research instruments on the ground in the Dryden mission control rooms.



Wheel well on B-52 depicting fuel, hydraulic, and pneumatic system.

Without pressurized fuel, hydraulic, and pneumatic lines a modern aircraft could not fly, nor would there be hydraulic or pneumatic-driven power to operate the majority of the systems aboard the aircraft. The proper function of the fluid and pneumatic systems on an aircraft is vital to its operation and safety of flight.

Requests to initiate repairs, modifications, or creation of a fluid system are originated by maintenance personnel, systems engineers, or research project engineers. The requests can also come from contractors and other agencies working jointly with NASA in a research project or flight support operations. Once initiated, the work requests are processed through the Dryden Aircraft Maintenance Branch for final approval and coordination.

Materials

Hydraulic and gaseous systems must withstand test pressures of up to 12,000 pounds per square inch (PSI) and operate routinely at pressures of about 3,000 PSI, so they must be made of durable materials. Most flight-qualified hose and line fittings, valves, pumps, and regulators are made of titanium, stainless steel, strong aluminum, and brass. Non-flexible tubing and lines are also made of the same materials. Flexible lines are usually made of rubber-like synthetic materials, with some wrapped in a protective flexible metal mesh to increase the pressure limits and also to protect the lines from contamination and damage.

Aircraft Ground Equipment (AGE)

The Dryden Fluid System Lab is also responsible for the design, repair, and modification of fluid systems in all of the AGE units used on the flightline and in the hangars. AGE units are the self-contained portable pieces of equipment used to provide ground power to an aircraft, provide ground test capabilities on the aircraft, and furnish fluid and pneumatic power during all pre- and post-flight aircraft operations.

AGE units and SR-71 aircraft.

Fluid system pressure and safety requirements for AGE units are the same as those on the aircraft they support; therefore AGE maintenance and operational standards must be equally as high.

Hydraulic test stand tester.

The System Simulator

One of the most unique pieces of equipment developed by the Dryden Fluid System Lab is a hydraulic test stand tester. It is used to test and validate the accuracy and readiness of the many AGE hydraulic units used on the various types of aircraft flown at Dryden. The portable tester has actual hydraulic and pneumatic systems, complete with valves and pressure regulators that simulate real aircraft systems. The ability to check an AGE unit before it is rolled out to an aircraft prior to a flight can save considerable time and expense, and may save postponing an important research mission.

Recent Projects

Among the most visible projects associated with the Dryden Fluid System Lab have been designing and installing the pressure source

Oil flow visualization on F-18 aircraft nose.

systems used to release oil-based dyes and smoke in aerodynamic flow visualization studies during research projects gathering aerodynamic data.

Most recent uses of the dye and smoke at Dryden have been during high angle of attack

Smoke flow visualization on X-29 aircraft.

research flights with the forwardswept wing X-29 and a highly modified F-18. The tinted fluids are released from tiny orifices installed on the aircraft and the pattern created by the flow of air is studied by engineers to improve their knowledge of aerodynamics.

The Fluid System Lab helped design and install hydraulic and pneumatic systems used to convert a Convair (CV)-990 jetliner into the Landing Systems Research Aircraft (LSRA).

CV-990 aircraft.

The project aircraft was used to test and evaluate space shuttle tires under varying loads and landing conditions. Installed in the belly of the modified 990 was a landing gear strut and wheel system, along with a mechanism to lower and raise the gear system and produce several hundred thousand pounds of pressure during test operations.

Experience

Skills required to work in the Fluid System field can be obtained in several ways. Many vocational schools offer training in fluid dynamics, a necessity in this specialized field. Skills and knowledge can also be gained through on-the-job training at some of the larger civilian aviation repair facilities, and also from aviation and fluid dynamics training in the U.S. Armed Forces. NASA does not require formal school training to work in this field; however, applicants must have a good working knowledge of fluid dynamics and fluid and gaseous flow requirements. They must also possess and demonstrate the ability to read and

comprehend engineering drawings, produce the required fluid systems from those drawings, and operate shop equipment competently and safely.

Fluid System Lab personnel must be capable of taking part in the engineering design process of aircraft modifications or manufacture to assure that the proper fluid systems are recommended.