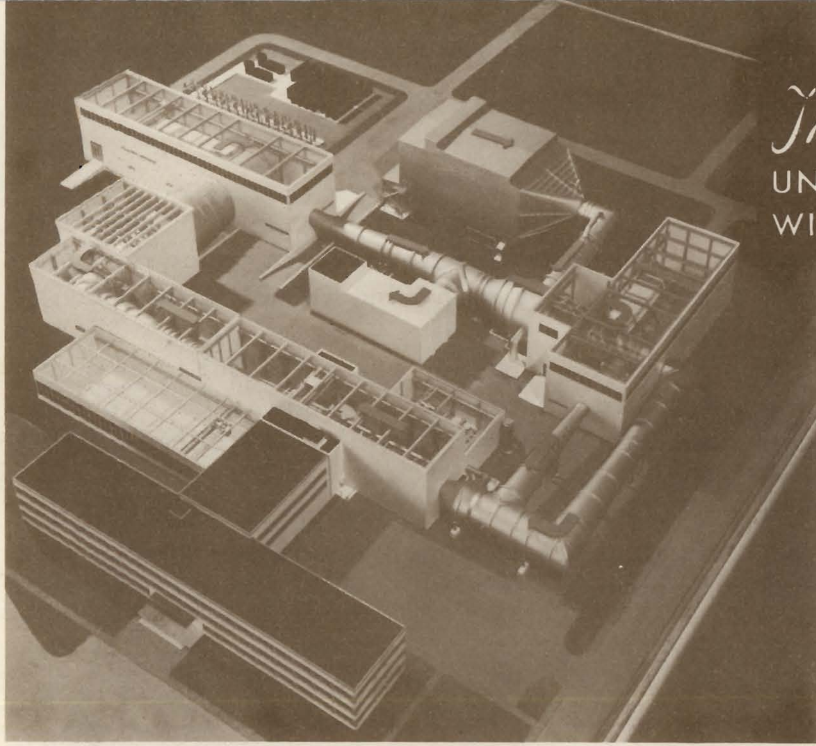


The Lewis UNITARY PLAN WIND TUNNEL

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LEWIS FLIGHT PROPULSION LABORATORY

CLEVELAND, OHIO

Welcome ....

The National Advisory Committee for Aeronautics welcomes you to its inspection of the Lewis Unitary Plan Wind Tunnel at the Lewis Flight Propulsion Laboratory.

This new facility is one more important research tool to help us deal with the complex problems of supersonic flight. The rapidity with which these problems are solved is determined to a large extent by the facilities available.

We value this opportunity to discuss this unique tunnel with you and we hope you will gain an understanding of its use as well as its importance to aviation progress.

Edward R Sharp.

Director

Lewis Flight Propulsion Laboratory

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LEWIS FLIGHT PROPULSION LABORATORY

Inspection of the Lewis Unitary Plan Wind Tunnel, May 22, 1956

Welcome - - - - - - - - - - - - -	Dr. Edward R. Sharp, Director, LFPL
"The Unitary Plan" - - - - - -	Dr. Hugh L. Dryden, Director, NACA
"Tools for Research" - - - -	Mr. Abe Silverstein, Assoc. Director, LFPL
"Creation of the Tunnel" - -	Mr. Eugene W. Wasielewski, Asst. Dir., LFPL
"Description of the Tunnel" -	Mr. Carl F. Schueller, Chief, Lewis Unitary Plan Tunnel Branch
Tour of the Facility - - - - -	Mr. Robert R. Godman, Asst. Chief, Supersonic Propulsion Division
Luncheon and Static Displays -	
"Operation of the Tunnel" - -	Mr. Robert R. Godman
"Data Processing" - - - - -	Mr. Elmer M. Sharp, Chief, Automatic Data Reduction Branch and Mrs. Kathleen B. Priem, Asst. Chief, Mechanized Computing and Analysis Branch

The NACA

The business of the National Advisory Committee for Aeronautics is research — scientific laboratory research in aeronautics.

Known to everyone in the aircraft and aviation industries as the NACA, this independent agency of the Federal Government was established by Congress in 1915 with instructions to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution," and to "direct and conduct research and experiments in aeronautics."

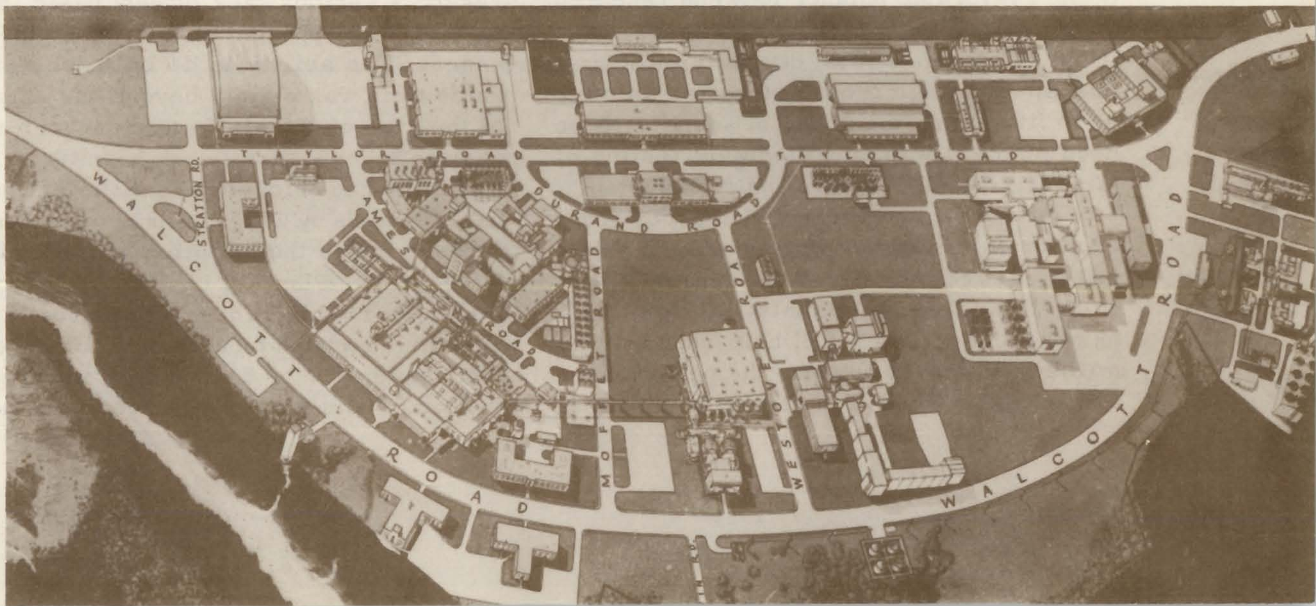
This the NACA does on a much bigger scale than was contemplated in 1915, when aviation was in its infancy. NACA has steadily grown into the world's greatest aeronautical research establishment - large, diversified, and geographically dispersed.

The NACA now operates three large research centers located in Virginia, Ohio, and California, and two field stations in Virginia and California. The United States Government has invested more than $300 million in the NACA's laboratories, buildings, and equipment.

The NACA staff now consists of about 7,500 men and women, all Civil Service employees. Nearly one third of them are professional scientists and engineers, more than one third are skilled trades and crafts workers of many different types, and the rest are technicians and other supporting personnel.

The Lewis Laboratory

The laboratory was authorized by Congress in 1940 and by May 1942 was making "quick fixes" on World War II piston-engine problems. It now employs 2700 persons at its 200-acre site and operates $130,000,000 worth of top caliber research facilities to explore new concepts in all phases of jet propulsion. Results of Lewis Laboratory research have greatly accelerated jet progress.



The Unitary Plan

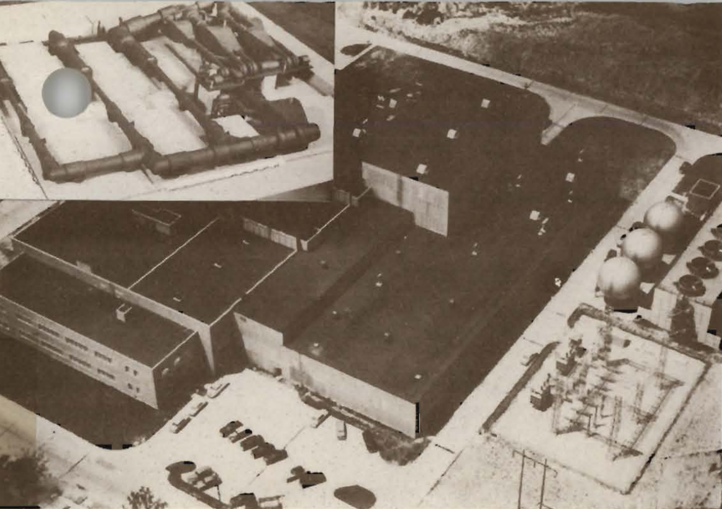
The three new facilities built by the NACA under the Unitary Plan, one at each major laboratory, at a total cost of $75,000,000, begin work this year. As they move toward full-capacity operation, other NACA facilities will be released for basic investigations and a more favorable balance between research and development will be achieved.

The new test facilities, designed for studies in a speed range from 500 miles an hour up to five times the speed of sound, will be used primarily for development testing of aircraft, missiles and propulsion systems.

In each of the new Unitary plants, designers of aircraft and engines will be able to obtain full measurements on both scale models and full-scale components, at high Mach numbers. Facilities will help industry and military designers advance the performance and reliability of aircraft now being developed and planned.

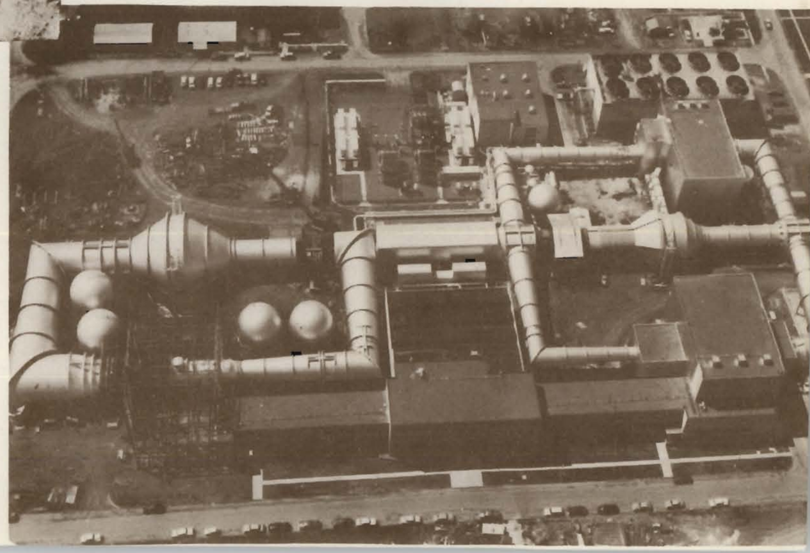
During World War II military needs laid heavy emphasis on development work and nearly all of the NACA's facilities put aside fundamental investigations to supply the more urgent demand. The inevitable result, a serious lack of new basic information, was apparent shortly after the war ended. The ability to do both jobs at the same time was plainly beyond the capacity of the size of the staff and research tools available.

Mature and informed assessment of the nation's needs by Congressional and scientific leaders led to the adoption of the Unitary Wind Tunnel Plan Act of 1949. In essence, the Act provided for a series of large, powerful new wind tunnels in which development testing can be done without interrupting the vital business of fundamental research.

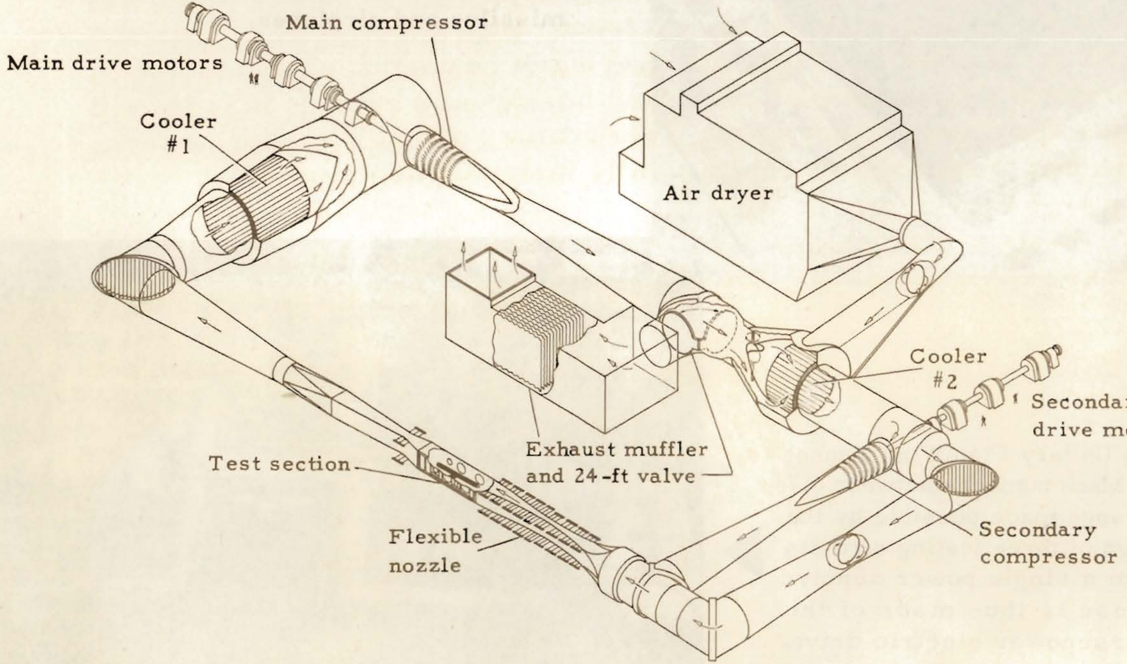


At the Langley Laboratory, a 4- by 4-foot tunnel is in operation in the range of Mach numbers between 1.2 and 5.0, on aerodynamic studies of missiles and airplanes.

The Ames Unitary Plan Wind Tunnel operates at Mach numbers between 0.7 and 3.5, a range made possible by the unique design of three testing circuits driven from a single power supply. Efficient use is thus made of the 180,000-horsepower electric drive motors.



The Lewis Unitary Plan Wind Tunnel ....

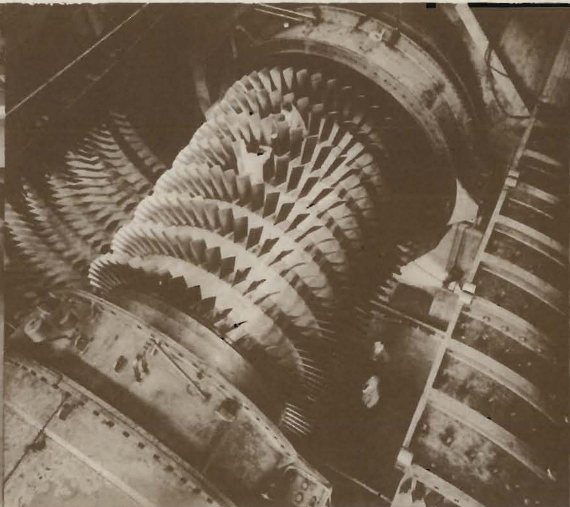


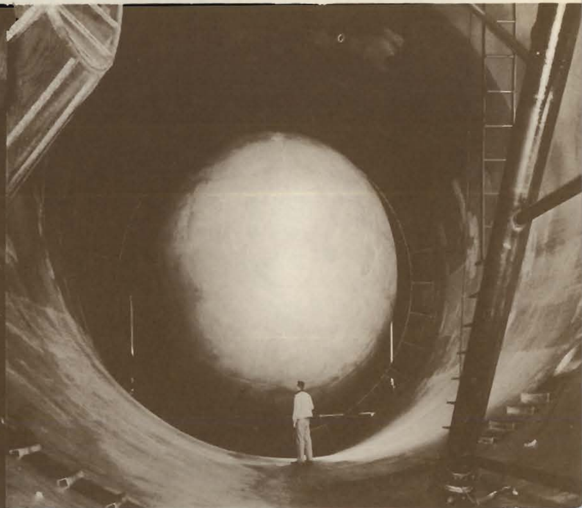
MAIN DRIVE

··········This newest NACA facility will be operated by NACA, for research and development in cooperation with industry and the military services.

Designed primarily for tests of high-performance propulsion systems, this large supersonic wind tunnel has features that provide a wide choice of test conditions. Full-size engines, and components as large as 5 feet in diameter, may be studied in the test section. Such problems as engine-inlet and outlet geometry, engine matching and interference effects, and over-all performance will be evaluated on carefully instrumented models.


TORS


MAIN COMPRESSOR

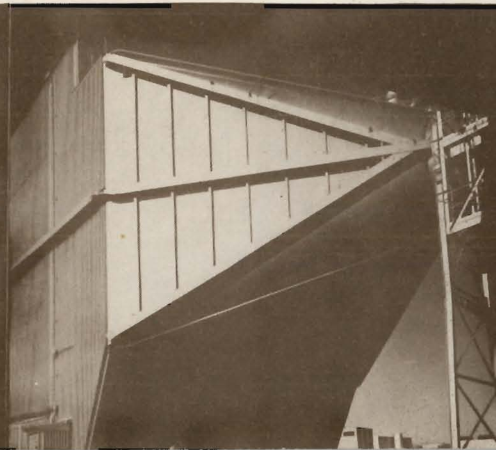

COOLER NO. 1

Main features: Seven electric drive motors in two banks, rated at 250,000 lip, can provide 300,000 lip total for limited periods.

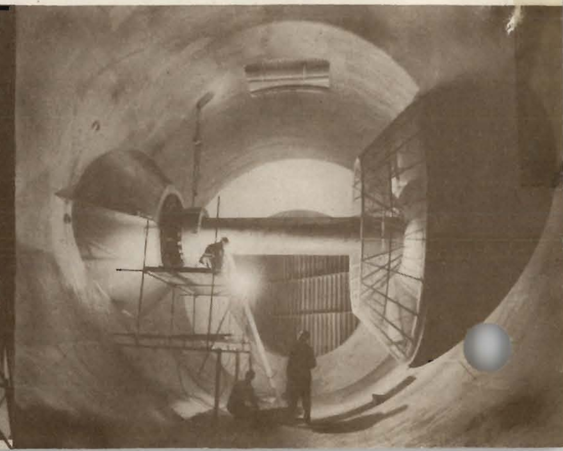
- Two multistage compressors handle up to a ton of air per second to produce air speeds ranging from Mach 2.0 to 3.5 in the 10- by 10-ft test section.
- Exhaust pumps can simulate test-section altitudes up to 150,000 feet.
- A 24-foot 2-position valve permits a choice of closed aerodynamic circuit or open circuit for tests of operating engines.
- An air dryer containing 1800 tons of activated alumina maintains better than - 40°F dewpoint for one hour on hot humid days or up to 10 hours on cold dry days.
- A stainless steel flexible-wall nozzle permits varying test-section airspeed during tunnel operation.
- A muffler reduces tunnel exhaust noises during propulsion cycle oper-

COOLER NO. 2

AIR DRYER



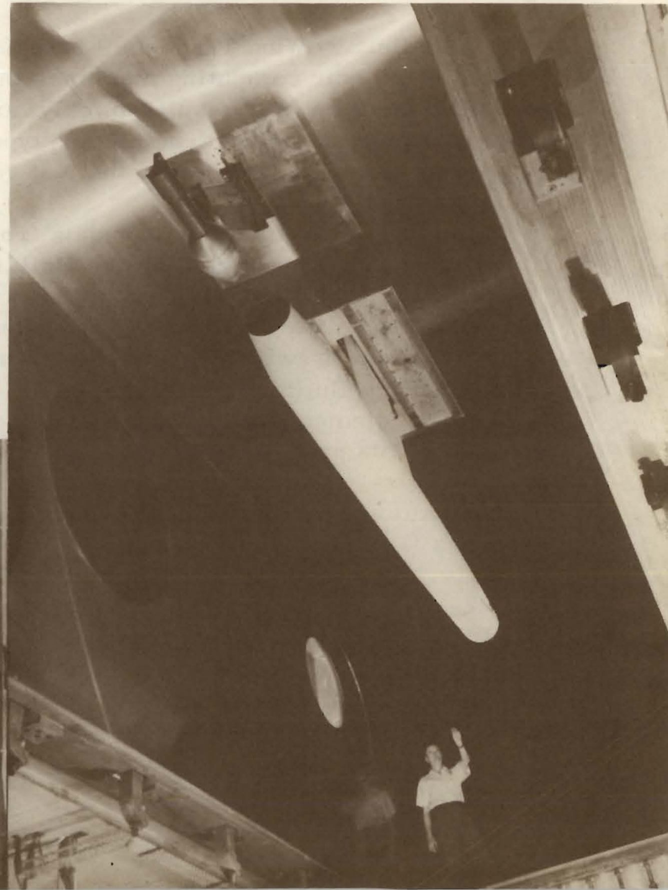
SECONDARY COMPRESSOR INLET



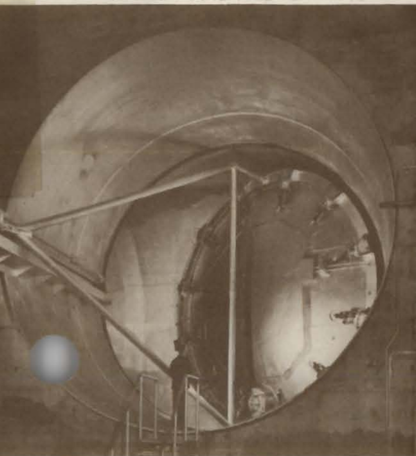
ation.

- Two huge coolers supplemented by direct water sprays cool engine exhaust and remove compressor heat input to maintain steady test-section temperature.
- The test-section floor serves as an elevator to bring models into the tunnel.
- A closed-circuit television system permits remote monitoring of tests.

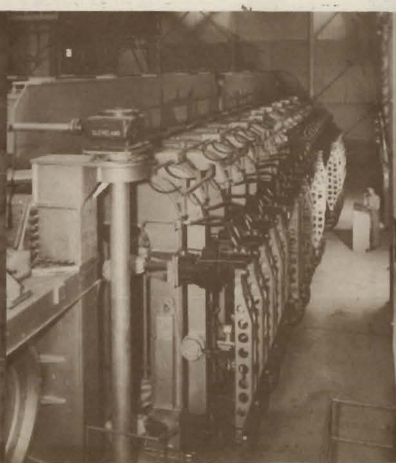
TEST SECTION



4-FT VALVE



FLEXIBLE THROAT



Central Automatic Data Processing System

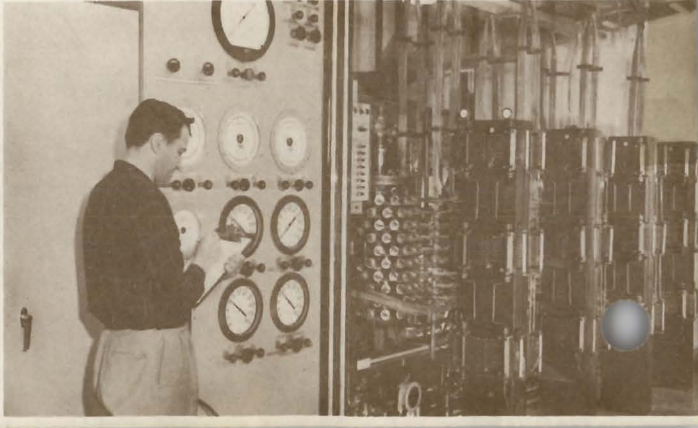
NACA's Unitary Wind Tunnels all have advanced electronic computing machines that calculate complex test results quickly, and present them to the project engineer on typewriter and curve plotters while the test run is in progress.

At Lewis great volumes of raw data from five major facilities including the Unitary Tunnel are transmitted on a 24-hour basis to the central automatic data processing system located in the Lewis Unitary Plan Wind Tunnel Office Building.

Essential elements of the laboratory-wide integrated data processing system are Automatic digital Potentiometers (ADP) and Digital Automatic Multiple Pressure Recorders (DAMPR) located at each major facility. These send data signals to the Central Automatic Digital Data Encoder (CADDE) where it may be stored, returned on typewriters or Facsimile Receivers as raw data to the control room of the originating facility, or fed into the ERA 1103 (UNIVAC) for final calculations of end results.

DIGITAL AUTOMATIC MULTIPLE PRESSURE RECORDER (DAMPR)

In ten seconds as many as 300 unknown test pressures can be converted at once to electrical signals by balancing individual pressure switches against these variable pressure reference tanks. The coded electrical signals are transmitted via telephone cables from this and similar installations at other major facilities to the central station (CADDE) where it is recorded in systematic digital form.



ERA 1103 (UNIVAC)

Raw data in the form of punched paper tape or magnetic tape from (CADDE) and other sources are accepted by this high-speed, electronic digital computer which calculates the end results of the test. Selected output may be typed out immediately and presented to the project engineer while complete detailed results may be stored on punched paper tape for later study.

CENTRAL AUTOMATIC DIGITAL DATA ENCODER (CADDE)

Major facilities at Lewis daily transmit as many as 80,000 separate test measurements concerning speed, thrust, fuel flow, temperature and other propulsion factors to these magnetic tape recorders. Selected data may then be returned directly to the control rooms or fed immediately into the electronic computor for further evaluation.

Principal Contractors and Suppliers ....

American Bridge Division, U.S. Steel Corp.
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