

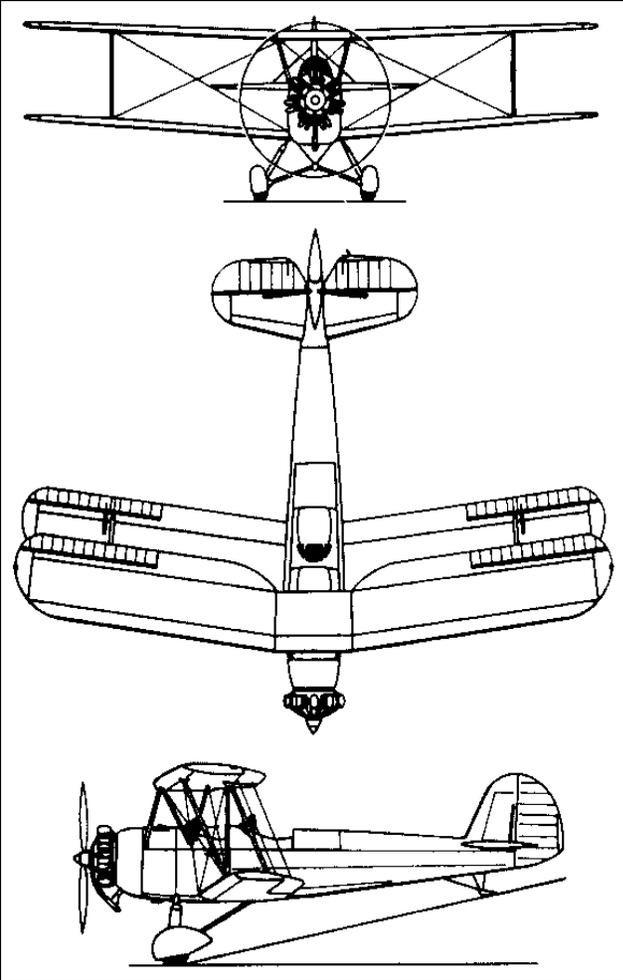


The NACA's High Speed Flight Research Station and the Development of Reaction Control Systems

Christian Gelzer

Curtis Peebles

NASA Armstrong Flight Research Center



“a scientific investigation into the early use [of H_2O_2] as wing 'bonkers' in imposing a roll moment for aerodynamic stability study.”

P. R. Stokes

3-30
18
2771

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS

JUL 10 1947

TECHNICAL MEMORANDUM

No. 1170

REPORT ON ROCKET POWER PLANTS BASED ON T-SUBSTANCE

By Hellmuth Walter

Translation

“Bericht über die R-Triebwerke auf Grundlage des T-Stoffes.”
R-Antriebe, Schriften der Deutsche Akademie der Luftfahrtforschung
Heft 1071, Nr. 82, 1943



Washington
July 1947

NACA LIBRARY
LANGLEY MEMORIAL AERONAUTICAL
LABORATORY
Langley Field, Va.

The Bell X-2, launch aircraft, and the support equipment and personnel necessary for a flight.

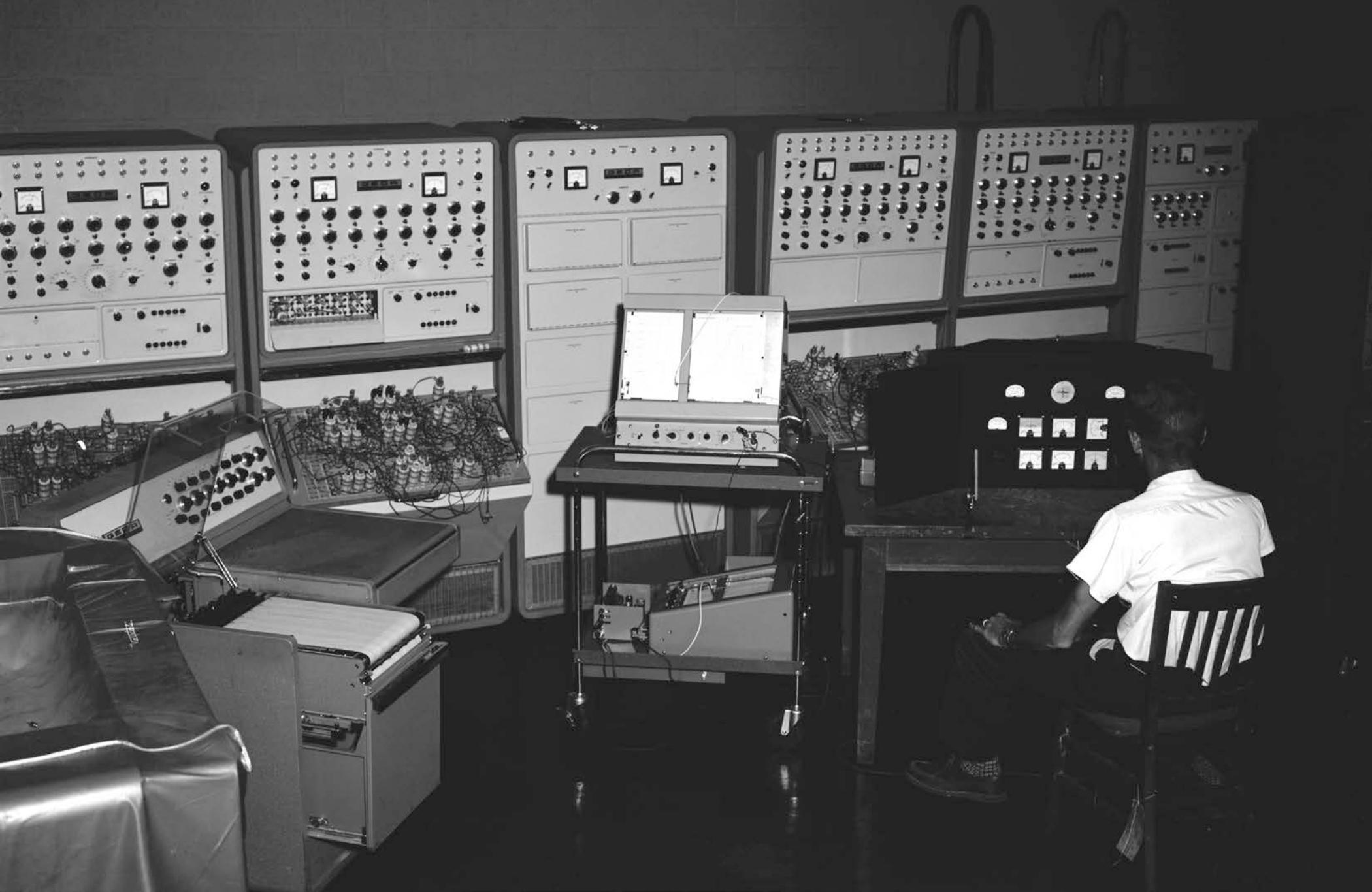
The Air Force bought the GEDA to model the X-2's flight in a simulator but the NACA first used it to reconstruct the flight of a North American Aviation F-100A that crashed near Edwards in 1954.



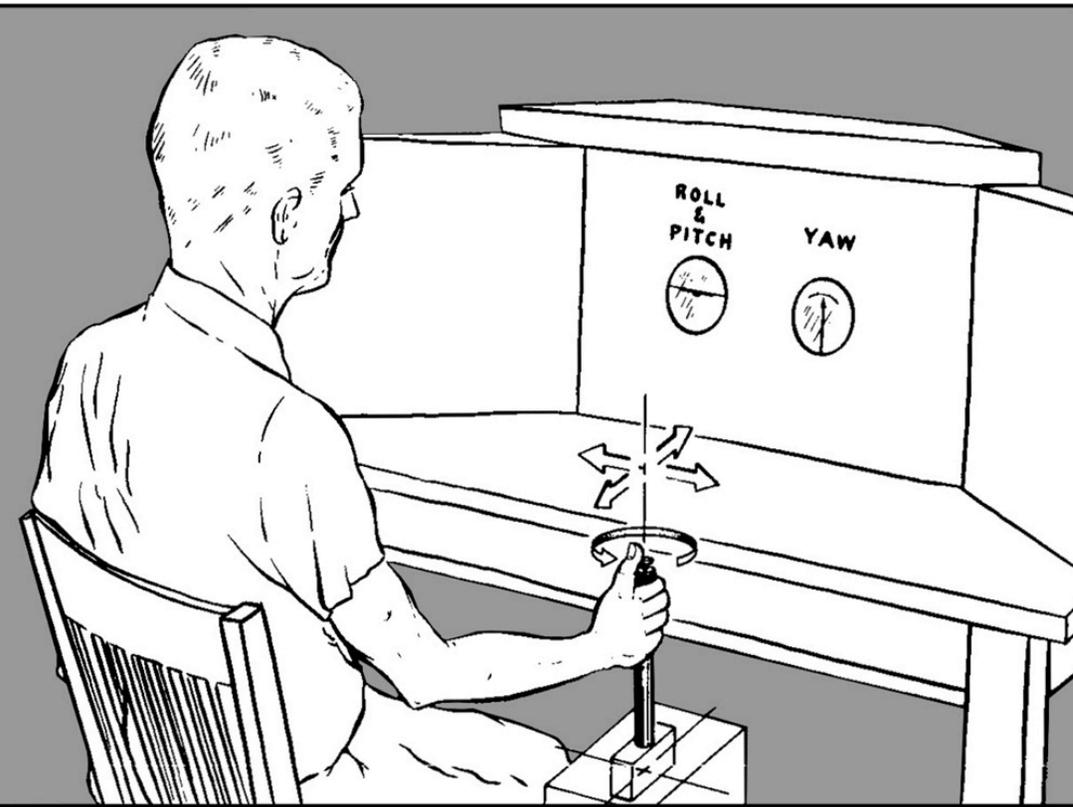


The Bell X-1B. The HSFS engineers created their RCS simulation based on this second generation X-1 rocket plane.

Dick Day at X-1B/RCS simulation desk with the Air Force's GEDA in the background.

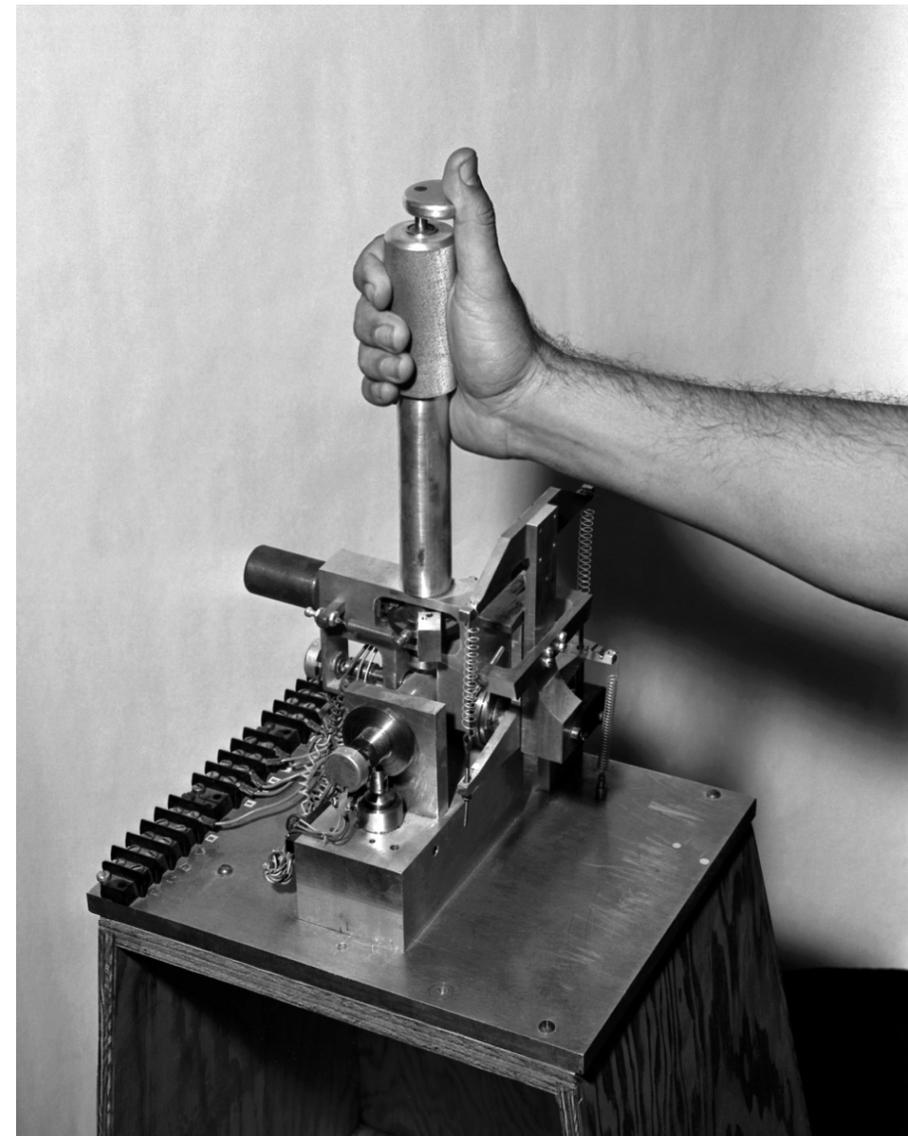


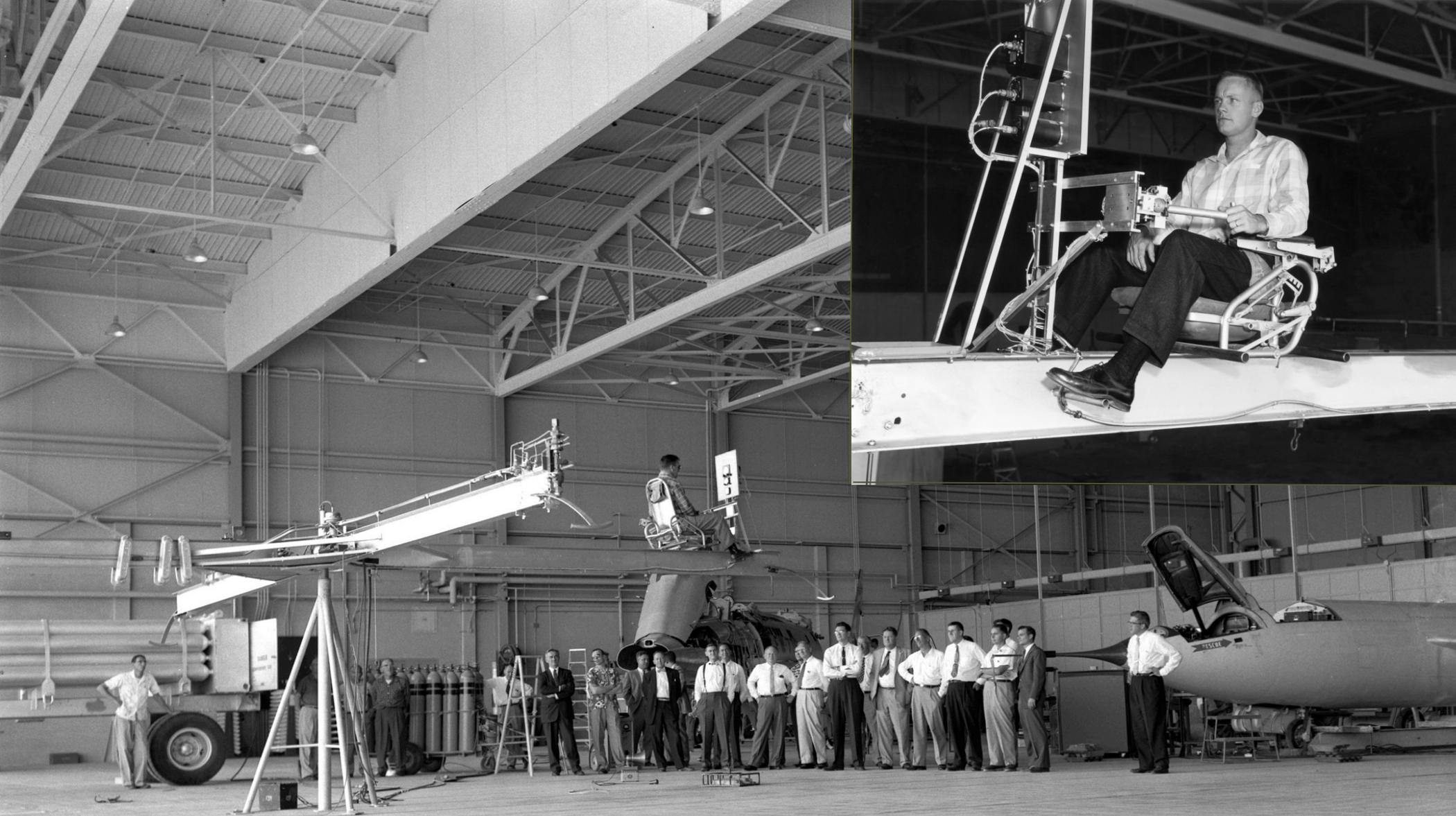
ANALOG CONTROL AND PRESENTATION



An illustration from the 1956 X-15 report showing the original simulator the pilots were asked to fly.

Photograph of the control stick the pilots used in the simulation.





Stan Butchart, in 1956, piloting the Iron Cross in hangar 4801 (Loads Calibration Hangar), while engineers, a few pilots, and technicians look on. Neil Armstrong takes a turn at the simulator in image at the upper right.

Stan Butchart at the controls, illustrating just how difficult it was to control. It's also a good example of the nitrogen (cold gas) RCS jets at work.

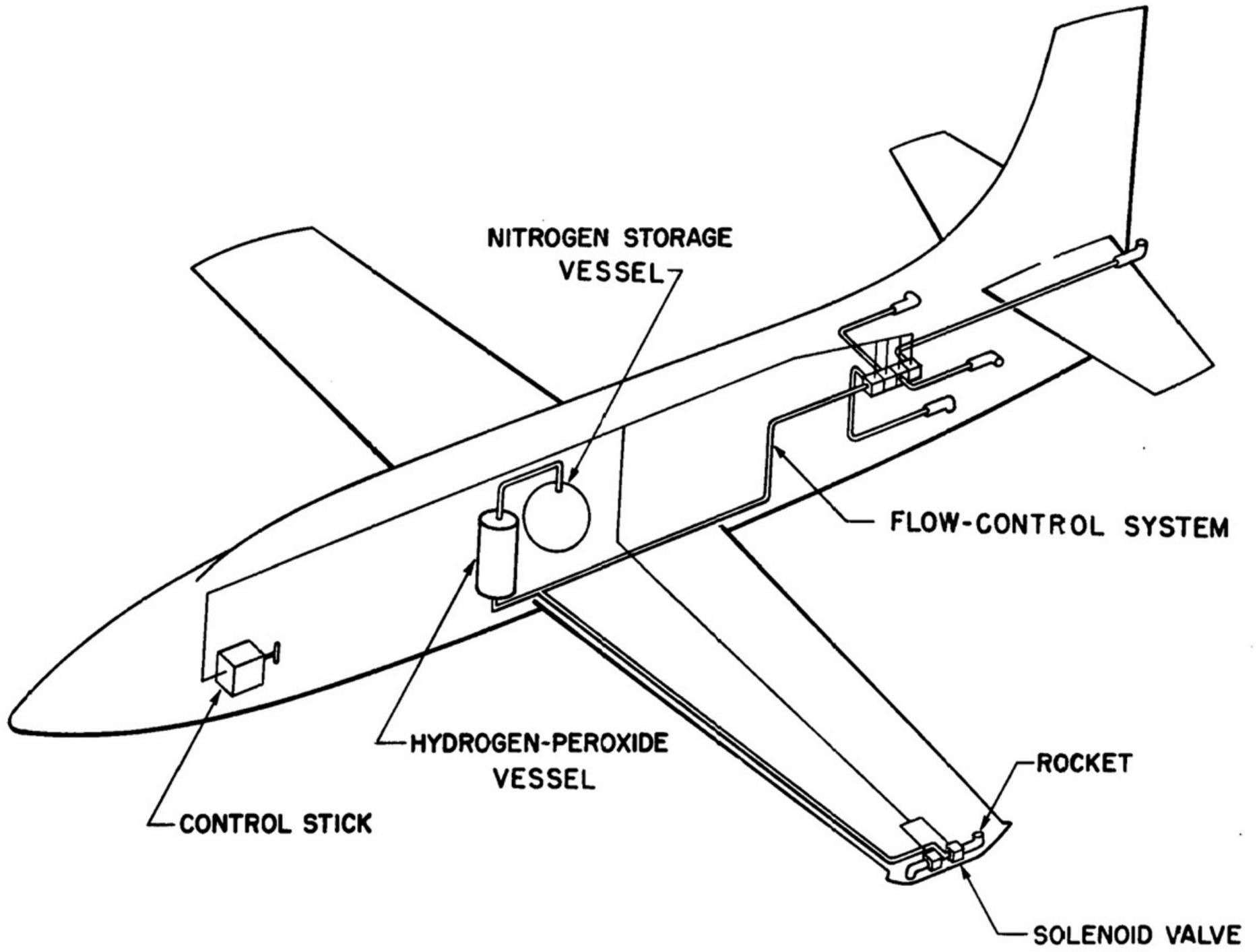




The final version of the Iron Cross, now enclosed to prevent the pilot from using visual cues while flying.

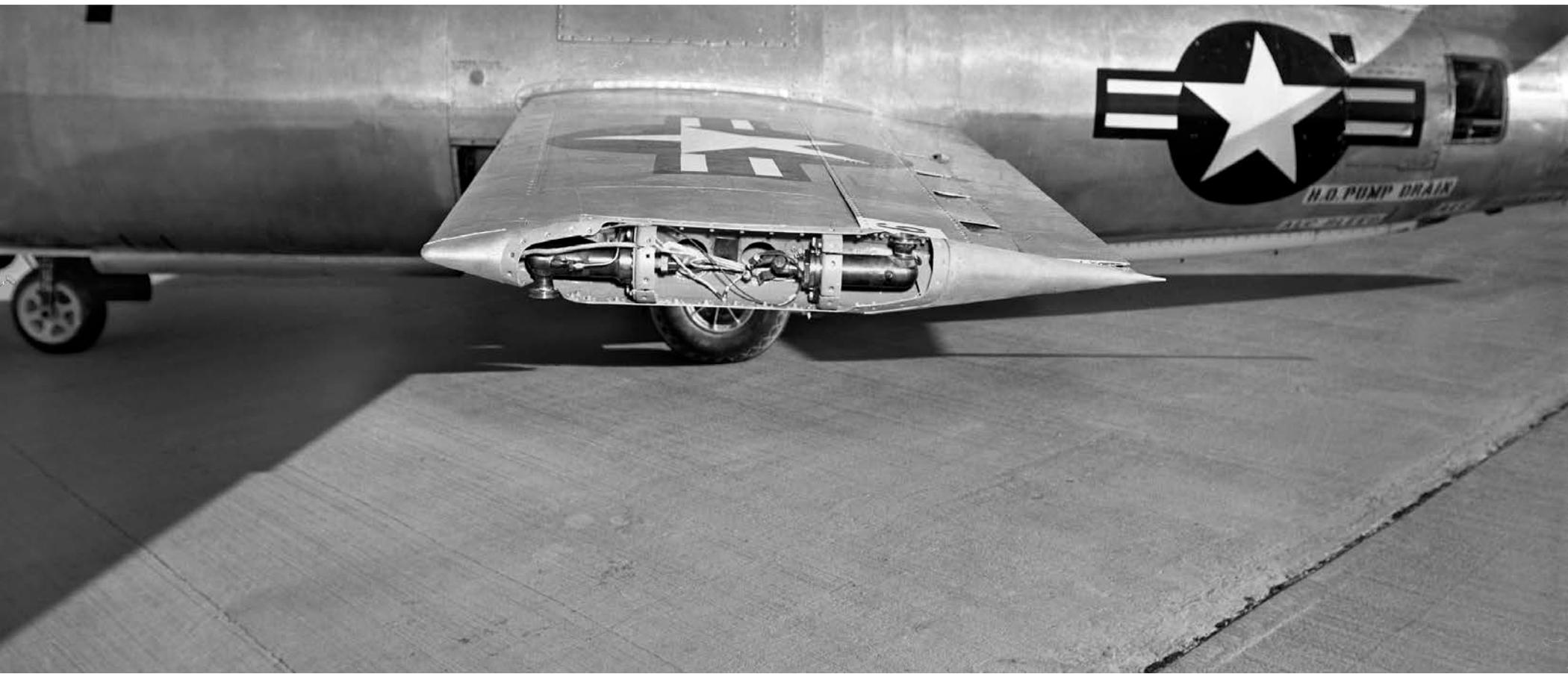


The Bell X-1B modified with its RCS. Barely visible are the exhaust nozzles at the left wing tip, in the fuselage aft of the Air Force marking, and just above the rocket exhaust. Not visible is the nozzle under the fuselage.



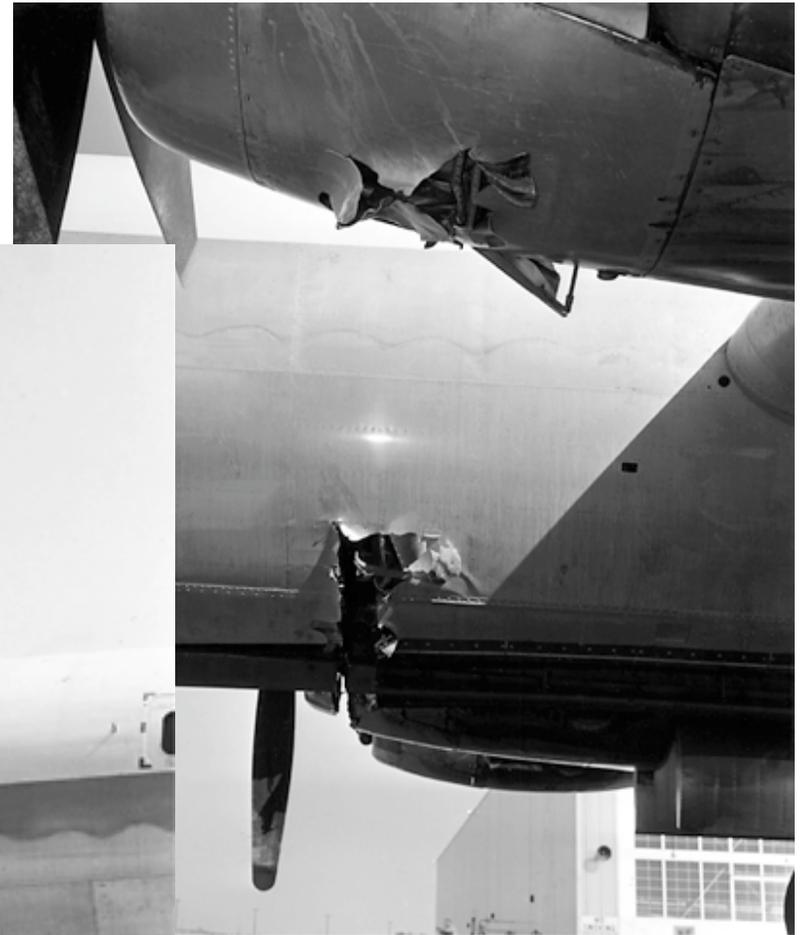
The RCS controller in the X-1B, reminiscent of the controller in the Iron Cross.





Uncovered, you can see the two nozzles for roll control that fire in opposite directions.

P2B-1S after a runaway prop governor. The 4 blades went in separate directions—one through #3 engine and the fuselage where Jack McKay had been moments before in the D-558-II (they dropped him just in time ...).



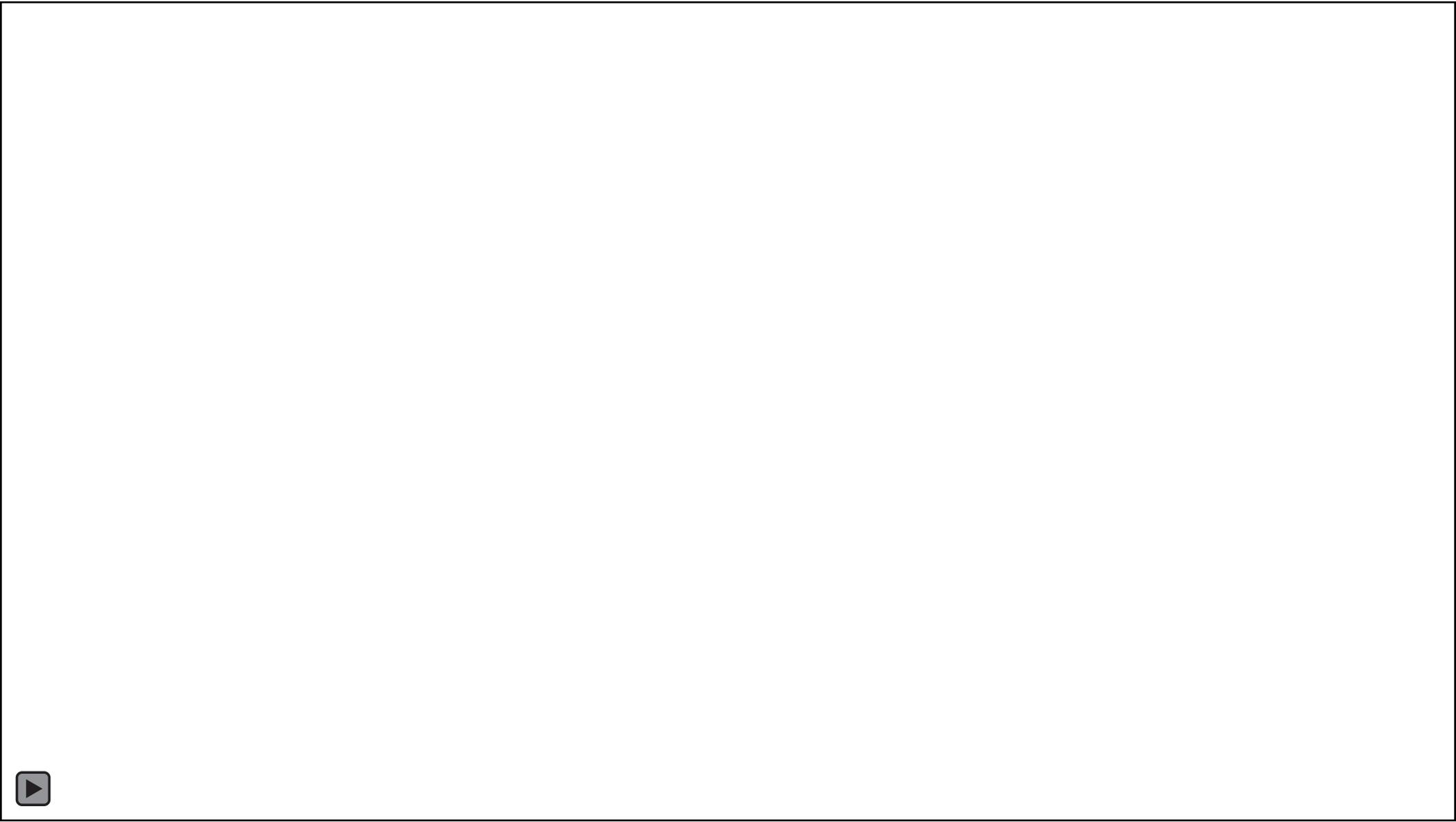




The Station's YF-104 that, in 1958, became the second RCS testbed.

Now called the JF-104, slightly shrouded in steam from decomposed H_2O_2 . Note the added wingtip pod and the exhaust nozzle in the nose.

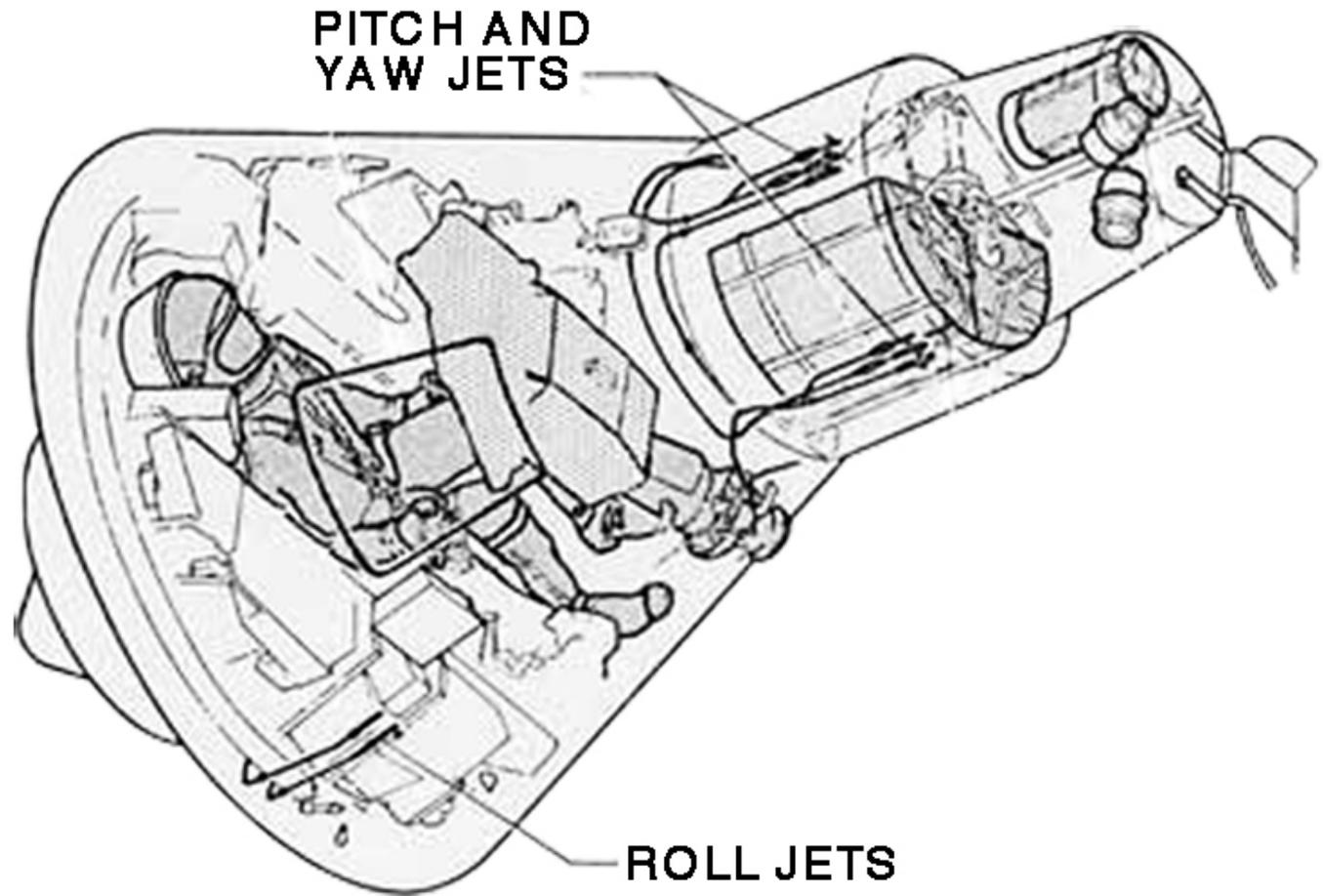






The intended beneficiaries of all this: the X-15s at the Flight Research Center, (1964).

A line drawing of the Mercury capsule showing the locations of the RCS thrusters.





NASA / Apollo 15

