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Information Summary

IS-1997-08-003-DFRC

Aerospace Careers: Machine Shop

Modifying an aircraft for a research project involves the activities of many people at Dryden, and high on the list of this team are the highly experienced specialists at the Machine Shop.

The official title of each machine shop member is Model Maker, but the description belies their real role. They are specialized engineering technicians who provide Dryden with a complete aircraft modification capability by producing hardware.....one-of-a-kind machined parts....that help modify an aircraft to carry out a specific research role. This capability is critical because modification work rarely uses components “off the shelf.” Most are custom made for specific research projects.

Microswitch

X-38 pylon and shop crew.

The items made in the Machine Shop run the gamut, from tiny microswitch mechanisms to hefty pylons that carry research vehicles and test articles beneath the wing of NASA’s B-52 carrier aircraft, and parts in between like air data probes, custom aircraft load-bearing members, and jet engine mounts.

Shop Specialists

The capability of the Dryden Machine Shop is unique, compared to most industrial shops of its size. All seven of the shop specialists are experts at operating every one of the 40

Electrical Discharge Machine

machines on hand, from common bench grinders to the large computerized milling machines and lathes. The specialists work with engineers in designing the product, and can make any item that the machines are capable of producing.

Machine shop tasks arrive in the form of a standard work request, normally originated by a project engineer and coordinated through the maintenance branch. Working from simple descriptions or sketches all the way up to engineering drawings accompanying the work request, personnel at the machine shop stay with the item until it's completed and can be handed over to the customer.

While the largest percentage of the work performed in the machine shop supports the Aircraft Maintenance and Modification Branch, other organizations at Dryden also utilize its talent when unique parts for vehicles, support equipment, or utility systems are needed.

Machines and Materials

The machinists work with many types of materials. Most of it is aluminum, the basic metal used in aircraft structures and available in a variety of alloys based on strength. Other materials commonly used in aircraft modification work are titanium, another lightweight metal but one that resists heat; stainless steel; and chromium-molybdenum steel.

The largest milling machine in the facility can handle a piece of steel or aluminum that is 60 inches long, 30 inches wide, and 24 inches thick.

One of the most interesting machines in the shop is the Electrical Discharge Machine (EDM). It looks like a massive bandsaw. Instead of a saw blade, the computerized machine uses a wire carrying an electrical current to cut any material that will conduct electricity.

EDM cut in progress.

The electrical discharge burns the metal to make a smooth clean cut while the computerized machine guides the wire automatically, without the aid of a human operator.

Unique Projects

Products coming out of the Dryden Machine Shop, over a period of time, have supported every aircraft flown at the center.

CV-990 aircraft.

The largest pieces of machined steel produced by the Dryden shop were used on the Convair (CV)-990 Landing Systems Research Aircraft, a former jetliner used to test space shuttle tires. The assembled pieces were installed in the belly of the CV-990 and became a massive support structure which held a landing gear retraction system. The structure was engineered and built to withstand up to 200,000 pounds of pressure to simulate space shuttle landing loads. The CV-990 project was the largest aircraft modification job performed at Dryden. Its success led to broader landing capabilities for space shuttles at the Kennedy Space Center in Florida.

A highly modified F-18 called the High Alpha Research Vehicle (HARV) was flown at Dryden with thrustvectored engine exhaust to help achieve sustained high angles of attack

F-18 HARV aircraft.

(alpha) while engineers studied the flow of air over the aircraft at the high pitch angles. The Dryden Machine Shop created the functional model of the thrust vectoring exhaust nozzles. The nozzles were mounted on a non-flying F-18 dubbed the “Iron Bird” that was used to test and validate engineering software ultimately used in the HARV.

X-29 aircraft.

When the X-29 forward swept wing research aircraft was flown to study high angle of attack flight characteristics, smoke was released from tiny orifices around the nose of the aircraft to plot the flow of air. The smoke generator was fabricated in the machine shop.

F-16XL aircraft.

Machine Shop personnel were also involved with the NASA F-16XL laminar flow research aircraft. The aircraft's highly modified left wing carries a large titanium panel designed to create smoother air flow over the wing's upper surface to enhance performance. The project is being carried out by NASA to see if similar laminar flow devices would be feasible on future commercial transports to help lower operating costs. To support the big titanium panel and added hardware inside the wing, components to strengthen wing ribs and spars were made by the Machine Shop.

Experience

Personnel working in machine shops can receive their training and experience from a variety of sources — military service, trade schools, industrial schooling, and on-the-job training at commercial machine shops.

NASA's machinists of today need to have skills far beyond an understanding of the machine tools they operate on a daily basis.

Computer version of X-33 wind tunnel model.

They must be knowledgeable in all types of metals and other materials common to aircraft construction, be skilled in mathematics and trigonometry, and take an idea and transform it into a functional system. This involves analyzing a problem or situation and coming up with a workable solution.

Computer version of X-33 wind tunnel model.

Aerospace engineering technicians must not only be skilled with modern computer-operated machines, they also must be able to use computer-aided packages to design parts, put this information into a language the machine tool understands, set the machines up, and then manufacture the parts.