WING TIPS

Lewis Flight Propulsion Laboratory, NACA

Vol. XV Cleveland, Ohio, May 23, 1956 No. 11

LEWIS ANNOUNCES INITIAL OPERATION OF LUPA TUNNEL

Over 150 leading members of the community, the press and contractors were present at a demonstration of the Lewis Unitary Plan Wind Tunnel yesterday, May 22.

Now in the initial stage of operation, this newest NACA facility will be operated by the NACA for research and development in cooperation with industry.

For pictures of the tunnel, turn to pages 4 and 5.

NACA DIRECTOR RECEIVES HIGHEST BRITISH AERONAUTICAL HONOR

On Thursday, May 17th, Dr. Hugh L. Dryden became an Honorary Fellow of the Royal Aeronautical Society at the meeting of the Society in London. Dr. Dryden is the seventh American whose accomplishments in aeronautics have similarly been recognized by the Royal Aeronautical Society since 1920. The other Honorary Fellows are Dr. J. C. Hunsaker of the NACA in 1920; Major Lester D. Gardner in 1939; Dr. T. P. Wright in 1942; Dr. E. P. Warner in 1943; Dr. Theodore von Karmen in 1948 and Igor I. Sikorsky in 1955.

ATTENTION, ALL FORMER LANGLEY PEOPLE!

You are invited to join in the celebration at Langley on June 8, 1956. It's the Old Timer's Honor Night, celebrating the silver anniversary of the Full Scale Tunnel and Tank No. 1, and paying tribute to staff members who have received NACA meritorious service emblems during the past several years.

Two special awards will be made at this time. A giant "emerald"-encrusted NACA emblem will be presented to the Full Scale Tunnel and Tank No. 1 for twenty-five years meritorious service. The second award goes to the Lockheed-10 in recognition of fifteen years meritorious service. The affair will begin with a social hour, followed by a buffet dinner and an informal program.

Dr. H. J. E. Reid cordially invites you to join with them in renewing old acquaintances on this festive occasion. Reservations should be made with Irene Kives by May 30th.

WING TIPS, an official publication of the Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, Cleveland 11, Ohio, is published bi-weekly in the interest of Lewis employees. Send contributions to the Editor, 104 ERB, telephone 3284. Deadline: Thursday after pay day.

Editor.....Marjorie Hyre
Reporters.....NACA Employees

AS TIME GOES BY

Our fast-moving world has wrought many changes in the past 20 years. One of the latest (and amusing) changes is in the usually staid volume of Webster's New International Dictionary. A list of new words recently added to the American language (I doubt if the English would recognize some of these) reflects the changes in our social, political, medical and aeronautical fields.

The word Ball is now defined as "having a rousing good time." Cheesecake is "photography accenting display of a woman's legs." Webster also informs us that Black is now defined as "used with the; condition of showing a net profit; as it took four years to get into the black, contrasted with the red." Another new one is Mad money. This is "carfare carried by a girl on a date to provide a means of escaping her escort in the event of unwarranted familiarities." Here's one our conference participants will chuckle over; Panelist is defined as "a member of a panel participating in an entertainment program."

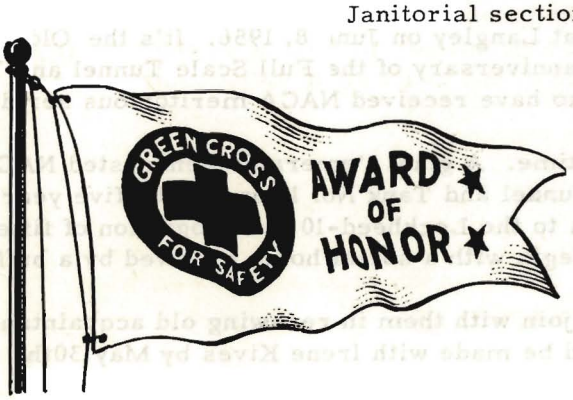
See what you're missing if you don't read the dictionary?

New Enrollees in the Home Life Insurance Program may pick up their contracts now at Jessie Sheward's office, 108-C, Ad Bldg.

Note of Thanks - I wish to thank the many NACA friends for their cards and flowers at the time of my husband's death. Mrs. August Wickman.

Four More Groups have maintained perfect safety records since January 1, 1953. Adding their names to the list of honor are the following:

1.	Research Equipment Bldg. Stockroom area	1234 days
2.	Supersonic Wind Tunnel 8x6 Foot Shop area	1234 days
3.	Technical Service Bldg. Machine shop	1234 days
4.	Utility Bldg. Janitorial section	1234 days



SINCE OUR LAST LOST-TIME ACCIDENT:

380 DAYS

5,199,742 MAN-HOURS

LOST-TIME ACCIDENTS IN 1955....1
LOST-TIME ACCIDENTS IN 1956....0

MAY 18, 1956

NACA LEWIS PROVIDES "CASUALTIES" IN MOCK "DISASTER"

Friday, May 11th, "disaster" occurred at Lewis Lab. An emergency first-aid station was set up in the hangar where twenty-five "casualties" were administered first-aid. The "injured" were tagged for identification, type of injury, and emergency treatment given, then transported via trucks and cars to Fairview Park Hospital.

The "disaster" and "casualties" were faked, but the intensive drill was not. Working in cooperation with hospital officials who were making a test of their mass disaster plan, Lewis Lab provided a variety of "casualties." The laboratory tied in its own civil defense and disaster plan with those of Fairview Park Hospital and the local Civil Defense.

When the hospital received the "disaster" call from NACA, it started its plan of action. Spare beds were set up in the auditorium of the hospital and as the "casualties" arrived, they were screened for type of injury and directed through the proper casualty flow routes. Realistic acting on the part of Lewis "casualties" resulted in two men actually being administered oxygen. A third, supposedly blinded by acid, walked into a wall when asked to move across the room.

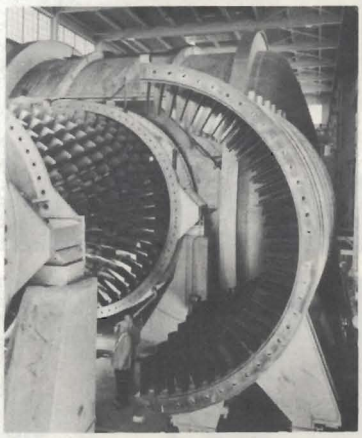
This extensive disaster-treatment drill is believed to be the first of its size ever held in a Cleveland hospital. Both hospital and Lewis observers were well satisfied with the results of the test. The few kinks that appeared in the handling of large numbers of casualties are now being corrected.

LOBBY LINES

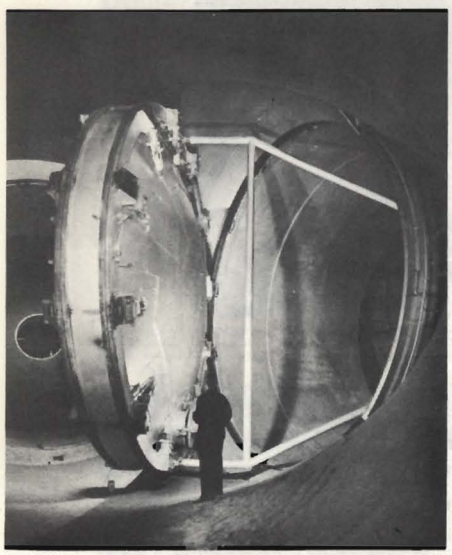
Dr. Dorothy Simon, formerly of F & C, visited Lewis Lab last Friday. Dorothy, now located in Connecticut, commented particularly on the high regard with which the NACA and its work is regarded in industry today.

LEWIS UNITARY PLAN

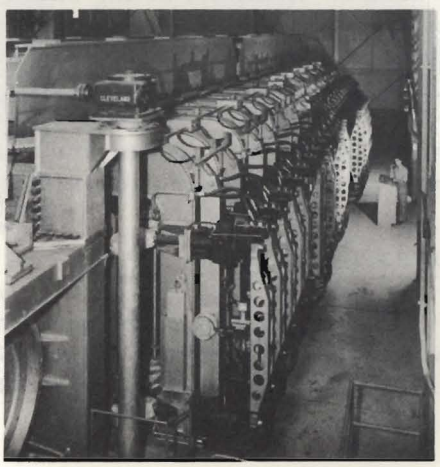
Control room of the tunnel, viewed from the adjacent observation-conference room. The tunnel diagram (top conter) provides a pictorial indication of the position of each of the major valves that control tunnel operation. Each of the 24-inch television monitors (near ceiling) can be connected to any of the three TV cameras that survey the tunnel.



The fully-bladed 8-stage main drive compressor, driven by 150,000 h.p. electric motors, prior to assembly of the stator halves. This compressor, with a pressure ratio of 2.8, is one of two that provide Mach 3.5 air speeds in the test section.

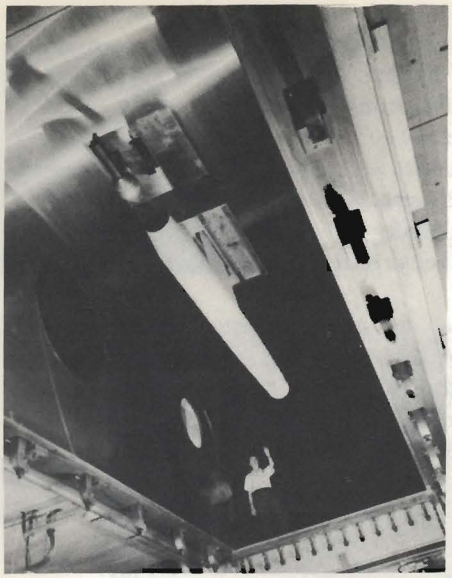


The 24-fool-diameter swinging valve shown is one of the key control elements of the tunnel. In one position, it seals off the tunnel exhaust, making the tunnel a closed circuit, which is used for aerodynamic testing of models. In its other position, the valve acts as a seal across the tunnel and leaves the tunnel exhaust open. This arrangement, used when combustion is to take place in an engine model, makes the tunnel a nonreturn type: all air going through the tunnel is taken from the atmosphere, and returned to the atmosphere after one pass through the tunnel.



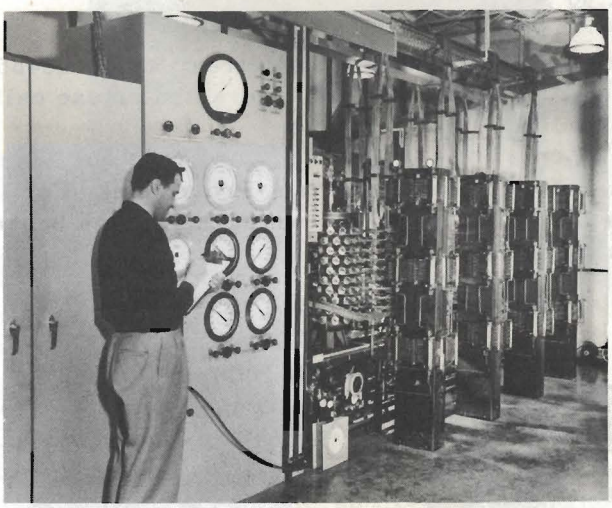
Hydraulic jacks flex the side walls of the nozzle of the tunnel. Size of the nozzle opening controls velocity of the air through the test section. Each of the side walls is a plate of stainless steel, 10 feet high, 76 feet long, and 1 3/8 inches thick; they are flexed in and out a maximum of 26 inches each.

WIND TUNNEL



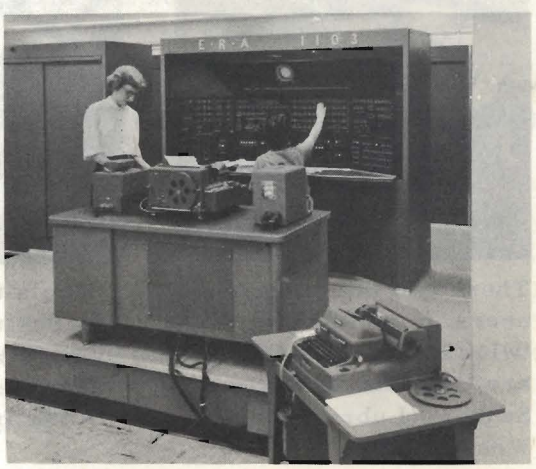
Aft view of a 16-inch ramjet in test position, seen through the floor opening of the tunnel. The body of revolution downstream of the ramjet nozzle is a movable plug, used to simulate the changes in internal flow that would take place during engine combustion.

Photo on the right shows the installation of a calibration rake. Precise determination of actual flow patterns in the tunnel increases the accuracy with which test-data can be interpreted.



Copper tubing conducts pressures from sensors in the tunnel to capsules mounted on a pressure tank (center). Electronic counting of the time required for the test pressure to balance a diaphragm in the capsule against gradually increasing tank pressure transmits the pressure data to the recording system.

Electronic digital computer of the tunnel, which receives decimal numbers from CADDE. The computer processes these readings and signals automatic typewriters in the control room, where computed values of selected parameters are typed 30 seconds after the data signal is sensed. Values of nonselected parameters are recorded on punched tape for later analysis.



15 YEAR PINS AWARDED

Franz L. Logerwell, Head of the Research Electrical Engineering Section, received his 15 year Meritorious Service Award last week. Joining the NACA at Langley on May 1, 1941, Franz transferred to Cleveland in December, 1941 with the AERL construction group. "It looked like an open prairie," is his comment. Franz was the electrical project engineer on the ERB, designing and installing the dynamometers in ERB test cells. He was graduated from the South Dakota State School of Mines and Technology in 1938 with a B.S. degree in Electrical Engineering.

Also wearing the 15 year lapel pin is Lloyd M. Wescott of the High Energy Fuels Lab. He was presented the Meritorious Service Award last week by Bruno Pinnow. Lloyd joined the NACA as a machinist at Langley Laboratory on April 30, 1941. In June of 1943 he transferred to Cleveland, where he has since been working as a flight propulsion mechanic.

COMING EVENTS

Line Up Your Babysitters Now for June 2! Yes, that's the night of NicNACA's big Farewell Fling. Dinner will be served at 6:30 p.m., dancing to Gene Beecher's music from 9:00 p.m. The deadline for obtaining tickets is Thursday, May 31st, so get them soon! Dinner & Dance, $3.00 per, Dance only, $1.50 per.

NACA Girls' Annual Retreat is planned for St. Joseph's Diocesan Retreat House, 18485 Lake Shore Blvd., over the weekend of June 22, 23, 24. All girls interested please call Gertrude McNeeley, 4194 or OL 1-4848.

Directing The CYO Minstrel Show is our own Jack Schneider (Plant Protection). For tickets call Don Vargo, 4238, for one of the May 27th performances at the Parma Schaaf School. $1.00 for adults, $.50 for children under 12.

WITH THE YOUNGSTERS

These two future engineers, 6 months old twins Milan and Marlin, are the sons of Max Swikert (Lubrication & Wear).

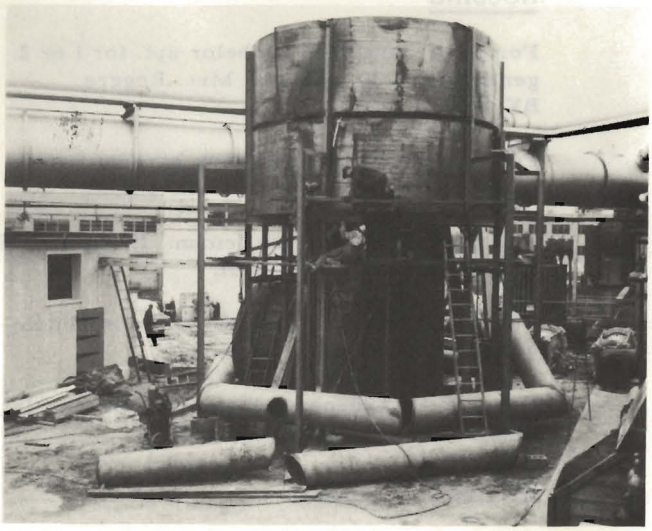
Who's the operator? He is Samuel Vincent, the year old son of Fern (formerly C&CA) and Anthony Diaguila(C&T).

Here are Kevin and Kendall, twin sons born to the Vernon Brauns' (Procurement) on March 28th.

WITH OUR SPEAKERS

Dr. Melvin Gerstein, Chief of the Lewis Lab's Chemistry Branch, traveled to Oslo, Norway on May 16 to attend a meeting of the Advisory Group of Aeronautical Research and Development (AGARD) of NATO. Dr. Gerstein is one of three U.S. members on the Combustion Panel of AGARD. The May meeting is devoted to discussions of ways and means of increasing the aeronautical research potential of NATO countries. A start has been made in this direction through the medium of symposia and technical publication. The exchange of students and young research scientists, as well as the joint use of certain specialized equipment, is under consideration.

Norman E. Pentz of Radiation Physics Section, will present two papers at the American Physical Society Meeting, June 21-23 in New Haven, Conn. His first paper is titled "The Groetzinger Effect In Germanium" by N. Pentz and J. Aron. The second is titled "Dielectric Behavior of Pile Irradiated Fused Quartz," by W. Tomasch and N. Pentz.



PREHEATER - 5 MONTHS LATER

In the December 9, 1955 issue, the preheater under construction on the West side of C & T Research Wing was pictured as little more than a hole in the ground.

For all you Sidewalk Superintendents who have been lax in your duties, here is last week's progress photo. The men are working on the heat exchange unit. The blower building is partially visible on the left.

The preheater will be used in conjunction with altitude test chambers SW-23 and SW-24. It will be capable of heating large quantities of combustion air for ram-jet and turbojet engines up to ram temperatures characteristic of high supersonic speeds.

ACTIVITIES LIST

Lewis Lab offers many and varied activities throughout the year for all staff members and their immediate families. For the benefit of new employees who are not yet acquainted with our activities, and for old employees who have lost touch through the years, Wing Tips lists here the activity and its representative to contact for further information.

American Legion, Post 696, George Yonek, 5281; Archery, Howard Witzke, 4190; Basketball, Paul Sirocky, 3231; Men's bowling, Mel Hartmann, 4174; Women's bowling, Tina Dimitry, 4245; Bridge, Stan Smith, 3159; Chess, Ralph Lewis, 4246; Dance band, Don Sandercock, 2140; Dance group, ballroom, Jeanette Koskee, 4230; Dance group, square, June Bahan, 5202; Film classics, Marj Hyre, 3284; Men's golf, John Delargy, 2194; Women's golf, Arlene Weaver, 2167; Llama Club, H. B. Bracy, 4152; NACAdets, Don Buckles; NicNACA, Don Mohr, 6219; Servicemen's Club, Al Muraco, 5109; Ski Club, Dick Schleicher, 2149; Softball, Nick Diaconis, 4241; Tennis, Virgil Sandborn, 4228.

FOR SALE

22½ hp Evinrude Speeditwin, early model with many spare parts. Sell or swap $45. Paul Stiglic, BO 2-6513.

12 inch console TV, $25. C. Crabs, VI 3-6108.

Muffler & tailpipe for 41-48 Ford or Mercury. 25-20 bolt action rifle, with or without telescope. G. Reading, BE 4-4478.

Revere 8 mm. movie camera f 1.9 lens & case. Revere projector & screen, $200 for all. 1950 DeSoto fordor. Mrs. A. Wickman, CL 1-7278.

8 pc. carved oak dining set, marble-top table & mirror, misc. chairs. A. Busch, ED 1-5111.

Remington 5 electric shaver, complete. Harry Oberst, JA 6-8414.

1950 Hudson tudor. Evans, LA 1-6084.

Crib, high chair, stroller, toilet seat, baby scales, tub & lamp. E. Samfield, TR 1-8383.

Parakeet breeders. Pucci, BE 4-7328.

1950 Chevrolet, $225. J. Gibbons, TR 1-1343.

Hallicrafters communication receiver $45. RME 10 & 6 meter converter $15. BC-453 (200-500 kc) Q-5'er $8. Eureka vacuum cleaner $5. Disposal unit mfg. by Mullins, $10. John Esterly, ED 1-6306.

Antique vases. Mrs. B. Glassner, LA 1-2012.

Kenmore gassspace heater 45000 BTU with blower $65. 2 yr. old male Beagle dog $10. H. Maslach, 5109 (no home phone).

Binoculars 8x30 with case($65 value). Girls' black patent shoes size 13½B, worn twice. Girls' black suede shoes 12½C. Al Rybicki, FL 1-5634.

Pedigreed male boxer, 4 yrs. old, $25. Dan Williams, RE 4-0089.

Universal wringer washer, 4 yrs. old, $30. B. Maple, TR 1-5880 after 6 pm.

78 rpm record albums, classical music, cheap. M. Tucker, WY 1-2848.

Service: Handsaws sharpened. Jancsek, AT 1-7803.

FOR SALE

Gas range, green livingroom suite, grey walnut dining room suite, baby crib & chest, child's swing set. S. Staats, Medina 2-4603.

Craftsman 8 inch tilt arbor saw with ½ hp motor. Molding head cutters, dado set. 30 inch woodlathe with 1/3 hp motor, complete set turning chisels, Shopmaster 18 inch jigsaw & motor. Craftsman air compressor with tank, hose, 2 spray guns. $225 cash takes all. L. Jancsek Sr., AT 1-7803.

Boys' 16 inch bicycle $10. D. Lee, AD 5-2227.

4 sets pinless curtain stretchers. G. Pesman, OR 1-2263.

WANTED

Starting set of mens' golf clubs. Len Robins, FL 1-8608.

Boys' 20 inch bike. Cochran, CL 1-3765.

HOUSING

For rent: furnished bachelor apt. for 1 or 2 gentlemen, $20. per wk. Mrs. Rogers, BE 4-6282.

For rent: unfurnished apt. & garage, 5 min. from lab. Mrs. E. Grimm, RE 4-0351.

For rent: room for gentleman. 1542 Roycroft, Lkwd. F. Clotz, LA 1-0051.

For sale: 5 room Briarcliff home in Middleburg Hts. R. Rutley, BE 4-1225.

For sale: 3 bedroom bungalow in Berea. 1-1/2 story. Mrs. E. Smith, BE 4-4154.

TRANSPORTATION

Join or form combo from vicinity Memphis & Ridge Rds. Len Robins, 5265.

Ride wanted from vicinity Dover Center & Center Ridge Rds. Ed Samfield, 3231.

FOUND

White chiffon scarf, in Photo Lab. Claim at Teletype room, Ad Bldg.

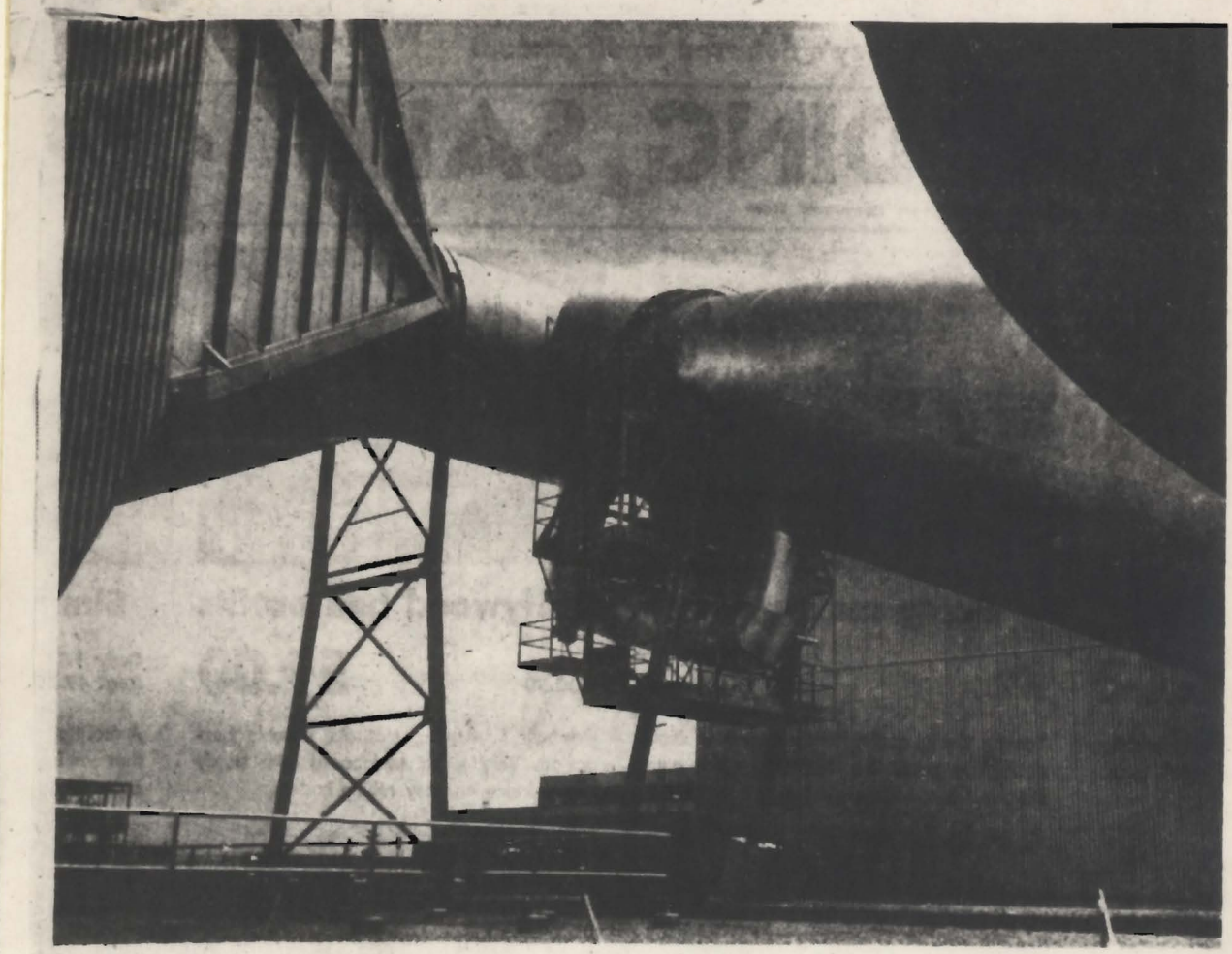
Mexican silver thunderbird pendant, outside ERB. Claim at Lost & Found, Teletype Rm.

All-a-Glitter is Marge O'Connell (Flight Problems) who received her diamond over the windy week-end from Ralph J. Melda. The wedding is planned for next year....The Bells Will Ring on June 2 for Jim Carlton (C&T) when he weds Julianna Breitenback....Leaving For The Home Front is Joanne Kramer (C&T computing)and June Rini (8x6 computing)....New Arrival is Cheryl, 3rd daughter of Martin Brown (Photo Lab) She was born May 10th....Visiting her son George in Topfield, Mass. is Mary Northrup (Print Shop)....Back To College go Edward Bittner & Paul Holowczak of C&T computing. Co-op students, they attend Fenn College and will return to NACA in three months.

CLEVELAND PLAIN DEALER
May 27, 1956

"If Wilbur and Orville Could Only See Us Now!"

Cleveland Press - 5/22/56



WINDS 30 TIMES STRONGER than the destructive gale that whipped westerly suburbs are blasted through these giant tubes and passages from the air intake section (left), into the supersonic throat of the Air Lab's new wind tunnel at Cleveland Hopkins Airport.

New Wind Tunnel Here to Aid Jet Research

By CHARLES TRACY, *Aviation Editor*

Jet engine conditions at supersonic speeds and altitudes of 160,000 feet can be duplicated on the ground here in a new wind tunnel at the Air Lab on Cleveland Hopkins Airport.

It was exhibited today in the first public inspection for representatives of the press and aviation industry.

The tunnel's 250,000 horsepower electric-motor drive is the most powerful of its kind in the world.

Air speeds within the tunnel's test section can range from 1300 to 2000 mph at high altitudes. Tests of ramjet and turbo jet engines for planes that will fly five to 10 years from now are made in the tunnel.

Power plants for intercontinental missiles also can be studied in the new facility. It will take test models up to five feet in diameter.

The tunnel cost 33 million dollars, is one of three different types built by the National Advisory Committee for Aeronautics in the Unitary Plan wind tunnel development for which Congress approved 75 million dollars.

Main features of the new tunnel are:

TWO COMPRESSORS that handle a ton of air per second.

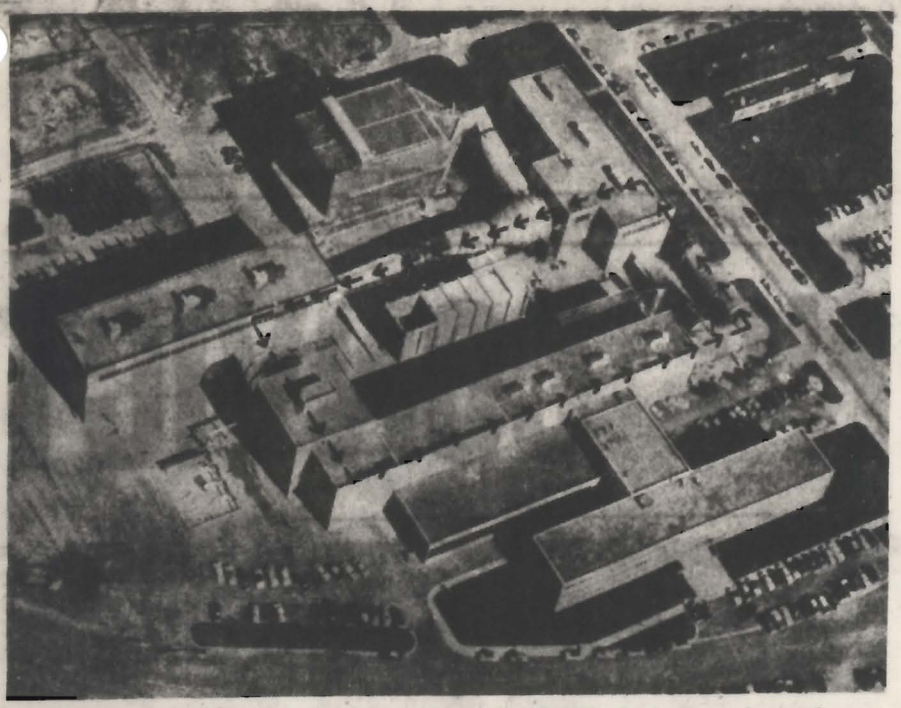
SEVEN ELECTRIC motors in two banks developing a total of 250,000 hp.

A STAINLESS steel flexible-wall nozzle that controls air flow and permits change of speed during operation. Walls are 1½ inches in thickness, moved by a series of hydraulic jacks.

AN AIR DRYER that can remove 15,000 gallons of water or enough to fill a community size swimming pool.

A NOISE-REDUCING exhaust muffler that quiets the operation so much neighbors weren't aware the tunnel was operated for the first time last Thursday night.

A CLOSED-CIRCUIT television for watching tests in progress.



Aerial view of the new wind tunnel at the NACA laboratory here shows tunnel sections and the scientific and service buildings connected to the new installation. The dotted line shows wind flow through the tunnel route and control buildings.

One of several control panels at the new wind tunnel is manned during an engine test by Robert C. Finke of 1325 W. 116th St. (left), and Phil Blumenthal of 985 Thornhill Rd.

$33 Million Wind Tunnel Is Unveiled at Air Lab

BY GEORGE GHETIA
News Aviation Editor

The nation's aviation interest today was centered on Cleveland-Hopkins Airport, where Lewis Flight Propulsion Laboratory officials unveiled one of the most powerful and versatile wind tunnels in the world.

Engineers and scientists looked to new horizons in speed and altitude with the opening of the $32,856,000 facility. There is nothing like it in the entire free world.

On the surface, the tunnel could be described as a giant electric fan. In detail, the complexities of construction and operation represent more than four years of intensive planning and research.

Helped Develop F-104

A smaller tunnel at the NACA laboratory on Brookpark Rd. has already given the nation dividends in security and aviation leadership. Design data from the six-by-eight tunnel played a vital part in development of the new F-104 fighter that slices through space at more than 1,000 miles per hour.

The new ten-by-ten-foot tunnel opens infinitely broader opportunities for wresting aeronautical secrets from space.

Although firmly anchored to the earth, the tunnel can create conditions encountered 160,000 feet above the ground at speeds in excess of 1,500 miles an hour.

Housing the most powerful electric drive motor in the world, the tunnel's power and wind section can easily reach speeds of 1,800 miles an hour.

Power used to operate the tunnel could meet the electricity needs of the entire city of Cleveland on an average day.

Dries Air

To dry the air used in the 1,180-foot tunnel a special building housing 32 nozzles which blast natural gas into a baffle and dehumidifying system. It has the capacity of 12,000 home laundry dryers.

The dryer heating system could satisfy the winter time needs of a city the size of Berea.

To dissipate heat created by engines and friction of racing air, the tunnel is coupled to a cooling tower engineered to provide capacity equal to 250,000 household air conditioners.

Control valves enable NACA engineers to make the air circulate through the tunnel continuously or exhaust it into the atmosphere. The exhaust muffler is a huge building in itself.

According to Dr. Edward R. Sharp, director of the laboratory, the new tunnel was designed for work on the problems of turbojet and ramjet engines.

The dimensions of the tunnel will enable engineers to test actual engines rather than running tests on scale models.

The test section of the tunnel has stainless steel walls more than an inch thick made of plates ten feet wide and 78 feet long. It is believed they are the largest in the world.

Flexible Walls

The test walls are flexible, permitting adjustment to vary wind speed past engines being tested. Though the walls weigh 20 tons each, they can be positioned with an accuracy of one five-thousandth of an inch.

To process the data obtained from tunnel tests, a special electronic computer was designed by Sperry Rand Corp. Called the Univac-Scientific 1103 Computer, the device is completely automatic and almost instantaneous.

Where computations once required three weeks or more, the new computer is capable of gaining results within 30 seconds of completion of a test.

"The computer was initiated when we realized there weren't enough people with skill and temperament to do the volume of work required," Dr. Sharp said.

Need for Data Increases

"Our need for data is ever increasing and delays in processing data are costly. Through the use of electronic aids and automation delays can be reduced or eliminated."

At the wind tunnel preview today, a ramjet engine was operated for guests representing government and industry. Engine performance was registered on tapes, graphs and visible on a closed circuit television system within the tunnel.

The installation will be called the Unitary Plan Supersonic Wind Tunnel after the "Unitary Act" passed by Congress authoriting funds.

The tunnel is operated and staffed by NACA employees living in this area. Facilities are available for use by industry, the armed forces and other agencies interested in aeronautical engineering. Business firms pay full costs for use on projects.

Flight Lab Blows Up Its Own Storm

Gargantuan facts about its iant new wind tunnel were isclosed at the Lewis Flight 'ropulsion Laboratory yesterday with the first public showing of the 33-million-dollar 'electric fan."

The tunnel is for research on aircraft and missile engines to produce speeds up to 2,400 miles an hour at altitudes up to 30,000 miles.

The electricity bill for the tunnel alone will run more than one million dollars a year.

Heat generated by operating the tunnel and engines being tested has to be overcome by cooling equipment equal to 250,000 average household air conditioners.

Air Dryer

It has a giant air dryer that takes water out of the air at the rate of 1.5 tons, or 10 bathtubs full, every minute. This is about equal to the capacity of 12.000 household dryers.

Heat for the dryer comes from 32 natural gas burners, blown by eight 200-horsepower fans. The heating system is large enough to satisfy the wintertime needs of a city the size of Berea.

The tunnel's electric-motor drive—there are seven motors in two banks—develops a normal 250,000 horsepower, with 300,000 horsepower available for limited periods. It is the most powerful system of its kind in the world. Electricity consumed could light more than 700,000 homes.

Walls of Steel

The test section of the tunnel is only 10 feet wide, 10 feet high and 40 feet long. This section has stainless steel walls nearly 1½ inches thick.

The walls are flexible and can be moved to vary the size of the tunnel's "throat." Changing the throat varies the air speed inside. The throat can be squeezed to less than a foot wide and opened to nearly six feet wide.

Although the walls weigh 20 tons each, they can be positioned with an accuracy of .005 inch.

Jet Tested

First-day visitors saw, via television screens in a remote control room, a ram-jet engine tested under conditions approximating a speed of 1,700 miles an hour and at an altitude of 80,000 feet.

Dr. Edward P. Sharp, director of the Lewis lab, pointed out that the tunnel would speed the development of new engines.

Some 200 scientists, engineers, mechanics and other personnel will be assigned to the new facility. Total employment at the lab runs about 2,700.

WASHINGTON STAR
May 22, 1956

Big Tunnel Thrusts Wind At 1,800 Miles an Hour

By CHARLES J. YARBROUGH
Star Staff Correspondent

CLEVELAND, May 22.—A multi-million dollar wind, caged for aeronautical research, roared in one spot on Cleveland's outskirts today at the unveiling of the most powerful wind tunnel of its kind in the world.

The National Advisory Committee for Aeronautics, Government's prime air research agency, gave the first public showing of the Lewis Flight Propulsion Laboratory Tunnel. Here the wind roars in excess of 1,800 miles an hour at simulated altitudes up to 160,000 feet.

The tunnel's 250,000 horsepower electric motor drive runs only at night to prevent overloading of Cleveland's electric power capacity.

It was a project similar to this that enabled young Richard T. Whitcombe of the NACA to develop the so-called "area rule" that boosted the speed of the new century series fighter planes by 25 per cent and kick them past supersonic speed even in climbing.

The Lewis supersonic tunnel is one of three completed under the unitary plan legislation passed by Congress in 1949. The other two are now operating at Langley, Va., and at Moffett Field, Calif., at a total cost of $75 million.

Great value of the Lewis tunnel here, according to Dr. Edward R. Sharp, laboratory director, lies in the problems presented by turbojet and ramjet engines at extreme altitudes and speeds. He said engines and components as large as 5 feet in diameter may be studied in the 10-foot square section.

"There is ample evidence," he said, "that the rate of development of modern engines is influenced very strongly by the facilities available for testing them at full scale." Some models are used, however.

In operation, the tunnel draws air through a dryer into the test section where the model or engine is mounted. For speeds over twice that of sound, the two compressors are operated together. The dryer is equivalent to 12,000 like the one in your laundry room.

WASHINGTON DAILY NEWS
May 23, 1956

New Wind Tunnel Tests 2400 MPH Flights

CLEVELAND, Maq 23—Any plane or missile of the future can be given a test flight in the world's most advanced wind tunned that has now started to roar here at the National Advisory Committee for Aeronautics Lewis Flight Propulsion Laboratory.

It is a $33 million research plant that can test engine, rocket planes and other flying structures at up to 2400 miles per hour, and under conditions equivalent to as much as 100,000 feet altitude.

It can test full-scale jet engines in full operation.

WASHINGTON POST
May 23, 1956

$33 Million Wind Tunnel Unveiled

CLEVELAND, May 22 (AP)—A huge wind tunnel for research on aircraft engines that must produce speeds up to 2400 miles an hour—and reach altitudes up to 30 miles—was opened for its first public showing today by the National Advisory Committee for Aeronautics.

The main test section of the breezy monster is 10 feet square and 40 feet long—big enough to house jet engines 5 feet in diameter, much larger than any airplane engines yet in use.

It is the largest wind tunnel to be built for the simulation of supersonic speeds and cost $32,856,000.

WASHINGTON STAR
May 24, 1956

STAR 5-24-56

Experts Seek 'Silencer' For Coming Jet Planes

By CHARLES YARBROUGH
Star Staff Correspondent

CLEVELAND, May 23.—Ear-splitting sounds from wind tunnel jet engine testing which once had the neighborhood dogs whining and their owners complaining, has been silenced.

Experience gained is now being applied to research seeking a mute for the engines of commercial jet transports due in the skies in two years.

Scientists and engineers of the National Advisory Committee for Aeronautics, the Government's top aeronautical research agency, have a full speed program going in the noise abatement department.

Best example of progress was shown here yesterday during the first public showing of the new 250,000-horsepower wind tunnel at the NACA's Lewis Flight Propulsion laboratory at Cleveland airport.

'Baffles' Muffle Sound

A workman carrying a screaming, 100-decibel hand siren entered a series of floor-to-ceiling baffles, walked 20 feet and the sound faded to a level that couldn't be discerned unless you were actually trying to hear it.

The baffles, which literally beat the sound to death in 20 feet, are at one end of the wind tunnel where jet engines and ram jets are tested. The tunnel is the largest of its kind in the world.

A few years ago, during initial night tests in a smaller tunnel, officials of the NACA project here were aroused from their beds by indignant telephone calls from residents as far as 5 miles from the laboratory at Cleveland Airport.

One official told it this way, still painfully:

"We were running night tests on a ram jet and complaints had been rising."

Sound Is "Felt"

"The sound was a pulsating condition more felt than heard. One night it became so bad my mother-in-law awakened me and insisted that something was wrong with the furnace. She wouldn't even go back to sleep until I admitted that it was noise from the wind tunnel tests."

That complaint was eloquent.

The NACA then spent some $400,000 to build a sound dampening series of baffles and profited by the experience in the construction of this new $37 million tunnel exhibited yesterday. The new muffler cost a lot less and was built on NACA design.

Obviously, the engineers point out, you can't apply the same principle to commercial jet engines—or military jets for that matter. Any obstruction at the exit end of the jet engine reduces power.

Source of Noise Tackled

Any attempts to deaden the full sound of a happy jet on take-off below the decibels of complaining neighbors would leave the airplane on the ground.

But what the researchers are doing here, with the full experience and knowledge of commercial jet aircraft manufacturers, is to tackle the sound at its source.

"We are making new discoveries on jet engine sound by researching the fundamentals of noise itself," one authority said. "We have done extensive research in the region where the noise actually is formed a few feet downstream from the exit."

Best solution so far advanced and one on which the manufacturers are placing some hope, is the corrugated nozzle, or exit, of the jet pipe which tends to dissipate the noise to at least the decibels of current propeller-type aircraft.

THE NEW YORK TIMES
May 23, 1956

GIANT WIND TUNNEL OPENED IN OHIO

CLEVELAND, May 22 (AP)—A huge wind tunnel for research on aircraft engines had its first public showing today. The engines must produce speeds up to 2,400 miles an hour and reach altitudes up to thirty miles.

The main test section is ten feet square and forty feet long. This is big enough to house jet engines five feet in diameter, or much larger than any plane engines yet in use.

It is the largest wind tunnel to be built for the simulation of supersonic speeds. The cost is $32,856,000.

Dr. Hugh L. Dryden, director of the National Advisory Committee for Aeronautics, said that when funds were appropriated for the project, six years ago, many persons considered it foolish to talk about supersonic speeds.

It will be only another five years before planes appear that are based on information gained from the new tunnel, he added.

Dr. Edward R. Sharp, director of the N. A. C. A.'s flight propulsion laboratory, said the main purpose of the tunnel would be to investigate such problems as engine inlets and outlets, the delicate matching of parts and the determination of interference and "drag" effects.

He said there was ample evidence that the development rate for engines could be speeded greatly by testing them at full scale instead of in miniature, as has been done in the past.

THE NEW YORK TIMES
June 10, 1956

WIND TUNNEL OPENED

New Device Tests Planes and Missiles of Future

CLEVELAND—(Science Service)—Any kind of airplane or missile of the future can be given a test flight in the world's most advanced wind tunnel, which has been put into operation here at the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics.

It is a $33,000,000 research plant that can test engines, rockets, airplanes and other flying structures at up to 2,400 miles an hour, and under conditions equivalent to as much as 100,000 feet altitude.

Its ten-foot-square test area can test jet engines in full operation.

Missiles and airplanes that will start flying five years from now are being developed fundamentally in the new wind tunnel. It took five years to build the great testing device, for which plans were first made as much as twelve years ago.

NACA Unveils $33-Million Windtunnel

Cleveland facility permits testing of ramjets and turbojets at speeds to Mach 3.5 altitudes up to 160,000 ft.

By JOSEPH S. MURPHY

CLEVELAND—The nation's research capability was given a $33-million boost up to speeds of Mach 3.5 and altitudes of 160,000 feet here when National Advisory Committee for Aeronautics unveiled its newest windtunnel.

The facility is a 10-by-10 foot "Unitary Plan" supersonic tunnel at NACA's Lewis Flight Propulsion Laboratory. Already in operation since mid-May, it permits aeronautical engineers, to prove out, for the first time, the design of complete engine and nacelle combinations for future high-speed aircraft.

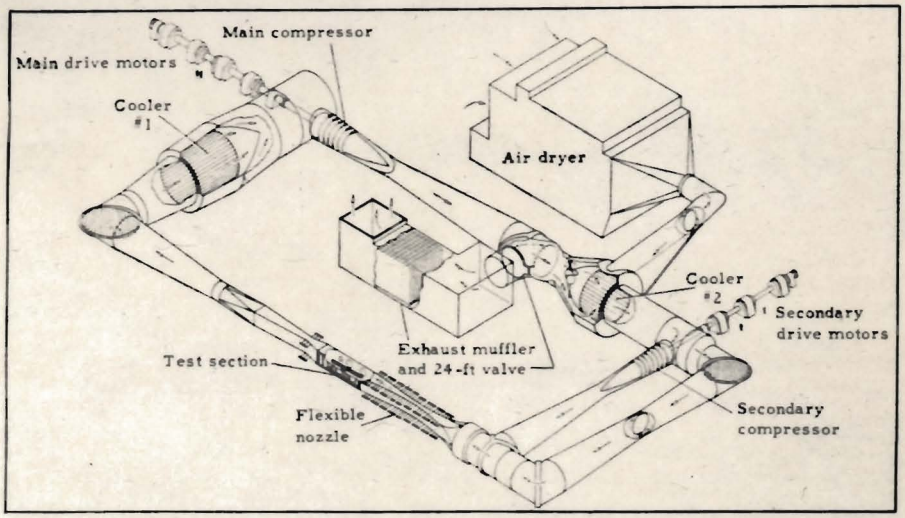
Testing with the new facility got under way last month with hot burning trials on a 16-inch diameter ramjet engine. Among models to follow are a 19-inch diameter "cold" ramjet (for engine inlet research) and a 28-inch operating ramjet, also for "hot" tests. Lewis officials said the test schedule for the new tunnel is already booked 15 months ahead and will include such newer jet engines as the General Electric J79 in addition to ramjets.

• **Operating range** of the facility extends from Mach 2 to 3.5, making it an ideal research tool for both turbojets and ramjets. The former, although in the past considered efficient only to speeds up to Mach 1.5, have now broadened their potential into the complete range between Mach 2 and 3. Similarly, the role of the ramjet gains momentum in this same speed range, giving the new NACA tunnel a dual purpose in life.

This so-called "Unitary Plan" tunnel is the last of a trio authorized by Congress in 1949 at a cost of $75 million. The others, already in operation, are a 6-by-6 foot model at Langley Aeronautical Laboratory, Virginia and an 8-by-8 foot tunnel at Ames Aeronautical Laboratory, California. Their costs were $15,000,000 and $27,000,000.

Whereas the Langley and Ames tunnels are intended for aerodynamic testing, the Lewis installation is more versatile. It can be used either in closed circuit for aerodynamic tests or on an open-end cycle for combustion propulsion research. Simulated altitudes can be varied from 49,000 to 160,000 ft. in closed-circuit tests and from 56,000 to 87,000 ft. in open-end runs.

High speed airflow for the new Lewis tunnel is produced by two compressors, a main compressor used alone for test speeds from Mach 2 to 2.5 and a secondary compressor which combines with the main unit to handle speeds up to Mach 3.5.



Overall layout of NACA's new 10-by-10 ft. supersonic test facility capable of testing full-scale turbojets and ramjets to speeds of Mach 3.5, altitudes of 160,000 feet.

• **The main compressor** is an 8-stage unit of 20-foot inlet diameter driven by four General Electric 37,500-horsepower induction motors mounted in tandem on a 40 in. diameter, 108 ft. shaft. The secondary compressor has ten stages, a 15-foot inlet diameter, and is powered by three G.E. 33,334-hp motors.

Tunnel airflow is brought up to supersonic speeds at the entrance to the test section by flexible wall nozzle containing some 125 tons of stainless steel. Wall construction consists of 1⅜ in. thick stainless sheet 10 ft. wide and 78 ft. long. Nozzle throat can be varied from 0.933 ft. to 5.92 ft. and positioned to an accuracy of .005 in. A bank of 27 screw jacks move each of the 20-ton wall sections a maximum of 2.5 ft. and the change from maximum to minimum opening takes 25 minutes.

Other major tunnel components include:

• An 82-foot high air dryer that houses 1,900 tons of activated alumina to dry incoming air to a dew point of —40°F. It absorbs water at the rate of 1.5 tons per minute, which NACA says equals the drying power of 12,000 household clothes dryers.

• A 900-million BTU-per-hour cooler that dissipates heat generated by the tunnel and test articles. It maintains constant tunnel temperature at 120°F.

• Altitude simulation provided by two exhausters located near flexible nozzle (see sketch). Each unit is rated at 2,000 hp, is of 8-cylinder design with a 40-inch diameter and 14-inch stroke.

• A Schlieren optical system that "observes" and photographs airflows. A closed-circuit television system permits control-room technicians to monitor flow conditions while a test progresses.

• A Remington Rand Central Automatic Digital Data Encoder (Cadde) that speeds the processing of test results. Through a system of recording on magnetic tape, reprinting on paper tape via automatic typewriters in the control room, and conversion to graphic form by automatic plotters, NACA expects test computations will be available within 30 seconds after a reading is taken. This compares with delays of as much as three weeks for similar data using past methods.

Individually, the test speeds and altitudes possible with the Lewis tunnel are not entirely new to NACA. Past propulsion tests using pressure tanks, either by direct engine coupling or the free-jet approach, have made such research possible.

What the new facility brings to NACA, however, is the ability to go a step beyond these past devices. It not only has the high-speed, high-altitude potential, but adds the capability of testing full-scale engines up to five feet in diameter. And it does this while permitting full reproduction of engine/aircraft mating effects, a factor of rapidly mounting importance in researching tomorrow's aircraft. ◆◆◆

In Research

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Biggest Supersonic Wind Tunnel Studies Tomorrow's Plane Problems

A new $33-million supersonic wind tunnel in Cleveland will duplicate air speeds from two to three-and-a-half times the speed of sound for engines and engine parts as large as 5 ft. in diameter. The tunnel, largest of its kind in the U.S., was designed for research on airplane engines of the future, and is part of the National Advisory Committee for Aeronautic's Lewis Flight Propulsion Laboratory at the Cleveland Airport.

The tunnel's electric motor drive in developing 250,000 hp. is the most powerful in the world, according to Dr. Edward R. Sharp, director of the airport.

Initially, the Cleveland tunnel will work on turbojet and ram-jet problems, but NACA also is looking ahead. That means that although most research problems will be run under conditions of 10-mile altitudes (the usual operating altitude of current jet planes) they will also be duplicated under conditions simulating those up to 30 miles above the earth's surface.

• • •

Heat-Test Facilities Pave Way For New Hypersonic Missiles

New equipment for testing component parts under extreme heat is the latest contribution of McDonnell Aircraft Corp. to the development of guided missiles.

At the company's heat-test research units in St. Louis, Mo., **a missile 15 ft. long and 3 ft. in diameter can be tested at temperatures up to 1,000F, and smaller structures can be tested at heats up to 1,500F.**

McDonnell engineers tried various means of raising temperature at a desired rate of 15F a second. The method finally adopted is a radiant heat system using quartz lamps and heat reflectors. This system allows wide flexibility, according to McDonnell, because the number of lamps used and the distance between the missile and the lamps can be adjusted to obtain a higher or lower rate of heating.

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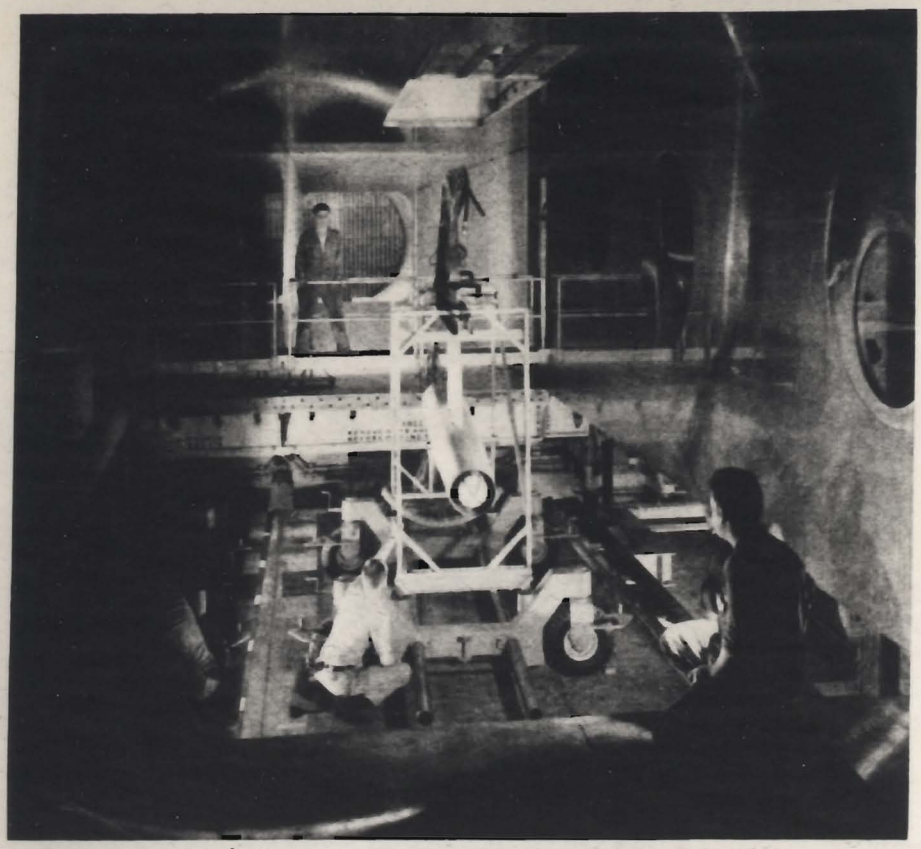
Bureau of Mines Tells Coal Men To Step Up Bituminous Research

In a 52-page report released last week, the Bureau of Mines—cooperating with the Bituminous Coal Institute—urges more independent coal research.

Concerned over the fact that most foreign countries—which are tied economically closer to coal than is the U.S.—are way ahead of the U.S. in coal research, **the bureau specifies 209 projects that need immediate attention.**

Included are more research on (1) nuclear gasification of coal; (2) polymers, wetting agents, and the use of sonics and ultrasonics to improve flocculation and mechanical drying; (3) behavior of coal minerals at high temperatures; (4) new uses for fly ash; and (5) low temperature carbonization.



RAMJET model being raised into test position by elevator-floor in Lewis tunnel. Note reflections in highly-polished corrosion-resistant steel wall at left.

Supersonic Bomber Engine First Lewis Tunnel Turbojet Project

Cleveland—Lewis Flight Propulsion Laboratory's advanced 10 x 10 ft. test section propulsion tunnel is officially open for business, NACA officials announced last week.

First turbojet project will be a check in mid-June on an inlet-engine system for a future bomber. This will be the first time a high performance aircraft propulsion system has been fully simulated on the ground before flight-test.

Currently the tunnel is being used to evaluate a new high-energy chemical fuel in an NACA "boiler-plate" ramjet. The 10 x 10 tunnel, largest now in operation of the unitary plan tunnels authorized by Congress in 1949, uses 250,000 hp. compressors to simulate up to 148,000 ft. altitude at Mach 3.5 as a closed circuit for aerodynamic testing, or up to 87,000 ft. also at Mach 3.5 as an open circuit for powerplant research.

Exhaust gases from operating propulsion systems would soon contaminate a closed circuit. The test section can handle engines up to 5 ft. in diameter.

For the time being, the lower limits of the facility are almost more significant than the upper limits. The tunnel is unable to test below 50,000 ft. and Mach 2. Though the bomber system referred to has these capabilities, it will be some time before the general state of the art catches up to the Lewis tunnel.

The $32,856,000 spent on the tunnel will be justified in a few years by the certainty that it will eliminate in the future million-dollar engine program failures, asserted Abe Silverstein, associate director of laboratory.

Realistic advance testing in this tunnel will discourage engine manufacturers from trying to squeeze impossible degrees of performance out of limited engines during hazardous and expensive flight-test programs.

The flexible throat of the tunnel is stainless steel, Type 410 stainless, manufactured by the United States Steel Corporation. To eliminate joints, specifications called for the largest stainless steel plates ever to be rolled at the U. S. Steel Homestead Works.

Precise machining was done at the South Charleston, W. Va., Naval Ordnance plant where necessary heat treating, pressing and machine equipment was available.

New Cabinet Proposal

Washington—The creation of a cabinet post to represent both military and civil aviation is being pushed by Sen. Frederick Payne (R.-Me.).

Payne accused the Air Force of going a "little too far afield in not giving proper and due recognition to the requirements of civil aviation." He proposed an Air Secretary who "will be at policy level and can whack the heads of the Defense Department together" whenever the Air Force comes into conflict with civil aviation.

The Senator's suggestion was made during a Senate subcommittee hearing on divorcing the Civil Aeronautics Administration from the Commerce Department, a bill sponsored by A. S. Mike Monroney (D.-Okla.).

CF-105 Supersonic In Climb, Firm Says

Windsor, Canada—The Avro CF-105 is supersonic even while climbing, the Royal Canadian Air Force Assn. was told by Crawford Gordon, Jr., president of Avro Canada Ltd., Toronto. Flight tests are expected to begin next year on a new delta-wing interceptor being built for the RCAF, he said.

Power required to propel the CF-105, Gordon said, will be almost twice that generated by the S. S. Queen Mary. The aircraft unofficially is described as designed for a top speed of 1,500 mph. and a ceiling of 60,000 ft. Powered by the Orenda PS-13 engine built by Orenda Engines Ltd. of Toronto, the plane will be supersonic for both level flight and climbing.

Gordon said the CF-105 will be subjected to loads, stresses and heat never before encountered in a jet-powered operational aircraft. At 1,000 mph. the friction of the air raises the temperature of the skin to 300F. At high altitude with the outside air at −50F the skin temperatures will be 252F.

Plastic canopies are out, Gordon said. The CF-105 will use laminated glass an inch thick.

Gordon noted there will be 60,000 ft. of wiring in the plane and enough electronic tubes for 200 television sets. It will require 24 gal. to start the two engines, and in a normal 40-min. mission they will burn as much fuel as the average motorist uses in six years, Gordon said.

The Canadian executive urged his government to prepare for a long-term aircraft production policy in order to give the industry the necessary stability to meet whatever emergency arises.

He also said that the British defense chiefs are watching the development of the CF-105 with indications that they may order some.

AERONAUTICS

New U. S. Wind Tunnel

National Advisory Committee for Aeronautics now operating the world's most advanced wind tunnel for testing tomorrow's aircraft. It took five years to build.

See Front Cover

➤ ANY KIND of airplane or missile of the future can be given a test flight in the world's most advanced wind tunnel that has now started to roar at the National Advisory Committee for Aeronautics Lewis Flight Propulsion Laboratory, Cleveland.

It is a $33,000,000 research plant that can test engine, rocket, airplanes and other flying structures at up to 2,400 miles per hour, and under conditions equivalent to as much as 100,000 feet altitude.

It can test full scale jet engines in full operation. Its test area is ten feet square. It is probably better and bigger than the Russians have. No one seems to know or at least no one will say. It cannot be assumed that the Soviet aeronautical research is necessarily lagging, but our Government's aeronautical research agency has certainly built more wind tunnels than any one else.

Missiles and airplanes that will start flying five years from now are now being developed fundamentally in the new wind tunnel.

It took five years actually to build the great testing device and Government plans were first made as much as 12 years ago. The research development will have an important bearing on keeping America supreme in the air and in guided missiles in the years to come.

Lewis Laboratory staff engineers made more than 100 design studies before selecting the configuration of the Lewis unitary plan wind tunnel. They built and tested a small scale model of the selected proposal before making final plans.

Design studies began in 1950, construction of equipment was started in early 1952, and ground was broken for the buildings July 31, 1952. The project was completed and the tunnel put into operation in May, 1956. NACA engineers supervised the construction job, which was carried out by more than 450 contractors, engineering firms and suppliers.

Shown on the cover of this week's SCIENCE NEWS LETTER is an aft view of a 16-inch ramjet in test position, seen through a floor opening of the Lewis unitary plan wind tunnel. The body of revolution downstream of the ramjet nozzle is a movable plug, used to simulate the changes in internal flow that would take place during engine combustion.

The continuous-flow wind tunnel has a Mach number range from 2.0 to 3.5, and is operational either in closed circuit for aerodynamic tests or an open end cycle for combustion propulsion research.

In operation, the tunnel draws air through the dryer and the flexible wall nozzle into the test section, where the engine or airplane model is mounted.

For speeds above Mach 2.5, the two compressors are operated together. For lower speeds, the secondary compressor is shut down and the air flow is valved around it through a bypass circuit.

The altitude simulated in the test section where the model is located is regulated by means of exhausters located near the flexible nozzle. Air temperature is controlled by a water cooling tower separated from the main tunnel structure.

Elaborate systems for safety and for remote control of all elements of this huge research tool are included, and soundproofing reduces external noise to acceptable levels. For the propulsion cycle, duration of a single test is limited by capacity of the air dryer to less than an hour on a humid summer day and to about ten hours in the winter. Operation of the facility on the closed-circuit aerodynamic cycle, however, is not time limited.

Complete test information is recorded automatically by electronic devices for immediate processing or for later computing in a unique central data handling system. This center, located in the tunnel offices, handles not only the data produced in the unitary tunnel but that of four other major research facilities on the laboratory grounds.

The new tunnel is the highest powered of three designed and built by the NACA.

Science News Letter, June 2, 1956

● RADIO

Saturday, June 9, 1956, 1:45-2:00 p.m., EDT

"Adventures in Science" with Watson Davis, director of Science Service, over the CBS Radio Network. Check your local CBS station.

Dr. Renato Contini, research coordinator, research division of the College of Engineering, New York University, will discuss "Medical Engineering."

GENERAL SCIENCE

Government Publishes Russian Atomic Papers

➤ THE WORK of Russia's atomic energy experts is now available in English translation from the U. S. Government.

Eighty-seven technical and scientific papers, originally presented at a conference in Moscow sponsored by the U.S.S.R. Academy of Sciences in June, 1955, have been published by the Government Printing Office.

The papers, printed in four volumes, can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

The first volume, priced at $1.25, consists of 23 papers covering such topics as nuclear properties of heavy elements, theoretical and experimental work on uranium-graphite, reactors and lattices, and radiation effects.

The second volume, selling for $1.00, has 19 papers on radiochemical studies of high energy fission and spallation, effects of ionizing radiation on chemical reactions, and application of nuclear techniques on chemical structure and reactivity.

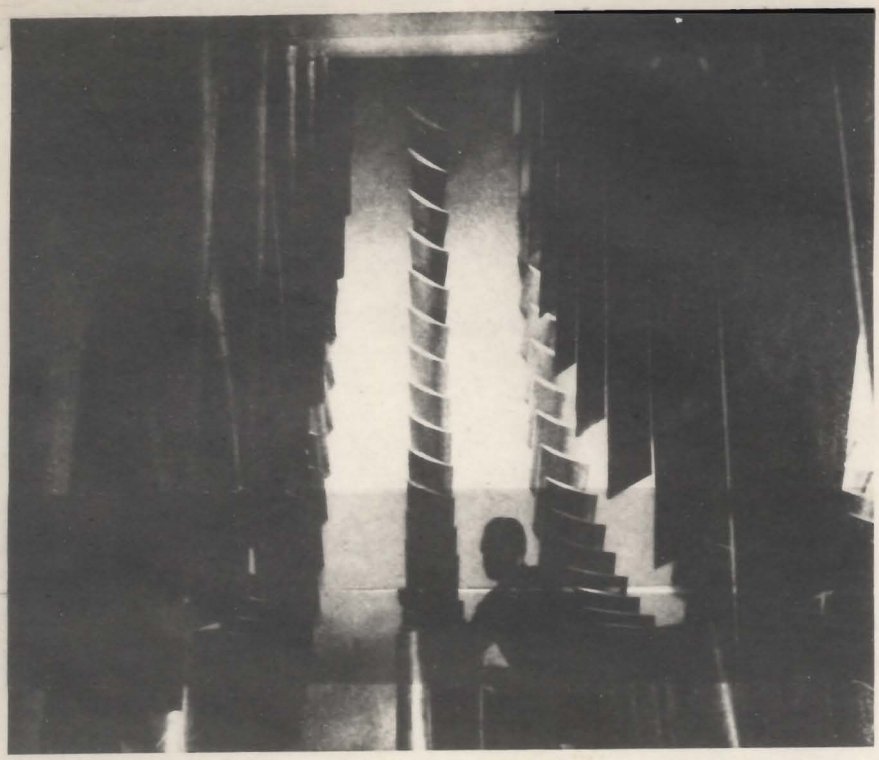
Volume 3, priced at $1.00, has 18 papers describing the application of nuclear technology to industrial processes and prospecting.

The fourth volume, priced at $1.00, has 21 papers dealing with biological, biochemical effects of ion radiation, and the application of nuclear techniques in biochemistry.

Science News Letter, June 2, 1956

***WIND TUNNEL CONTROL ROOM**—The control room of the Lewis unitary plan wind tunnel. The tunnel diagram (top, center) provides a pictorial indication of the position of each of the major valves controlling tunnel operation. Each of the 24-inch television monitors (near ceiling) can be connected to any of the three TV cameras that survey the tunnel.*

STEEL - June 4, 1956



Blades of compressor used in NACA's new wind tunnel. In operation, the rotor blades sweep past the stator blades (center) at about 600 mph

Big Wind Blows Good

INDUSTRY has gained another research tool in the new supersonic wind tunnel now in operation at NACA's Lewis Flight Propulsion Laboratory, Cleveland.

Full-size ramjet, turbojet and other engines for supersonic aircraft and missiles can be operated in the tunnel at simulated air speeds of Mach 2 to 3.5 and altitudes of 30 miles.

Power Plants—Supersonic speeds are developed by two rotary compressors that handle a ton of air a second and a 78 ft long, flexible, stainless steel "throat." The compressors are driven by seven electric motors, in two banks, which develop 250,000 hp. The tunnel's peak electric power requirements are roughly equal to the residential needs of a city of 650,000.

The flexible walls of the "throat" are plates of Stainless W which are 1⅜-in. thick, 10 ft wide and 78 ft long. Hydraulically operated screw jacks close down this nozzle from 5.92 ft at low air speeds to 0.933 ft for Mach 3.5. The plates were the largest ever rolled at U. S. Steel Co.'s Homestead Works. Machining and heat treating were done at the South Charleston, W. Va., Naval Ordnance plant.

The new facility has a complete 138-kva electrical substation, a data processing center and closed-circuit television to monitor tests.

Operation — The compressors draw air through a dryer building (it can remove 15,000 gallons of water) and the flexible wall nozzle into the test section. A second, adjustable throat, behind the test section, decelerates air speed to cut down power requirements. For speeds above Mach 2.5, the two compressors are operated together; for lower speeds, only No. 1 unit is used.

The Lewis tunnel is the most powerful of three designed and built by the National Advisory Committee for Aeronautics under the legislation passed by Congress in 1949. Its cost was $32,856,000. The other tunnels are at NACA's Langley and Ames laboratories.

TIME
June 4, 1956

Biggest Tunnel

The taxpayers got a look last week at the gigantic new wind tunnel (cost: $33 million) at the propulsion laboratory of the National Advisory Committee for Aeronautics at Cleveland. It has been abuilding since 1952, and so far as the Western world knows, it is the most powerful in operation. Engines up to 5 ft. in diameter can be tested in its 10 ft.-by-10 ft. throat, fed with air rushing past at Mach 3.5 (1,800 m.p.h.). To move so much air at this speed requires monstrous fans that soak up 250,000 h.p.

When a passive model is being tested, the air in the tunnel is sent around a circuit and used repeatedly, but jet engines or ram-jets poison the air with their exhaust gases. New air must be taken from the atmosphere, and its excess moisture eliminated. So the tunnel is provided with a monstrous air dryer stocked with 1,890 tons of activated alumina, which soaks up 1.5 tons (ten bathtubs) of water per minute. On a muggy day the alumina has to be dried out after two hours, and this takes enough gas burners to keep the whole city of Berea, Ohio (pop. 13,200) warm in winter. The air in the tunnel must be cooled, and the job is done by cooling apparatus equivalent to 250,000 household air conditioners.

An important part of the new tunnel is an automatic system for making sense out of the flood of information that streams from it. Eighty thousand separate measurements may be made in a single day. The figures are first put on magnetic tape, then worked over by an electronic computer that reduces them quickly to curves and tables. In old-style wind-tunnel setups, most of this job was done by hand and often took several weeks.

Many a Clevelander was apprehensive while the new tunnel was under construction. Lesser tunnels at the same site jangled nerves with their dreadful racket. This tunnel has an enormous muffler in which even the loudest sounds get lost. A screaming siren can be carried into the muffler and become inaudible in a few yards. When the tunnel is in operation, its noise is reduced to levels acceptable at least to N.A.C.A.'s hardened neighbors. The tunnel works late at night only, so its inordinate thirst for electricity will not slow the city of Cleveland (pop. 935,000).

TIME, JUNE 4, 1956

LATEST NACA WIND TUNNEL IS NOW OPEN

MAIN COMPRESSOR BLADES PROPEL 2000 POUNDS OF AIR PER SECOND THROUGH TUNNEL

C-39724

A FEW MANIPULATIONS of the control panel initiates a series of operations that almost stagger the imagination. Huge motors, mazes of flickering dials and gigantic metal tubes form the backdrop of the new supersonic wind tunnel, in full operation since May, at NACA's Lewis Flight Propulsion Laboratory, adjoining the Cleveland Airport.

This wind tunnel makes nature's most violent hurricane seem like a breeze. The tunnel's 250,000 hp electric-motor drive, the most powerful of its kind in the world, can produce air speeds between Mach 2.0 and 3.5, or between 1200 and 1800 mph at simulated altitudes up to 30 miles.

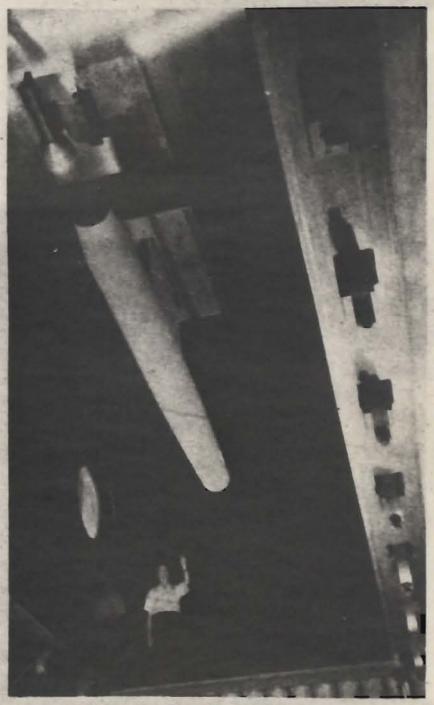
The Lewis Unitary Plan Supersonic Wind Tunnel, built for development testing of engines and components for high-performance aircraft, is used in cooperation with industry and the Armed Forces by the National Advisory Committee for Aeronautics. This cooperation accounts for the name *Unitary Plan*.

According to Dr. E. R. Sharp, director of the laboratory, the new tunnel is valuable especially for work on problems of turbojet and ramjet engines. Engines and components as large as five feet in diameter may be studied in the 10-foot-square test section.

The tunnel may be operated either in closed circuit for aerodynamic tests, or in open-end propulsion circuit, with engines running under combustion test. Its main purpose is to investigate such problems as engine-inlet and outlet geometry, engine matching and interference effects, and over-all drag. The test section can accommodate full-size engines and components.

In operation, the tunnel draws air through a dryer and a flexible-wall nozzle, which controls air flow and permits change of air speed during operation, into the test section. This is where the engine or airplane model is mounted. For speeds above Mach 2.5, two axial flow compressors are operated together. For lower speeds, the secondary compressor is shut down and the air flow is valved around it through a bypass circuit.

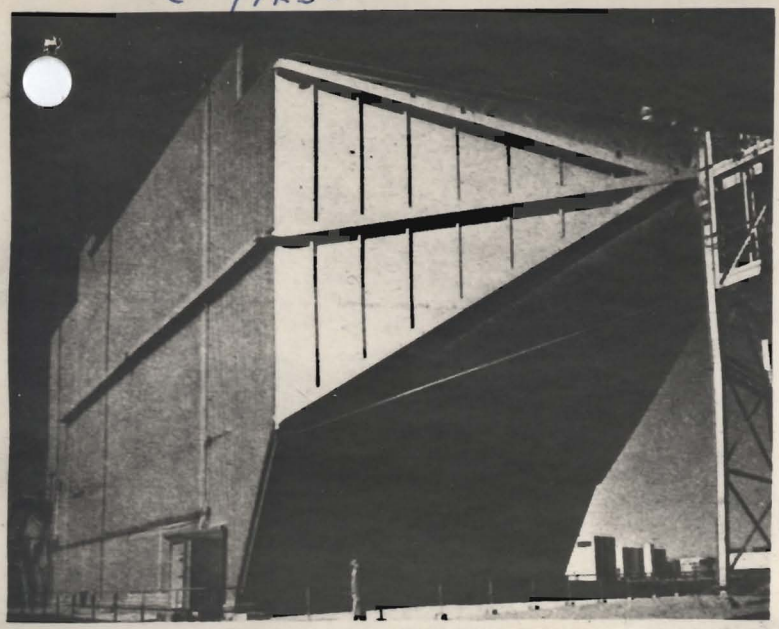
Centerline length of the wind tunnel circuit is 1090 feet through both compressors, 1180 feet through primary compressor and bypass leg. A 24-foot diameter, 38-ton two-position valve closes in one position to direct tunnel air through the exhaust section into open air, or in the other position to seal



A 16-INCH RAMJET IN TEST POSITION

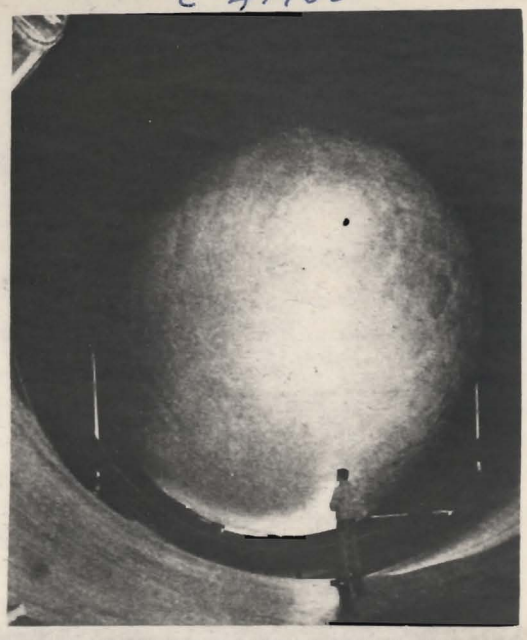
C-42032

C-41250



THIS IS THE AIR DRYER BUILDING OF LEWIS UNITARY PLAN WIND TUNNEL

C-41950



COOLED TUNNEL AIR IS DIFFUSED AROUND THIS CONE

the exhaust section for closed circuit operation.

The bottom of the test section is an elevator platform, which can be lowered to shop floor level to facilitate model mounting. Force data on test models is measured by electrical resistance strain gauges. Air flow is observed and photographed through a Schlieren optical system, and closed-circuit television provides test monitoring from the control room.

The simulated altitude is regulated by means of exhausters located near the flexible nozzle. Air temperature is controlled by a water cooling tower separated from the main tunnel structure. Sound-proofing reduces the noise.

Complete test information is recorded automatically by electronic devices for immediate processing, or for later computing in a unique central data handling system. These "electronic brains" cut delay between a test run and the return of computed data to the engineer. Computations are available within 30 seconds after the data is taken in the test section.

The new Lewis tunnel, the highest powered of three designed and built by NACA under the Unitary Plan Legislation passed by Congress in 1949, cost $32,856,000. The other two tunnels are at the Langley and Ames laboratories.

C-40871

SCREENED INLET OF COMPRESSOR NO. 2

C-39782

RONIC DIGITAL COMPUTER IS MASTER 'BRAIN'

CONTROL ROOM OF THE WIND TUNNEL, VIEWED FROM THE OBSERVATION ROOM

C-40247

approximately 40 per cent nickel, it is close enough to ferritic alloy steels to permit the two materials to be joined without special provision for thermal expansion. In addition to bar and forging stock, the alloy is also produced as sheet in the same sizes and gauges as those offered in Inconel X and Inconel "W" age-hardenable alloys.

Incoloy 901 is expected to find wide application for use in turbine rotor and compressor disks and structural parts calling for an intermediate temperature range of 1000 to 1400 F.

Unitary Plan Wind Tunnel

ENGINE-OPERATING conditions at supersonic speeds and altitudes of 30 miles can be duplicated on the ground in a new wind tunnel at the NACA Lewis Flight Propulsion Laboratory, Cleveland Airport, Ohio.

Now in full operation, the tunnel's 250,000-hp electric-motor drive is the most powerful of its kind in the world. Air speeds range between Mach number 2.0 and 3.5, or between 1200 and 1800 mph at high altitudes.

The 10 × 10-ft Lewis Unitary Plan Supersonic Wind Tunnel, built for development testing of engines and components for high-performance aircraft, is used in cooperation with industry and the armed forces by the National Advisory Committee for Aeronautics.

The new tunnel is valuable especially for work on problems of turbojet and ramjet engines. Engines and components as large as 5 ft in diam may be studied in the 10-ft-sq test section.

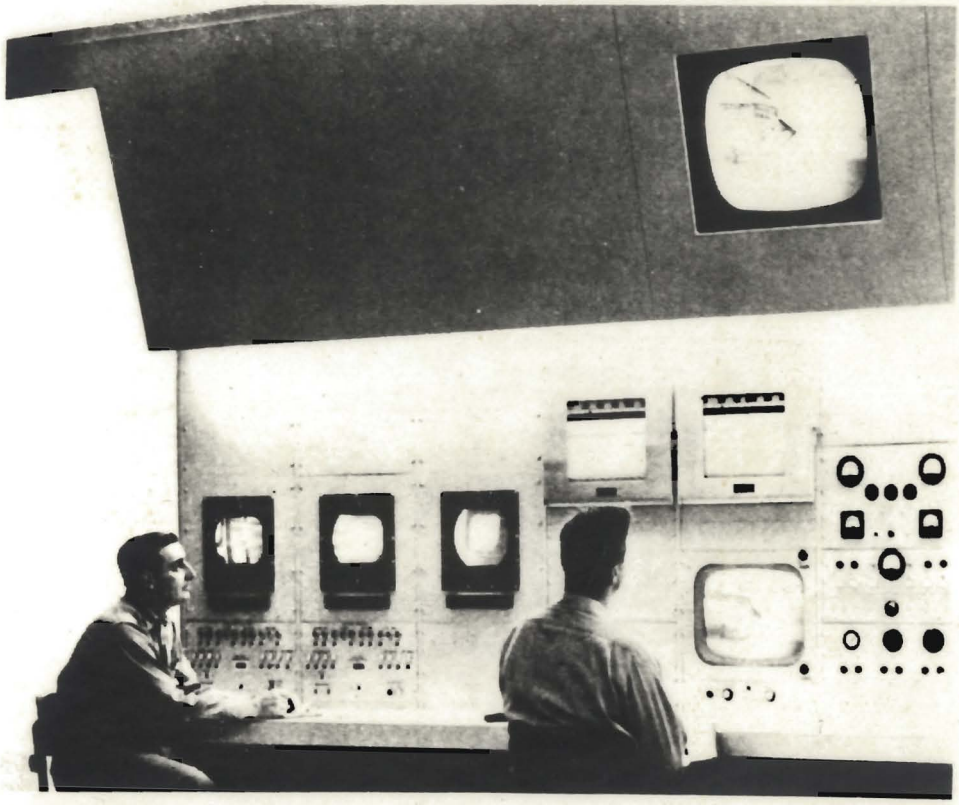
The tunnel may be operated either in closed circuit for aerodynamic tests, or in open-end propulsion circuit, with engines running under combustion test. Its main purpose is investigation of such problems as engine-inlet and outlet geometry, engine matching and interference effects, and over-all drag. Though many tests will be conducted with scale models, the test section can accommodate full-size engines and components.

The Unitary Plan Supersonic Wind Tunnel supplements the Lewis 8 × 6-ft Supersonic Wind Tunnel, which has a Mach number range of 1.4 to 2.0. Experience with that research tool produced large performance gains for the current "century series" fighters, such as the F-102 and F-104. As a result of the significant gains obtained with this tunnel, the larger and higher speed new facility was built.

Fatigue Testing Laboratory

TO ANSWER questions such as "How much bounce in a spring?", and to provide for customers a more accurate evaluation of other wire products, U. S. Steel's American Steel and Wire Division has established at its Cuyahoga Works in Cleveland, Ohio, a laboratory devoted exclusively to fatigue testing.

For testing helical springs such as automobile valve and front suspension springs, springs for beds, machine



Wind-tunnel tests of aircraft models and engines are observed remotely with RCA closed-circuit television installation at NACA Lewis Flight Propulsion Laboratory, Cleveland, Ohio. Research personnel in control room operate and observe performance of model undergoing tests in wind tunnel 250 ft away. Three RCA industrial TV camera chains and four 24-in. TV monitors are utilized to provide safe observation for personnel operating 10 × 10-ft supersonic wind tunnel and conducting research on aircraft engines and propulsion systems.