1951 BI
FLIGHT RESEARCH
Champine

Speech and Commentary Given with the Films from Muroc
High Speed Flight Research Station

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Introductory Remarks

At Muroc, California, the NACA is engaged in a cooperative program of flight research with the Air Force, Navy and airplane manufacturers. In the movie that follows you will see some of the aircraft and operations being conducted by our personnel. These films show the actual operation of the various airplanes. You are reminded that these airplanes are highly instrumented for investigations of stability and control, performance and load distribution in the transonic and supersonic flight range. This picture gives some indication of the large amount of instrumentation that is carried in each of these airplanes.

X-1

Here we see the X-1. Pre-flight attention is being given. The airplane is being backed down into the loading pit to facilitate loading in the B-50 mother plane. The rocket motor is noticeable in the rear of the fuselage. To study airflow conditions, wool tufts have been placed on the fuselage and rudder. Your attention is directed to the instrument door on the fuselage above the wing. The B-50 is positioned over the X-1 and hoisting slings are used to raise it into place. The airplane is equipped with internal recording instrumentation. The airspeed, altitude, control positions and forces, accelerations, angle of pitch and yaw, are but a few of the quantities derived from the records.

The front of the X-1 is being pulled down to clear the nose wheel door. The mother airplane is now in proper position for raising the X-1 into its bomb

bay. Hoisting slings are attached to the winches in the bomb bays of the B-50. These slings are then carefully placed under the fuselage fore and aft for necessary balance while lifting the research airplane. It is now in proper position to engage the bomb shackle, and the slings are removed. After the landing gear is raised and inspected, the airplane is ready to be loaded with propellants. Alcohol and liquid oxygen are the main fuels while nitrogen is used to force these propellants into the engine.

These are the storage tanks for the liquid oxygen and nitrogen. The large tank on the left contains the liquid oxygen. The smaller spherical tank on the right is the nitrogen container and it is connected directly to an evaporator which converts the liquid nitrogen to a gas at high pressure. The yellow trailer contains the alcohol which is pumped into the X-1. Next the liquid oxygen and high pressure nitrogen are fed into the airplane. The complete fueling operation takes about 45 minutes. During this same period final checks of the instrumentation are made and the B-50 is then moved to the ramp for starting engines.

A short briefing between the pilots of the X-1, B-50, and chase airplane is held just before take-off. After the pilots and crew have boarded the B-50 the engines are started for take-off. The ground clearance between the X-1 and the runway is approximately 9 inches which is sufficient for take-off and landing. The B-50 has been stripped down and even with the X-1 in its bomb bay, it has good take-off and climb performance. For reasons of personal safety the X-1 pilot is now riding in the B-50. After climbing to approximately 8000 feet he is lowered by elevator to the level of the X-1 cockpit. After entering, the door is closed and the pilot goes over his pre-drop check-off list. In flight the X-1 can easily be seen under the B-50. All the research airplanes are painted white. This gives an excellent color contrast with the dark blue sky, which facilitates visual tracking

from the ground. The wing span is 28 feet and fuselage length is 32 feet. The rocket engine delivers approximately 6000 pounds of thrust. The short vapor trail that will soon appear behind the X-1 is the final check of the propellant jettison valves. At full weight the wing loading is 100 pounds per square foot.

The drop is made without rocket power at an indicated airspeed of 260 mph and approximately 25,000 feet. Three or four seconds after drop the rocket motor is started and the airplane is climbed to test altitude.

This is the operations jeep which is in radio contact with the X-1 pilot. Simultaneously with the instruments in the airplane, data is also recorded by the radar and telemeter station.

While the rocket motor is on, the products of combustion produce a vapor trail that is quite visible. The rocket motor will run full power for only about 3 minutes due to its high utilization of fuel.

The remaining is glide flight, which lasts about 15 minutes.

Wing load during landing is 55 pounds per square foot. The landing is made on the lake at approximately 135 mph.

The airplane rolls about a mile and a half before it comes to a stop.

Preparation is now being made to return the X-1 to the hangar.

This complete operation requires about 15 men in the air and 10 on the ground to gather information and lend assistance.

D-558

This airplane is the D-558, Phase II, which is powered with a J-34 jet engine and a 4-cylinder rocket motor. It is being towed in an especially built trailer that contains facilities for pre- and post-flight engine check out. The

rocket propellants are alcohol and liquid oxygen which are fed to the motors by a hydrogen peroxide pump.

This shot will show an igniter check. The small dots that will glow in the center of the cylinders are the spark plugs and the igniters that start the rocket motors when fuel is present.

The use of 90% hydrogen peroxide makes it necessary for the loading crews to wear plastic clothes and take special precautions. The ground, in the area of the airplane and the trailer, is kept flooded to dilute any hydrogen peroxide which might be spilled. It is a very dangerous solution in concentrated form. If any of the workmen are exposed to the hydrogen peroxide, they step under this shower that is on the trailer.

The smoke coming from the end of the plane is gaseous oxygen which must be bled off to insure that liquid oxygen is present in the lines at the rocket motor. Instrument technicians are making their pre-flight checks.

This shot shows the rocket engine being started for ground check run. Each of the 4 cylinders are fired, and the intense heat and shock waves are noticeable in the rocket blast.

After loading alcohol and liquid oxygen, the airplane is ready for flight. The wing span is 25 feet, the length 53, and take-off gross weight 12,000 pounds. 35 degrees of sweep back are used on the wing and tail. Speed brakes are extended to slow the airplane down so the landing gear can be lowered.

An orange flare is set off to indicate the wind direction. The drift during landing must be kept to a minimum to reduce tire wear. The landing speed is approximately 160 mph, and 2 or 3 miles of runway is required to stop the airplane.

X-4

The next research airplane we will see is the X-4, a flying wing used to study stability and control problems associated with this type aircraft. The dive brakes are being checked for operation. The plane is powered with two conventional jet engines that are in the wing fuselage junction.

The F-86 in the background is the chase airplane taxiing out with the X-4. Both airplanes will take off from the runway. The wing span of the X-4 is 25 feet and the gross weight is about 6000 pounds.

This scene shows the speed brakes opening in flight. The landing is made on the runway as the landing speed is comparatively slow.

This view shows the speed brakes opened after landing.

The NACA is currently operating these 4 types of aircraft at Muroc -- D-558, Phase II, the X-4, the X-1 and D-558, Phase I.

Concluding Remarks

Our operations at Muroc have now been under way since early 1947. During that time there has been considerable exploration of the transonic and supersonic flight ranges. It has been a very productive source for design information on aircraft loads and general aerodynamic characteristics in the transonic and supersonic speed ranges and has been the major source of information on the dynamics of piloted aircraft at high speed.