WING TIPS

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AS OTHERS SEE US

This special issue of WING TIPS is published to make it possible for the people of the Laboratory to read a representative sample of the news stories about the Laboratory that resulted from the visit of the Aviation Writers' Association on June 11, 1945. These stories have been copied photographically from newspaper clippings.

Labs Prove Jet Planes' Promise

CLEVELAND, Ohio, June 24.—JET-PROPULSION is here to stay. Bet on it. You'll collect sooner than a lot of people imagine. Present plans, possibilities and problems of jet-propelled planes were previewed by aviation writers who journeyed here to inspect the huge National Advisory Committee for Aeronautics Engine Research Laboratories for the first time.

Here, the pursuit of jet-knowledge is carried on by the best aeronautical brains available, provided with the best equipment obtainable. Each day new facts about this fascinating new field are turning up posing new problems, new possibilities. And each fact is explored to the fullest.

Built at a cost of $24,000,000, the NACA Laboratories at Cleveland comprise some 15 large buildings and numerous smaller testing laboratories. More than 130,000 horsepower is provided to drive the research equipment.

Flight Hazards Simulated.

Under maximum operating conditions, about 50,000 h. p. is required to power the Altitude Wind Tunnel—the only wind tunnel of its type anywhere. It is capable of testing complete aircraft propulsion installations under precise altitude conditions up to 30,000 feet, while pressure conditions can be simulated up to 50,000 feet.

Designed to give wind velocities up to 500 m. p. h., the tunnel also is the world's largest refrigerating plant—capable of turning out 20,000,000 pounds of ice daily—which lowers air temperatures to minus 48 degrees Farenheit. This unparalleled design achievement is the most effective research apparatus in existence for jet-propulsion and gas-turbine work.

The Altitude Wind Tunnel makes possible full-scale studies of complete power plants as they are installed in fuselage or wing nacelles. Engine performance, cooling, drag, cowling efficiency, etc., can all be studied under almost perfectly simulated flight conditions.

Another unique research unit is the Icing Research Tunnel which is able to provide temperatures as low as minus 60 degrees Farenheit for testing plane engines under icing conditions. Both prevention and elimination of ice are the problems tackled here. In this tunnel, spray water is introduced into a 400 m.h.p. wind stream which whips against engines, propellers, wing sections, and other aircraft components.

The huge Engine Research Building, consisting of five-and-a-half acres of floor space, has nearly a hundred different research laboratories devoted to the study of all elements of plane power plants.

NEW YORK MIRROR
JUNE 24, 1945.

To study methods of improving combustion in aircraft engines or jet-propulsion burners, NACA engineers observe fuel burning through plastic or glass windows in combustion tunnels. Smooth burning means high anti-knock quality; intermittent flames mean low quality fuel.

Research All Phases

There are numerous engine and gas-turbine dynamometer laboratories, supercharger test test stands, jet-propulsion burner laboratories, and altitude chambers for testing engine accessories at low temperatures or air pressures. Research is done on every part of a plane from bearings and piston rings to nuts and bolts.

Still other laboratories are devoted to fundamental and applied research on problems of heat transfer, metallurgy, lubrication, combustion, waste heat recovery and ice formation in aircraft carburetors.

The nerve center of this vast operation is a small main control room from which one man dispatches power, cooling air, cooling water, and provides reduced air pressures and temperatures which makes it possible to carry on research and experiments.

NACA's History

The National Advisory Committee for Aeronautics was established by the Congress in 1915, to deal broadly with aeronautical research. Its principal function is to explore the infinite field of aeronautics and to provide a solid foundation for aeronautics as an exact science. It has amassed countless, priceless data from its wind tunnels, test cells, chemical reports and flight research equipment, for use by the nation's aeronautical engineers. There is no airplane in existence today whose design is not profoundly influenced by NACA research.

In order to conduct research on plane power plants that cannot be done under simulated conditions, actual flight tests are conducted whenever necessary.

The NACA Hanger at Cleveland houses about 10 planes of various sizes now and there's still room for a B-29 Superfortress. The planes range from single-engine fighter types to four-engine bombers and each one is a flying laboratory.

The Fuels and Lubricants Building contains chemical and physical laboratories where research is conducted on relative values of different fuels and lubricants. Rare fuels, commercially unobtainable, are synthetically produced and studied to determine their qualities for aviation application.

One problem this department faces is the loss of gasoline through evaporation and boiling at high altitudes. When a B-29 gets up over 15,000 feet, its fuel starts boiling because of the change in temperature and atmospheric pressure. Result: loss of gas. The higher the plane goes the higher the gas loss. If this boiling could be stopped it would mean a saving of nearly 450,000 gallons of gas on every 500 plane raid on Japan, and allow 1,350 more tons of bombs.

(A method of pressurizing the gas tanks is now being used by the British which solves the problem of gas loss but the self-sealing properties of the tanks are lost. Our Army and Navy have rejected this method. It's up to the NACA Laboratories to find another, better way.)

Jet Fuel Search

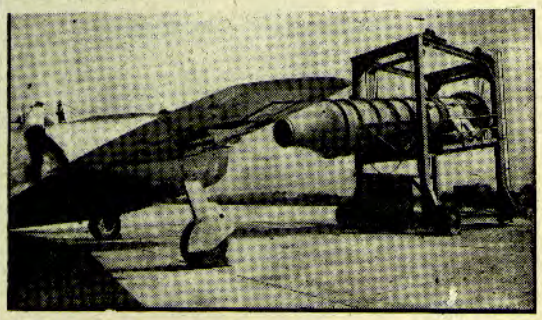
To the writer, the most interesting building is the Jet-Propulsion Laboratory which contains test cells for the measurement of performance of jet engines at sea-level conditions. (In jet engines, thrust rather than horsepower, is measured.) Here, the several different American modifications and improvements of the British jet engine are being tested incessantly.

Different fuels are tried. Burning characteristics are studied. Then fuels are test flown in jet planes for true performance characteristics.

Biggest problem with jet planes is where to carry fuel. In designing "jets," the ultimate in streamlining is reached. For instance, the new P-80 "Shooting Star" has been described as resembling "a bullet with razor blades for wings." Wings are necessarily too thin to be used for fuel tanks. Research experiments at the NACA Jet Laboratories are aimed at developing fuels more efficient than any now known—fuels which, in small quantity, will give as much or more power as those which now must be carried in bulk.

Most of the good work being carried on by the NACA is highly secretive. But when censorship permits a complete appraisal, those who ranted and raved against jet-propulsion will be able to see for themselves.

—Richard Kenny



This huge blower, capable of producing an air speed of 250 m.p.h., permits test engines to be operated at maximum take-off power and eliminates danger of making take-offs with untried engines. Here, the fan action of the blower is used to supply a blast of cooling air for the engine of a P-47 fighter plane.

LE 2 8180

CLEVELAND NEWS JUNE 23, 1945.

By Doris O'Donnell

Man's dramatic fight against the mechanical gremlins that haunt America's airpower was revealed today for the first time in the $24,000,000 research laboratories at Cleveland Airport.

The National Advisory Committee for Aeronautics decided to lower the veil of secrecy so that a group of newspaper and magazine writers could see the scientific struggle and accomplishment that is going on in its test tubes and mysterious wind tunnels.

For a layman reporter it was an excursion into the breathless world of tomorrow.

• • •

I watched serious young men juggling molecules to get more speed and power out of warplanes.

I saw the technicians at grips with the unknown power of new fuels, buzz bombs, jet engines.

I heard whispers that hazardous "bugs" are being eliminated from the air forces being hurled against the Japs.

• • •

Built in 1941 on the far northwest fringe of the Airport almost overlooking Metropolitan Park, the experimental buildings number 15 and contain the only altitude wind tunnel of its kind in the world.

• • •

IN THESE SPRAWLING, spotlessly clean buildings gremlins are being liquidated for such disturbing activity as: causing gasoline to evaporate at an alarming rate in large fighting planes; creating motor failures on the India-China run by icing carburetor screens; destroying certain engine parts on strenuous and dangerous missions.

The visiting reporters sniffed newly-developed fuels, shivered in sub-zero temperatures in the icing tunnel, jumped like frightened rabbits and stuffed fingers in ears to deaden a roaring, blazing buzz-bomb charge; gaped at jet propulsion performances, and, in general, received a thorough "briefing" on the significance of research by a staff of efficient and capable-looking engineers who seemed to know their way around.

• • •

The icing tunnel was interesting. We looked into it through small windows and saw a North Pole blizzard in progress. We donned heavy leather, wool-lined jackets and braved the storm. When the man-made wind subsided we saw a model plane, choked and smothered with ice and snow.

• • •

The ice tunnel simulated actual conditions encountered today in flying against the Japs. Icing of wings and propellers have caused ships to lose altitude, crash into mountains.

It is the task of the research scientists to overcome this handicap provided by nature, and they are doing a remarkable job, although details are not for publication.

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Another scientific riddle is loss of gasoline by vaporization. A crippled plane winging to its home base after a mission needs every bit of gasoline. It is known that in some cases as much as 10 per cent of the flight supply is lost by vaporization.

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Jet propulsion engine development, the glamor item of today's aviation research, is tested in the huge, snaky altitude wind tunnel where altitude conditions up to 30,000 feet and pressure up to 30,000 feet can be simulated.

In other parts of the laboratories, new fuels aimed at efficient combustion are tested, and high-speed, specially-developed NACA cameras photograph combustion reactions in engines.

According to Edward R. Sharp, manager of the aircraft engine research laboratory, there is no plane in existence today whose design is not profoundly influenced by NACA research.

Research on V-1 bombs with a view to adapting them to our uses is going on in one laboratory while search for fuels with higher anti-knock characteristics is carried on in another.

• • •

ON THE ADVICE of experts, we blocked our ears as a V-1 flying bomb charges exploded in rapid succession and we watched its deadly fire, reflected in mirrors, lick out its hungry mouth.

• • •

The hangar is big enough to house 10 planes of various sizes in addition to a B-29. Mechanical engineers take the gremlins out of cylinders, pistons, valves and crankshafts.

Test planes with untried engines don't have to leave the ground. There's a giant gray horn, almost as big as a plane, which blows at an airspeed of 250 mph, while the brand-new engines operate at top take-off speed.

HINT OF FUTURE WARS TOLD IN 2 WORDS: RAM JET

It's New Type Buzz Bomb; May Alter Air Plans

BY FRANK STURDY

[Chicago Tribune Press Service]

Cleveland, O., June 24—While carrying on extensive studies for the improvement of the turbine jet propulsion engine, scientists at the National Advisory Committee for Aeronautics engine laboratory are **exploring rockets, ram jet, and intermittent ram jet propulsion**

The terms are somewhat confusing. The ordinary Roman candle is **a simple example of rocket propulsion: flight achieved by a missile carrying its own fuel for production** of propelling gas.

Ram jet is based on the same principle as turbine jet, but is mechanically less complicated. Dispensing with the turbine and compressor of the jet engines now in use, ram jet depends entirely on its own extreme speed to secure sufficient air under pressure for combustion. A cross-section of such an engine resembles a length of stove pipe with a small baffle near the front, a narrowed section in the center for burning the air and fuel mixture, and a long tail for exhausting the gases. It has no moving parts.

Faster Than Sound

Such an engine does not begin to develop thrust [power] until air is passing thru it at high speeds, and according to present calculations will operate most efficiently at speeds in excess of that of sound.

No such engine is flying now and no airplane now existing could stay with it if it were. That it is possible planes may some day fly that fast is indicated by the fact that the NACA is building wind tunnels for testing wings at wind velocities up to 2,000 miles an hour. Such long term research illustrates the true function of the NACA: to be ready with general scientific data when such facts may be useful to an individual or an industry prepared to make practical use of them in production. The committee has departed from that policy to deal with immediate and urgent war problems.

Like Germany's V-1

It is almost possible to choke on the term intermittent ram jet propulsion: it is easier to call it the principle of the German V-1 buzz-bomb.

To prove to any doubters that ram jet works, the laboratory has a neat little gadget, a pipe about one foot long and an inch and a quarter in diameter, suspended by wires from a small stand. Above it is a pointer like the hand of a clock, which is arranged to move toward "thrust" when the pipe moves forward. The pipe is a miniature ram jet engine, equipped with a tiny fuel line. In front of it is a nozzle, connected to a compressed air tank. When the air is blown thru the engine at high velocity and ignited as it mixes with the fuel, the little tube roars louder than a dozen acetylene torches, and creeps inexorably against the air stream. It's hard to believe, but after all, you can see it.

Utilized by Germans

The ingenious Germans in the V-1 hit on a method of reducing straight ram jet to something they could handle, but hoped the Americans and British could not. Their buzz bomb engine, like the ram jet, has neither a turbine nor a compressor. Before entering the combustion chamber, the air is fed thru a plate containing a large number of vent-like nozzles. The nozzles are equipped with closing flaps, like little trap doors. As the engine flies, the inrushing air forces the flaps open, enters the burning chamber, and is mixed with fuel.

When it explodes, the expanding gas pressed against the flaps on the inside, closes them, and thrust is obtained from the inability of the gases to escape at that end, while they pass freely out the tail. Once the charge is burned, the pressure in the combustion chamber goes down, air again enters thru the flaps, and the cycle is repeated. This happens 40 times a second.

One of the laboratories has an arrangement of mirrors and lights so that it is possible to sit in darkness, look thru a thick glass window, and see such an engine in slow motion operation, the flame starting in the center, moving toward the flaps and pushing them shut, gradually subsiding and the flaps opening for the next charge

Wasteful, but Cheap

This type engine is extremely wasteful of fuel. Its beauty, from the German standpoint, was that it could be manufactured very cheaply, in greater numbers than airplanes, and required no expensively trained, hard to replace pilot or crew. It got along by itself, guided by pre-set compass and gyroscope devices.

Already recognized as the mere forerunner of a new sort of air war, the buzz bomb will have successors in any future conflict of such destructive power as can only be guessed at present. None of the other nations is asleep to the implications of the German V-2, an enormous rocket designed to reach an altitude of seven miles and fly at several thousand miles an hour. Neither is the NACA, nor the army air forces.

The NACA is conducting tests on a buzz bomb engine built by the Ford Motor company under contract to the air forces. It is patterned after the V-1. To a group of writers, the first to be admitted to the laboratory, the NACA disclosed that some success has been achieved in prolonging the life of the metal flap valves that control the engine air flow.

The German metals withstood for only 20 minutes the strain of flapping 40 times a second, then failed, thus limiting the V-1's range. American made flaps are lasting about 50 per cent longer.

A full size buzz engine is being tested by the committee researchers. Erected in a large building, the engine is fed air at high velocity thru a complicated system of air ducts, in simulation of flight. The searing exhaust gases escape out a large door into an adjacent wood.

Watching the engine operate is literally physically painful. Even with fingers pressed hard in both ears, the noise is so terrific the eardrums can be felt to flutter as long flames shoot from the tail and hot, tortured air plucks at one's clothing like a wind, even at a distance of 100 feet, to one side of the gas flow.

Use Is Kept Secret

Whether such weapons are to be used against the Japanese if suitable launching methods can be found, the army and navy have not disclosed.

The trend of future warfare, however, is written plainly in the army's NACA investigations. The bombers of this war have been in effect extensions of artillery range. They are tremendously expensive in money, and in lives.

It is easy to believe the air force experts who predict that when such cheap, destructive, pilotless missiles as the buzz bomb are perfected, an aggressor army may be able to obliterate a whole city, at long distance without losing a man, and without warning.

'LAB' MEN BRING AIRPLANE FLAWS DOWN TO EARTH

Speedy Camera Records Engine Operation

BY FRANK STURDY

[Chicago Tribune Press Service]

(Picture on back page)

Cleveland, O., June 22—A tall man in a business suit, standing between two pieces of machinery in the engine research laboratories of the National Advisory Committee for Aeronautics, spoke to a dozen people assembled on chairs before him.

"This camera was built in our laboratory," he said, "and as far as we know, there is no other like it anywhere."

He pointed to a gray painted instrument on his right, looking not like any camera, but like a steel safe mounted on a metal stand.

"It will take 40,000 pictures a second," he said. His voice had a touch of pride in it. "We are working on one that will be about half again as fast."

See Fuel "Knock"

NACA Engineer Cearcy Miller went on:

"The purpose of this camera is to make it possible for us to see the burning of a fuel charge in the cylinder of an airplane engine so we may determine the cause of detonation, which is called 'knock' or 'ping' by automobile drivers. It is destructive, and not infrequently causes engine failures that cost the lives of airmen.

"This knock lasts only 30 millionths of a second, which is the reason for the high speed camera. We project the film like a slow motion movie."

Miller pointed to the contrivance at his left, where a mirror was suspended above a test cylinder with a glass top.

Brilliant Red Flash

"We will fire it only once, because the mirrors become smoked up easily and taking the cylinder apart to clean them is a time consuming job," he said.

He nodded to two attendants, the room darkened, the camera began to whir, and the test cylinder driving mechanism pounded. Suddenly there was a brilliant red flash in the room, so fast it seemed almost like an illusion. The same thing happens a thousand times a minute for each cylinder in an 18 cylinder aircraft engine.

Now we will show you a movie of such normal burning of a cylinder charge, and another one of the violent explosion resulting from a detonation," Miller said.

A picture of the inside of a cylinder flashed on a small screen.

Four black dots appeared in the picture, grew larger and spread fast, joining in the center like a pie cut in quarters, then vanished evenly.

Irregular Blast

"Now the detonation charge."

Again the black dots appeared, but as they began to grow, two ran wild. There were no neat triangular pie sections, but irregular blobs bouncing madly about and subsiding into something that looked like quivering jelly before they disappeared.

There may be other institutions in the country about which the military have thrown equal secrecy, but none is more carefully guarded. The writers who saw Miller's demonstration were the first to be shown the NACA's advanced projects in aircraft power plant research, including jet and rocket propulsion. Much of the material cannot be published yet.

Build Laboratories

The NACA's first laboratory was established at Langley field, Hampton, Va. It is now the largest and best equipped such research center in the world.

Expansion of the NACA's work to meet the war's demands required the construction of the special engine laboratory at Cleveland. Another is at Moffett field, Cal., dealing in aerodynamics: the study of why airplanes fly.

Congress appropriated $5,000 a year for the committee's first five years. Now it has an annual budget of 26 million dollars.

The fastest airplane in the United States, perhaps the fastest in the world, is the new Lockheed P-80 Shooting Star, a jet propulsion fighter. Principles of design incorporated in its wing were established by NACA research. They were used also in the earlier fighter planes, notably the North American P-51 Mustang, and the Douglas A-26 Invader.

Conducts Investigations

This fact illustrates the function of the NACA, which is to conduct investigations and reach conclusions likely to be helpful in the future, rather than to correct faults in any particular engine or airplane. All the NACA's information is available to the aircraft industry.

During the war this policy has been suspended. Military necessity dictated that the committee's experts apply themselves to many specific problems that arose in the case of the Boeing B-29 Super Fortress and other airplanes essential to victory.

Since the war started Dec. 7, 1941, the NACA has investigated for the army 42 types of bombers, 50 pursuits, and about 40 miscellaneous types. The navy has profited from the NACA's work to a comparable extent.

300 M. P. H. WIND ROARS THRU JET TESTING TUNNEL

BY FRANK STURDY

[Chicago Tribune Press Service]

Cleveland, O., June 23—The variety of testing devices in the engine laboratory of the National Advisory Committee for Aeronautics is fantastic.

There is a wind tunnel without a counterpart in the world. In it an air stream 20 feet in diameter races at 500 miles an hour. It is the only place on the surface of the earth where jet propulsion engines can be tested under conditions similar to the cold and rarefied atmosphere found at 50,000 feet

In a building not far away, a small laboratory houses specialists who study the chemistry of petroleum fuels and uncover the secrets of the infinitesimal hydro-carbons that put the punch in gasoline. There are more hydro-carbons in one drop of gasoline than there are people on this planet.

Molecules Regrouped

Thru refining processes the hydrocarbon molecules can be regrouped and made to do such tricks as causing the gasoline to burn slower or faster, or to vaporize at lower temperature and pressure.

More than 130,000 horse power is generated by the power plants at the laboratory merely to drive the testing machines.

The wind tunnel under maximim operating conditions requires 50,000 horse power. Generators for it are housed in a separate building. Humidity, temperature, and pressure are accurately controled in the test section where the wind howls at 500 miles an hour.

To reduce the temperature to 48 degrees below zero Fahrenheit, the tunnel has a refrigerating system which, if the committee decided to go into the ice business, could be converted into the world's largest ice plant. Its capacity is equivalent to producing 20 million pounds a day.

The Lockheed P-80 jet propulsion fighter, based on the NACA's high speed wing design principles, was tested in this tunnel. It proved that the Shooting Star would be capable of flying faster than any previous airplane.

Later, flight tests were made to correlate the wind tunnel and performance data recorded in the air. The loads and stresses to which the airplane was subjected were recorded by NACA flight researchers who measured the air pressures on wing and tail surfaces during high speed maneuvers.

These were of exceptional value because they were the first ever measured at such high flight speeds. The NACA pilot who flew these tests rode faster than any other human being ever had, but he did not bother to establish an official speed record.

Approach Speed of Sound

The P 80 was not the first airplane in which the problem of compressibility was encountered at speeds approaching the rate of sound—about 750 miles an hour at sea level. Earlier pursuit ships, powered with conventional radial gasoline engines, reached such speeds in dives.

Production of a successful jet propulsion turbine engine and its use in the P 80, however, meant that such speeds would be approached in level flight.

At the velocity of sound, the flow of air over the surface of a wing changes in character. Drag increases, and in many cases, control surfaces cease to function wholly or in part.

Present research is aimed at overcoming this phenomenon so that supersonic speeds can be attained safely.

Airplane speeds have increased enormously. At the close of World War I. the best pursuits flew at about 135 miles an hour—and more economically than is possible in any other form of transportation. To increase the speed of an ocean liner only six miles an hour would mean doubling the ship's horsepower.

The NACA's research has demonstrated that flight faster than sound is possible with new types of power plants. Nevertheless, drag still occurs increasingly as speed approaches sound. The committee is conducting further research to improve wings, fuselages, cowlings, and tail surfaces.

Huge airliners traveling faster than sound will be powered in all probability with gas turbine jet propulsion engines delivering 10,000 horsepower each. Much of the research at the Cleveland laboratory is devoted to exploring gas turbine possibilities.

Asked to Build Engine

Gen. Arnold, commanding general of the army air forces, asked General Electric to build the jet engine designed by Group Captain Frank Whittle of the R. A. F. This English engine was in an advance stage, and had been flown in an English aircraft.

The Bell Aircraft company designed the P-59 to take the Whittle engine. This plane is used as a trainer for pilots who will eventually fly the P-80 in combat.

The P-80 has an engine similar to Whittle's, but developed by General Electric, as a result of the company's own experiments. The NACA believes it to be as good as the German or British engines of the type, perhaps superior.

Germany was handicapped in building gas turbines by a lack of high heat resisting alloys. Consequently, the German air force product had to rely on an elaborate air cooling system which impaired its efficiency.

Nevertheless, the jet propulsion, twin engined Me-262 was considered an excellent fighter by the Germans, who operated it in small numbers for about a year before the war ended. American and British pilots reported, however, that it seemed to lack maneuverability and the pilots who flew it appeared to be inadequately trained.

A second type, the Arrado 234, was identified, but the Germans apparently never got it into sufficient production to be dangerous.

PITTSBURGH PRESS
JUNE 24, 1945.

Sky Trails—

Writers View Wonders of Air Research Lab

Experiments Shape Future of Aviation

By HENRY WARD
Press Aviation Editor

With fingers pressed tightly to their ears, a group of newspapermen huddled in the small room. Their eyes were fixed on a small tub-like affair from which sprouted numerous wires and tubes.

Ward

From the tub came a screaming sound like the screeching of a score of air raid sirens let go at high pitch in a small enclosure. The higher the pitch the tighter the fingers were pressed. Suddenly there was a terrific crash. The hatch of the tub was released, and looking into the steel container, the reporters saw twisted pieces of metal that had, a few seconds before, been the impeller of a gas turbine supercharger.

The impeller, a sort of streamlined "paddle wheel" made of a strong alloy, had been purposely torn to bits in one of the many experiments performed for the aviation writers. The newspapermen were seeing for the first time some of the many wonders, secreted for years, behind the closely guarded doors of the National Advisory Committee for Aeronautics laboratory at Cleveland.

2000 Feet a Second

Reaching into the steel tub (six inches thick and lined with 4-inch oak plank that had been splintered to bits) a scientist withdrew a small piece of the twisted alloy.

"This was coming your way at better than 2000 feet a second," he said. "Faster than if it had been shot from a gun."

We had gone to the NACA aircraft engine resarch lab not knowing what to expect. We came away, some eight hours later, the witnesses of experiments that will shape the course of aeronautics in generations to come.

The National-Advisory Committee for Aeronautics was established by Congress in 1915 to deal broadly with scientific aeronautical research. So exhausting has been this research that there is no airplane in existence today whose design is not profoundly influenced by NACA research.

Under Security Wraps

The 24-million-dollar lab in Cleveland is one of three such installations operated by the NACA. The other two are at Langley Field, Va., and Moffet Field, Cal. Since its completion in 1942 the Cleveland engine research lab has been under security wraps while scientists and engineers went ahead with their airplane power plants and fuels. The majority of the experiments now going on deal with jet, rocket and gas turbine propulsion, although the conventional type of propeller engine is not neglected.

Because of a highly efficient system of operation at the lab we were able to see the results of many of these experiments. In a few minutes we heard and saw what had taken many men long hours of tedious experimentation to work out.

Buzz Bomb Power

Peering through a small glass window of a high altitude chamber, the only one of its kind in existence, we watched the action of a jet ship under the simulated conditions of 28,000 feet altitude and temperatures reaching 40 below zero.

We tossed large pieces of wood into the swooshing exhaust of a mounted jet engine and then watched the wood sail across an open field as if it had been yanked by a giant. A model intermittent, ram jet engine demonstrated the power thrust utilized in the German V-1 buzz bomb.

Again we jammed fingers in our ears for the firing of a model German-type buzz bomb. The earth shook beneath our feet and although we stood a good distance from the rocket we felt the intense heat from the fan of flame that shot from the nozzle. The terrific roar could be heard for miles from the testing ground.

Through the observation window of another wind tunnel we saw a full-sized airplane battle an "ice storm"; watched ice form on wings and prop and then donned fur-lined suits to enter the tunnel after the "storm" was over. In this unique tunnel, where man makes weather to his own liking, extensive research is being made in a gallant battle to rid flying of one of its worst enemies—icing. And the quiet, young and unassuming men at NACA, who work like scientists but talk like laymen, are making great strides in defeating the ice menace for future flying.

Correct Engine Knocks

Into this tunnel water is sprayed to meet a 400-mile-an-hour wind, lowered to 60 degrees below zero. The plant used for generating the extreme frigid "weather" for this tunnel and the high altitude chamber is considered the largest refrigeration plant in the world—capable of producing the equivalent of 20 million pounds of ice daily.

A NACA-built high-speed movie camera has been rigged up to photograph the explosion of gasoline in an engine cylinder, thus enabling the fuel experts to study and correct knocking in an engine. The camera shoots pictures at the rate of 40,000 frames a second. The regular home-movie camera makes pictures at the rate of 16 frames per second. Shot with this high speed camera it would require 3½ hours to project a film showing a baseball player running from home plate to first base, the scientists estimate.

How an airplane loses fuel from "boiling" as the ship climbs to altitudes over 15,000 feet was clearly demonstrated in one of tests in the vast research for fuels. Pressure forced into a huge glass gasoline tank caused the fuel to "boil" and the degree of vapor loss was shown on a graduated tank after the fuel had been under pressure only a few minutes. Engineers estimate that on a 500 plane high altitude raid over Japan approximately 45 tank cars of gas are lost through vaporization. This means a loss in range and the scientists, you can bet, are delving into all sorts of tests to eliminate this shortcoming.

Other Tests Staged

Several other tests were staged to demonstrate the research going into the fuels. A knockless fuel made an engine sound like a thrashing machine when a drop of a chemical was added; the combustibility and various grades of gasoline were shown; the effect of proper mixture of air and gas through a carburetor nozzle bar; the final check on the behavior of gasoline in a specially equipped B-24.

The NACA is not only interested in perfecting the engines for our aircraft of tomorow but also in reaching the fuel formula for these power plants.

No small portion of credit for the tremendous part that airpower played in winning the European war goes to the 15-man membership of the NACA and the men who win wars with test tubes in this house of magic at Cleveland

Engineers Delve Into Propulsion

By Albert D. Hughes
Aviation Editor of The Christian Science Monitor

CLEVELAND, Ohio, June 27—Engineers at the Aircraft Engine Research Laboratories of the National Advisory Committee on Aeronautics here can make an engine "knock" dance under your very eyes. This effect from an improperly combusting aircraft engine is just one of the many phenomena into which NACA's Cleveland laboratory is delving deeper in order to lay bare their secrets.

The NACA's high speed camera, developed here also, is able to take photographs at the rate of 40,000 frames per second through the glass side of a cylinder head revealing what happens during the interval of a gasoline explosion. The NACA can then "slow down" the action of the explosion by projecting the film at normal speed.

In a "knocking" cylinder the flaming molecules of gasoline and air seem to perform a rythmic dance. What causes it? NACA experts say they are not sure, or, perhaps, they are not telling at the moment. At any rate, by knowing the nature of knock and its causes, investigations can again be launched to suppress it or eliminate its ill effects on internal combustion engines.

Tests Carried Out

Several times during the course of the inspection visit by members of the Aviation Writers Association to these laboratories nearly two weeks ago, we were asked to stop our ears with our fingers. This precaution was necessary in order to withstand the noises or the intensities of the experiments which were greater than the ear can endure. These trials were being conducted on engines or aircraft materials upon which the NACA is running tests.

Once, we had to go through a de-compression chamber to return us to "normal altitude." Again, we skirted the fringes of intense heat. Another time, we walked from a normally warm day into a sub-zero temperature.

But not until now were we permitted to disclose what we had seen in our visit to NACA.

Obviously, the most noteworthy of the NACA researches at the moment are those it is conducting on jet propulsion and the exhaust gas-driven turbine which produces the jet.

This is a broad subject, however, which leads off into such separate fields as the study of improved metals to withstand the high rate of speed and intense heat of the gasoline turbine, air flow for better compressors, fuel and combustion research, and the various forms of jet propulsion engines.

Our laboratory trip, which was so beautifully timed that many of us suspected that it, too, had been done by slide rules, introduced us to various types of jet engines on which the NACA is running basic researches. The investigations are directed to determine the best lines of attack to increase the thrust developed by these engines, and to reduce the fuel consumed.

Besides the controlled forms of jet propulsion, we were also shown the intermittent, or resonant, automatic jet, which is the principle employed by the Germans to drive their V-1 "buzz bomb." Our group is convinced that it has probably been as close to the driving end of a "buzz bomb" as any group.

Typical Understatement

It is, furthermore, convinced that the phrase "buzz bomb" is a typical British understatement. If one could imagine the concussion of guns of heavy caliber being fired with great rapidity, this would convey in a limited sense the tremendous driving power of the buzz bomb.

Later, the so-called "ram," or high-speed jet, was demonstrated. This is another form of automatic reactive propulsion which will find uses in the much higher categories of air speed. A small laboratory model was first shown at work.

Then, in the NACA's unique altitude wind tunnel, the only one of its type in the United States, we saw an improved form of the "ram" jet. This tunnel is able not only to duplicate rarefied air conditions up to altitudes of 50,000 feet but also it is able to go down to the low temperatures of such altitudes, a "bottom" of minus 48 degrees, Fahrenheit. The tunnel, furthermore, can produce wind velocities up to 500 miles an hour.

Speeds Tremendous

In another room we saw turbine wheel metals, which revolve at speeds of 16,000 revolutions a second at temperatures of 1,200 degrees, subjected to high frequency heating until they parted. The greater strength of the newer alloys was strikingly disclosed. As the materials continue to be improved to withstand even higher temperatures the fuel consumption of the gas turbine will be reduced. The power or thrust of the jet engine, furthermore, will be increased.

Again, we saw one of these wheels revolved in a testing pit until it burst at a tremendous overrate of speed. The turbine wheel was placed in a chamber which was then evacuated to reduce air resistance. Then a powerful compressed air motor whirled this wheel. The damage that the flying wheel pieces did to several inches of insulating wood lining the steel chamber was eloquent. From these tests the engineers can determine the margin of safety should overspeeds become necessary.

Gasoline is gasoline to most of us, but the NACA demonstrated the differences in the burning qualities of fuels it is developing for jet propulsion. Straight gasoline burned in a retort, for instance, produced only a "plop" when it exploded, but jet fuel caused a distinct whistle as though the engineer had blown across the top of the test tube with his lips. Studies are also being made on various types of burners to obtain the most efficient combustion.

Along with its researching on jet propulsion, the NACA has continued with its investigations into improvements on reciprocating engines. These include the development of better fuels, lubricants, and reduction of losses that occur when gasoline boils at high altitudes.

"Stop" Propellers

Primarily safety research is conducted in NACA's icing tunnel. Here methods of prevention

Continued on Page 4

NACA Engine Laboratory Work Disclosed To Writers

Vast research facility unveils world's only high speed altitude wind tunnel, largest icing tunnel, farsighted advancements in buzzbombs, jet, rocket, and turbine power.

By ALEXANDER McSURELY

Magnitude of research work at the National Advisory Committee for Aeronautics' engine research laboratory at Cleveland, Ohio, closed to the public since its beginning four and a half years ago, was unveiled to aviation writers, including representatives of AVIATION NEWS last week for the first time.

Built at top speed to meet war's imperative demand for accelerated research in motive power for airplanes, the $24,000,000 laboratory has already made important research contributions and assembled a staff of more than 600 highly trained technicians. It should prove a major factor in continuing U. S. leadership in aviation in coming years.

The laboratory disclosed such interesting research equipment as:

▶The only high-speed altitude wind tunnel in the world, providing wind velocities up to 500 mph. while simulating precise altitude conditions up to 30,000 feet, including temperatures as low as minus 48 degrees, and atmospheric pressures up to 50,000 feet.

▶The world's largest icing research tunnel with three test sections, for examining flight characteristics of propeller aircraft and airplane components under icing conditions, one of the most serious limiting factors in aircraft operations.

▶An engine research building with 5½ acres of floor space containing nearly 100 various research laboratories working on basic research problems of engines, accessories, metallurgy, etc.

▶A flight research division, for studying all types of powerplants in actual flight with specially instrumented planes.

▶A fuels and lubricants building containing chemical and physical laboratories which seek to develop new and more powerful fuels for reciprocating, jet, and rocket engines.

▶Test cells for operating jet propulsion and reciprocating engines with propellers, and controlled missile (buzzbomb) powerplants.

▶An instrument building where new research equipment is developed, and the administration building containing an extensive technical library.

More exciting than the actual research equipment were some of the prospects held out for higher speeds and longer ranges in future aircraft as the result of specific projects and demonstrations disclosed during the tour.

Realizing that the future of jet propulsion and gas turbines depends in large measure on developing parts which will withstand the terrific heats, stresses, and pressures produced, NACA scientists are whirling impellers at a velocity twice as high as that of a service pistol bullet, to determine their failure speeds. In a demonstration, one impeller was shattered by stresses while it was traveling at 39,000 rpm. or a speed of approximately 2,000 feet per second.

▶**Better Buzzbomb**—In studies on the Aeropulse engine, a ram jet type similar to that used on the German V-1 buzzbomb, it was disclosed that flapper valves have been developed (to admit the air into the nose of the powerplant) which have twice the life of those on the original buzzbomb powerplants.

The inspection of the laboratory also included demonstrations of the ram jet engine in a test cell and a view of the huge General Electric *Superjet* engine in operation in the altitude wind tunnel. The engine powers the Lockheed P-80 *Shooting Star*, which the Army calls the fastest airplane in the world. The visitors also were permitted to inspect this airplane, at its first press showing.

Highlighting demonstrations of research on fuels, were three exhibits:

▶A high-speed motion picture camera developed by NACA, photographed the combustion process in a jet-type combustion chamber at 40,000 frames per second. Projected at slow speeds the film makes possible study of detonation in order to produce fuels of higher anti-knock quality.

▶A transparent pressure chamber showed effect of pressure change on airplane fuel. As the simulated altitude increased, the gasoline vaporized at lower temperatures, and boiled away. On a 500-plane long-range B-29 raid at high altitudes, it was estimated loss of fuel from this boiling might amount to 450,000 gallons or the equivalent of 1350 tons of bombs. NACA researchers are trying methods of cooling fuel tanks and seeking to redesign the fuel to eliminate some of the lighter volatile parts.

▶A new carburetor nozzle bar which reaches a new high in vaporizing fuel to mix it with the air in the carburetor, was shown. Secret of the thorough vaporization was a series of tiny orifices along the bar, set in pairs at right angles to each other. As fuel flowed from each hole it met an opposing stream from the hole set at right angles, causing a thorough diffusion and vaporization of both streams. It was estimated this nozzle bar, through producing increased power, decreased fuel consumption and more uniform cylinder temperatures, will accomplish a substantial fuel saving.

Flight research demonstrations showed a Consolidated B-24 equipped with special instrument panels and test equipment making possible engine flight tests which might provide as many as 10,000 readings in a single flight.

Dr. Jerome C. Hunsaker, NACA chairman; John F. Victory, NACA secretary; Edward R. Sharp, manager of the Cleveland laboratory, and Col. E. R. Page, veteran AAF powerplants specialist, and liaison officer at the laboratory, gave brief talks explaining the research aims of the laboratory.

Convinced

Rep. Frances P. Bolton, Ohio 22nd district representative in Congress, who was invited to accompany the Aviation Writers 'Association tour through the Cleveland NACA engine research laboratory, was so impressed by the importance of the research going on there that she urged the tour be made a "required subject" for every person having anything to do with research appropriations.

"Not until members of Congress, and the bureau of the budget see our laboratories can they understand the necessity for continuing aviation research at a high level in the coming years," she said.

AVIATION NEWS, JUNE 25, 1945.

Research Vital to Future Peace

By the Aviation Editor of The Christian Science Monitor

CLEVELAND, Ohio., June 27—The most fundamental conclusion reached by members of the Aviation Writers Association who recently visited the laboratories of the National Advisory Committee on Aeronautics was that NACA research must go on in peacetime.

Congressional committees, who sometimes cannot see the value of aeronautical research, because it often does not show any immediate benefits, ought to go through these laboratories to see for themselves the essential nature of the work.

Most solemn of the implications that emerged from this conference: The Allies won only by the "skin of their teeth" over Germany, whose significant jet plane and bomb developments came "too little and too late." Next time, we, or any other nation, will be given no warning of war or invasion.

The NACA is one way to assure that the United States will never be scooped by any other nation in aeronautical progress.

Fuel Tests Tell Facts About Gas

Continued from Page 3.

and removal of ice formations in and on wings, engine, propellers, air induction systems, fuselage parts, and radio antennas are developed.

By the employment of M. I. T. Dr. Harold Edgerton's stroboscope, NACA tunnel engineers were able to "stop" the rapidly whirling propeller of a Bell fighter plane. Through the plate glass inspection windows of the tunnel one could observe ice formations build up on the propeller blades and wing surfaces. Later, we donned fleece-lined coats so that we could go into the tunnel and observe the formations at first hand.

From these experiments the NACA evolves methods of elimination of icing hazards on operational military airplanes. Advanced stages of this research, in which heated wings have been employed, will permit our military commanders in the field to continue with operations in weather that previously might have cancelled them.

Plane Prospects

In a conference with the heads of the various research laboratories after the inspection, we had an opportunity to put the direct question to these heads on many phases of the work at Cleveland. The most interesting conclusions, naturally, were those based on the future of jet propulsion. These were:

Jet propulsion will achieve the greatest air speeds until strictly rocket applications begin to evolve.

The internal combustion engine rather than being forced into the background, will produce efficient types of operation when compounded with the jet engine.

Exhaust gas-driven turbines, operating propellers, will provide performance approaching that of jet propulsion except at very high speeds, but with much better flight range.

The internal combustion engine, using its exhaust energy to make a jet, will be nearly equal to jet propulsion in speed, but will surpass the strictly jet-operated aircraft in rate of climb, especially for operation at high altitudes.

These experiences indicate, symbolically, at least, the faster and higher realms into which aeronautical research is now delving. NACA's Cleveland laboratory is representative of this revolution in aeronautics since much of it is occurring in the field of propulsion which is its special study. The research regions are vast, and as new things are discovered, they open even vaster fields for future study. All these pose many new aerodynamical problems for NACA.

Secrets Shown

Our visit, furthermore, was the first time since the beginning of the war that such a large and specialized group of writers had ever been permitted to invade the physical boundaries of these wartime-preoccupied, and hitherto highly secret, buildings.

Ground was broken for the Cleveland laboratories in January, 1941, just 10 months before the Japanese attack on Pearl Harbor. The United States was well into the war when the first research project was launched here in May, 1942. By the spring of 1945, the $24,000,000 installation here comprised some 15 large buildings and numerous smaller testing laboratories.

This newest of NACA installations is the third of the facilities which the Committee has available for use on the Army and Navy aeronautical problems which it is called upon to investigate, or solve, or both. The oldest unit is NACA's Langley Field laboratories in Virginia. Aerodynamics researches are carried on at Moffett Field, California, the other member of the laboratory trio.

The military air forces order the best combat aircraft that it is possible to obtain from American manufacturers. But this fact in itself does not necessarily mean aircraft may be produced which is superior to that of other nations. But the Army and Navy, armed with experience from the battle zones, can set researchers to work to develop the best combat aircraft that it is possible to devise. This research is the task of NACA.

Under the chairmanship of Dr. Jerome C. Hunsaker of the Massachusetts Institute of Technology, the Committee employs a most impressive staff of engineers, natural scientists, and technicians. Their efforts are directed by Dr. George Lewis.

AIR LAB PRODUCES WAR KNOWLEDGE

Engine Research Plant Here Yields Vital Booklets

EDITOR'S NOTE—This is the first of several articles intended to acquaint Clevelanders with a local facility that is playing an important role in the war effort and which will have an equally important part in the development of peacetime aviation.

BY JAMES D. HARTSHORNE

Among the more remarkable of Cleveland institutions, but also among the least known is the aircraft engine research laboratory operated by the National Advisory Committee for Aeronautics at Cleveland Airport.

Situated away from main roads, at the far west side of the airport and closely guarded, the laboratory is somewhat of a mystery even to its newer employees.

In their first weeks on the job new employees note the score or so of buildings, including two huge wind tunnels and a gigantic hangar. They see acres of floor space jammed with great electric motors, vacuum pumps and test "cells." They come across machine shops, carpentry shops, pattern shops and sheet metal shops.

2,400 Are Employed

They find that 2,400 persons, most of them highly trained engineers or skilled craftsmen, are employed about the laboratory. They read in the newspapers of successive congressional appropriations that have brought the cost of the laboratory to more than $25,000,000, most of it for equipment, and they learn that it costs more than $10,000,000 a year just to operate the laboratory.

But these new employees see no railroad sidetrack, no loading platforms, no piles of finished war material. They note that the many trucks which enter the spacious grounds go away empty, and they wonder what all the money is being spent for and how the laboratory is contributing to the war effort.

They would be even more puzzled perhaps if they knew that the product of the thousands of man hours and the millions of dollars is a number of rather thin booklets which would not begin to fill even one freight car.

Results of months of research, of tests ranging from those performed in a test tube to those carried out in a four-engined bomber are to be found in the booklets in the form of curves, tables of data, conclusions and recommendations.

Information Awaited

This information is eagerly awaited by engineers in war plants or in the field with the armed forces. It plays a vital part in keeping the development and performance of our warplanes ahead of those of the enemy's military aircraft.

Continued on Page 5.

Air Laboratory Here Becomes U. S. Center of Jet Propulsion

EDITOR'S NOTE—This is the second of several articles intended to acquaint Clevelanders with a local facility that is playing an important role in war and peacetime aviation.

BY JAMES D. HARTSHORNE

National center for basic research supporting America's determination to keep pace with developments in jet propulsion is the $24,000,000 aircraft engine research laboratory operated by the National Advisory Committee for Aeronautics at Cleveland Airport.

Long after Pearl Harbor jet propulsion was so hush-hush that even the words themselves were not used by laboratory personnel in referring to the laboratory's feverish concentration on improving the performance of this new type of aircraft motive power.

With victory in Europe and the increasing use of jet-propelled planes on the war fronts, the curtain has been lifted a little by the NACA.

Even a peek, however, such as was afforded members of the Aviation Writers Association on a recent tour of the laboratory, indicated that jet propulsion research accounts for a large share of the laboratory's activities.

Tests of jet propulsion materials and principles were encountered throughout the series of demonstrations and inspections that occupied an entire day and wound through most of the score of buildings on the 200-acre laboratory site.

In keeping with a new force which very likely will make possible for man to exceed the speed of sound in controlled flight in the not-distant future, the tests were always spectacular.

With fingers in ears the writers watched purple flames shooting from the tail pipe of a "ram jet" of the type used to propel V-1 buzz bombs against England. The reverberations of explosions occurring 45 to the second shook the ground, and the heat could be felt some distance away.

In the altitude wind tunnel a large gas turbine type of jet propulsion engine cast an eerie light through the thick glass windows of the test cell as it "flew" through 40-below-zero air, zipping past at hundreds of miles an hour.

The visitors got a sense of expectancy of great things to come in the new propulsion field. There was a definite impression that in a laboratory designed primarily for research on conventional piston-type aircraft engine, research had taken an unexpected direction that might mean the end of the use of piston-type engines in aircraft.

Cagy About Predictions

Researchers are cagy about predictions until they can be supported with data, but here and there a hint was dropped as to what the laboratory men were thinking.

"Development of present-day heat resisting alloys for gas turbines has made jet propulsion possible," said one researcher. "Even more superior materials are in sight. When they come, jet propulsion will rival the piston-type in efficiency."

"Conventional engines should not be used at super-sonic (faster than sound) speeds," said another.

"There is great interest in application of jet propulsion to commerical planes," said a third. "For light planes, jet propulsion may play an important part."

Officially, the NACA position has been expressed thus:

"The aircraft engine research laboratory of the NACA is representative of a revolution in aeronautics. The revolution occurs in the field of aircraft propulsion. Much of this laboratory is devoted to the full exploration of that field. The research regions are vast and many, such as high-temperature alloys for gas turbines and jet propulsion engines, more efficient compressor and combustion chambers, gas turbines and rocket power plants, and fuels for supplying power. The new propulsion systems open up extraordinary high speed possibilities which pose many aerodynamic problems for the other NACA laboratories."

Beehive of Laboratories

However, since all except a handful of the thousands of planes now flying are powered by the older, or piston-type engine, research on such engines still occupies its share of the attention of the laboratory's corps of more than 800 scientists and engineers.

The laboratory is really a beehive of laboratories varying in size from small cells to the enormous altitude wind tunnel which can generate winds up to 500 miles an hour at temperatures as low as minus 48 degrees Fahrenheit and can simulate atmospheric conditions such as would be encountered in flying at nearly six miles above the ground. To operate the wind tunnel, the only one of its kind, requires approximately 50,000 horse power.

Col. E. R. Page, army air forces representative at the laboratroy, told the aviation writers that the value of this tunnel to the army alone was considerably in excess of its cost.

For purposes of carrying out the work of the laboratory there are eight research divisions. A brief description of each will give an idea of the extent and nature of that work.

ENGINE INSTALLATION DIVISION is in charge of the altitude wind tunnel and makes full-scale studies of complete aircraft power plants, including jet propulsion units, as they are installed in fuselages or wing nacelles. Engine performance, cooling, drag and cowling efficiency can all be studied under almost perfectly simulated flight conditions.

ICING DIVISION operates another unique research tunnel for investigating flight characteristics of propeller power plants and aircraft components under icing conditions. Icing is achieved by introducing spray water into the wind stream and reducing the tunnel air temperature to as low as minus 60 degrees Fahrenheit.

Any atmospheric flight condition can be reproduced through the accurate control of air temperature, spray water drop-size, water concentration and air velocities up to 400 miles an hour. The importance of this research was underlined by the engineer in charge with the statement that ice is second only to enemy action as a hazard in military aviation.

ENGINE DIVISION conducts research work on detailed engine parts such as cylinders, pistons, valves and crankshafts in the Engine Research Building, which holds almost 100 different research laboratories in five and one-half acres of floor space.

ENGINE COMPONENTS DIVISION handles research on engine auxiliary components such as carburetor and induction systems, fuel injection, ignition and automatic engine controls.

THERMODYNAMICS DIVISION has responsibility for the far-reaching problems connected with jet propulsion and gas turbines.

SUPERCHARGER AND AIR FLOW DIVISION is also deeply involved in jet propulsion and gas turbine research. Focal point of this division's activity is investigations of air compressors.

FLIGHT DIVISION operates flying laboratories varying from a single-engine fighter to a B-29 Superfortress. When this division goes aloft in a plane, they may bring back as many as 10,000 data readings from the maze of instruments installed in the plane. The three main functions of the division are to conduct primary research on aircraft power plants that cannot be done under simulated conditions; to obtain fundamental power plant operating data so that research projects can be planned, and to prove data obtained from other research methods.

FUELS AND LUBRICANTS DIVISION seeks the secret of obtaining more power and range from power plants through improved fuels and lubricants. Rare fuels, commercially unobtainable, are synthetically produced in glass-lined reactors and purified in three-story high distillation colums. The division's chemical and physical laboratories have the lastest in spectographic equipment, an electron miscroscope capable of 30,000 diameter magnification, special equipment for studying combustion phenomena and other advanced tools.

To supply instruments, parts, tools and equipment that are not available on the market and must be specially built for laboratory use, there are extensive machine, wood, sheet metal, metallurgical heat treating and other shops.

CLEVELAND PLAIN DEALER
JUNE 24, 1945.

Continued from Page 4.

Eventually the new employees learn that the product of the laboratory is knowledge, the "know how" of making better airplane engines or of obtaining better performance from engines already in existence.

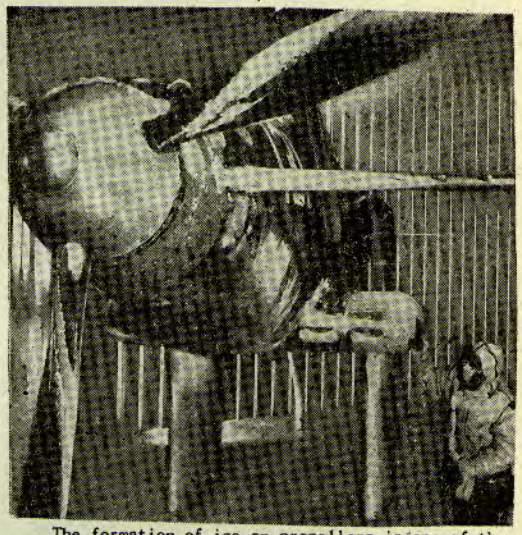
In peacetime the laboratory will be devoted chiefly to research of a fundamental nature, such as the improvement of cylinder surfaces, development of new fuels or the betterment of superchargers.

But in wartime the laboratory is dedicated to the needs of the armed services. Under the general direction of the Joint Aeronautical Board, the laboratory must relate all its activities to engines in use or intended to be used in the war effort.

Military security shrouds the accomplishments of the laboratory since it began operations early in 1942. Current research is even more hush-hush.

But it can be said that the laboratory has proved its worth many times over by the results obtained in military operations with information and methods developed at the laboratory or with the numerous "quick fixes" accomplished by its researchers in solving specific problems encountered by American aircraft flying in all parts of the world.

CLEVELAND PLAIN DEALER
JUNE 23, 1945.



The formation of ice on propellers is one of the major problems studied in the Icing Research Tunnel. This shows ice after a test run.

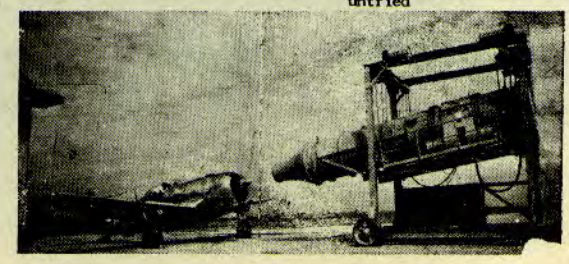
Victory Through Research

LOCKED in secrecy since shortly before Pearl Harbor, far-reaching technical accomplishments by the National Advisory Committee for Aeronautics have received little notice. As a kind of V-E Day bonus, NACA recently opened the doors of its great Aircraft Engine Research Laboratory at Cleveland, Ohio, to the Aviation Writers Association. They saw for themselves some of the far-reaching aeronautical strides already achieved and other now shaping up.

Photos on this page, first to be published showing NACA engine research, represent but a fraction of NACA activities. The Cleveland laboratories have become the well-spring from which flows the revolution now taking place in aeronautics. This revolution occurs first in aircraft propulsion, and new propulsion systems developed or improved here open up extraordinary possibilities which pose aerodynamic problems to be met by other NACA laboratories at Langley Field, Va., and Moffett Field, Calif. Engine research regions are vast and many, including high-temperature alloys for gas turbines and jet engines, more efficient compressor and combustion chambers, gas turbines and rocket power plants and fuels for supplying power. In addition, much improvement remains to be done in reciprocating-type power planes, and a considerable portion of NACA's Cleveland facilities is devoted to this end. These facilities include a 50,000-horsepower altitude wind tunnel, the only one of its kind in the world. With 30,000-ft. altitude conditions and 50,000-ft. pressures, it can duplicate humidity, temperature and pressures for testing complete power plant installations in winds up to 500 miles per hour. Cleveland's icing research tunnel provides a full range of conditions for testing propellers, power plants and other aircraft components in winds up to 400 miles per hour and temperatures as low as 60 degrees F. In addition, aircraft of all types and sizes are studied in actual flight. ★ ★ ★

SOUTHERN FLIGHT MAGAZINE

Full-power engine operations on the ground are made possible by this huge NACA blower, a life saver for test pilots. Producing 250-mph. airspeed, it eliminates take-offs with recent untried engines.



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TO
Jim Chambers, News Editor
The Daily Times Herald
DALLAS, TEXAS

NIGHT PRESS RATE COLLECT

AIR VIEWS by Lucien Zacharoff

Cleveland - A veritable revolution in warfare and world commerce is brewing as a result of secret aeronautical research, with very few laymen and not many more in the aviation circles aware of the profound developments gathering momentum under wraps.

Much of the world-shaking research that is very soon to burst upon us concerns aircraft propulsion. Promising breathtaking speeds above that of sound, the propulsion systems, now explored by miracle-working scientists and engineers, create problems of high-temperature alloys for gas turbines and jet-propulsion engines, of more efficient compressor and combustion chambers, gas turbines and rocket-power plants, and fuels supplying power.

The fastest warplane in operation today - the jet-propelled Lockheed P-80 Shooting Star - is but a harbinger of wonders to come. Don't be surprized if the windup of the air war in the Pacific is dominated by jet-propelled fighters ~~easily surpassing~~ approaching the speed of sound.

Were a new war to break out only a couple of years after this one, the nature of its weapons would be quite startling, with the P-80 appearing utterly obsolete. As yet undisclosed, the American research developments are proceeding apace.

But there's no telling what the other powers are accomplishing. Just let us fall a generation, just a fraction of a generation, behind in the

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To Jim Chambers, Times Herald, Dallas, Texas - 2 -

unremitting, extensive, urgent investigations feverishly pursued in the laboratories of the world, and a future annihilating surprize attack will make the Pearl-Harbor doublecross appear, by comparison, the very epitome of gentleness. No aggressor disposing of the ultra-modern Pandora's Box of aeronautical sciences and remembering the lessons of World War II, will give us a year or more to prepare a counter-offensive.

These reflections are prompted by a remarkable visit to the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics, at Cleveland Municipal Airport. NACA is the spearhead of aeronautical research in this country. With headquarters in Washington, its two other great scientific establishments are at Langley Field, Virginia, and Moffett Field, California.

Even before the Axis stab in the back had catapulted this nation into the war, NACA excluded all outsiders, including the press, from its wind tunnels and other facilities at Cleveland. It has just momentarily lifted for us a corner of the curtain shrouding its intensive work with the Army, the Navy, and the industry - the work of fashioning victorious air weapons. For the first time since the outbreak of the war, a group of members of the Aviation Writers Association was taken on an elaborate off-the-record tour of the lab here/

A mere technical enumeration of demonstrations given us may mean little

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To Jim Chambers, Times Herald, Dallas, Texas - 3 -

to the reader but we were left gasping and impressed as few revelations of wartime national secrets have impressed us.

We witnessed, among others, the fuels investigation on B-24, turbine materials research, impinging jets carburetor nozzle bar, fuel vapor loss demonstration, compressor impeller stress studies, axial flow compressor, combustion investigation with high-speed camera specially evolved by NACA, jet propulsion combustion research, fuels synthesis, altitude wind tunnel, icing research tunnel, intermittent ram jet propulsion, jet propulsion engine research.

Despite all those, ours was but a slight glimpse of NACA's program. Many absorbing volumes could be filled with the scientific magic already wrought and the almost incredible contributions about ~~kkk~~ to take shape.

As the air age's new areas of research and vistas of achievement stretch before us, let us remember that the NACA - and the research institutions maintained by the Army, the Navy, and the industry - are not only insuring our battlefield successes by studying and solving vastly complex military problems. They are making for safety and economy of peaceful aircraft operation, and for unprecedented performance levels.

Often we are reminded that civilization is transportation. The airplane is the most effective expression of modern transportation, with all its domestic and international social, political, economic, and cultural ramifications. Looking at the NACA in this light, it is difficult to name another factor that might rival it in its task of keeping the United States in the forefront of leadership in 20th century civilization. Our people and Congress owe the NACA, quietly going about its extraordinary business, all honor, gratitude, and support.

###

- Lucien Zacharoff

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