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Information Summary

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Aerospace Careers:
Engineering Mission Planner

At the Dryden Flight Research Center, NASA's premier aeronautical facility, engineering mission planners (EMPs) are involved in all flight projects.

What is an Engineering Mission Planner?

Often described as aeronautical engineers "on the go," their main responsibilities include establishing flight test procedures, developing flight test plans, coordinating research requirements, developing flight cards, coordinating pilot training, and taking part in pre- and post-flight briefings. Engineering mission planners monitor their research flights in the mission control center, keeping in radio contact with the pilot. They conclude each mission by writing post-flight reports, filling out logbooks, and starting preparations for the next flight.

This hiahlv modified F-15 was a NASA research aircraft for most of the 1990s.

The Work of Engineering Mission Planners

When a research project at Dryden nears the flight phase, the project engineer begins depending on an engineering mission planner to keep the operations schedule coordinated properly and intact.

One of the EMP's first tasks is setting up a database to keep track of all the parameters and restrictions associated with the project aircraft and any modifications to the structure. This database is used to establish the operational envelope of the research aircraft — speeds, limits on maneuvering and G-forces, maximum altitude, load-carrying capability, and other similar factors based on structural dynamics, propulsion, and safety.

Once the EMP develops an overall flight research plan with the research engineers, specific events and procedures to be carried out during individual flights are used to write the flight cards for each research mission. Each set of flight cards is the script for that particular research mission. The cards contain a description of each test or research activity, what type of maneuvers are involved, speeds and altitudes at which the pilot will fly, aircraft limits, an event timeline, and projected fuel consumption based on the timeline.

The flight cards are prepared by an EMP before each flight to allow research pilots to study the mission and discuss data points and activities with project engineers. Pilots also use the cards in the project flight simulator where they work with the EMP to practice the flight and verify that the aircraft can accomplish all the test points safely. If the pilot is not comfortable with the flight sequence or procedures, the EMP makes revisions.

As the day of the flight draws near requests are filed with the Flight Operations scheduler for a flight date and flight time. The EMP also requests supporting aircraft, if needed, such as a chase plane for flight safety and aerial photography, and an aerial tanker if in-flight refueling is needed. These requests, once confirmed, are filed with the appropriate airspace coordinators and air traffic controllers.

Pre-flight briefings, coordinated by the EMP, are usually held a few days before a mission.

EMPs work with the pilots as they practice a mission in a flight simulator like this one.

The meetings allow the engineers, support personnel, and the pilot to discuss the flight in chronological detail utilizing the flight cards prepared by the EMP. All team members must understand any limitations associated with the flight profile, and all safety issues and procedures are discussed. The activities and locations of any chase and support aircraft are covered thoroughly, along with communications call signs. A weather briefing is also part of normal pre-flight briefings, in addition to confirming the personnel who will be in the mission control room during the flight.

EMPs in the Control Room

The test conductor is the center of all communications during a research flight at Dryden. This is quite often an engineering mission planner. The EMP sits at a workstation where the research aircraft can be seen on a television monitor as it is followed by one of Dryden's long-range video cameras. Next to the EMP is a display on which all parameters associated with aircraft performance can be seen — speed, altitude, location as determined by radar tracking, flight control systems status, engine performance and fuel status.

At this workstation the EMP can also communicate with and hear the research pilot as he accomplishes each event on the set of flight cards strapped to the knee of his flight suit. The EMP monitors each step in the flight cards for safety procedures. Information from

the project engineers that must be relayed to the pilot is passed through the EMP.

Mission control room during a research flight.

An accurate log of all events and activities taking place during the flight is recorded by the EMP, including comments by the research pilot and the crews of any support aircraft. The EMP also keeps a close eye on the fuel status of the research aircraft, a safety precaution in case a pilot with a "busy" set of flight cards overlooks it. The main concern over fuel is having enough to complete as many data points as possible, while keeping an adequate amount to safely return to Dryden. Fuel observations are also a part of the EMP's flight log, which is used as a basis for postflight reports and evaluations.

Post-Flight Activities

Briefings after a research flight are just as important as a pre-flight session, and an EMP coordinates them. The flight is reviewed and critiqued by everyone, from the pilot and chief engineer to systems technicians and maintenance personnel. Dialogue, presented freely, leads to project improvements and better research data.

Post-flight reports by the EMP are written based on flight accomplishments and the observations of the pilot and mission control room team. The report includes the flight cards, and all of the instrumentation data produced during the flight — aircraft performance, research achievements, anomalies, fuel readings — and a summary of control room activities. The most useful section of the post-flight report will be the flight log summary that lists flight and research events chronologically and summarizes each test point. EMP post-flight reports represent the chronological history of each research project at Dryden and also the collective history of the Center itself. They also are used frequently as baseline information on which to plan new research projects, and as a library of "lessons learned."

The People and the Projects

Engineering mission planners have been associated with all research projects at Dryden, and have been actively involved in the planning and development of several past projects that are unique and significant.

The SR-71 was used in a program to study ways of reducing sonic boom overpressure that is heard on the ground when an aircraft exceeds the speed of sound. Data could lead to aircraft designs that would reduce the "peak" of sonic booms and minimize the "startle effect" they produce on the ground.

The QF-106A Eclipse project's primary goal of demonstrating the tow phase of the Eclipse concept using a scaled-down tow aircraft (C-141A) and a representative aerodynamically-shaped aircraft (QF-106A) as a launch vehicle was successfully accomplished.

Laminar flow projects on the F-16XL were the first that sought to achieve a significant percentage of laminar flow over wings comparable to those of a high-speed civil transport. Laminar flow conditions can reduce aerodynamic drag (friction) and help reduce operating costs by reducing fuel consumption.

QF-106A Eclipse being towed aloft (note tow line attached to the aircraft's nose).

Education and Experience

An EMP at Dryden has a bachelor of science degree in aerospace, aeronautical or mechanical engineering. Undergraduate education should include coursework at all levels of mathematics, science, physics and computer operations.

Individuals interested in working in this NASA career field should have a broad working knowledge of aviation fundamentals. The EMP must also have the ability to communicate skillfully with people at all levels of management and disciplines, not only at the Center but with individuals at other NASA centers, government agencies and commercial aerospace firms.

An important attribute for an EMP is the ability to see the “big picture” of a research project. The EMP must be able to prioritize events and arrange productive flight test procedures and schedules resulting in safe and successful flights.

All major aerospace companies have flight test branches where engineers work in positions common to NASA engineering mission planners. Within the federal government, similar engineering positions can be found in the Federal Aviation Administration and also in the flight test branches of the Air Force and Navy.