AERONAUTICS

World's Largest High Speed Wind Tunnel Just Developed

Only Glass Engine Cylinder, Through Which Scientists Can Watch Combustion, Among Sights at Langley Field

By ROBERT D. POTTER

DRONING airplanes overhead, guards at the gates and the colorful routine of an army post may catch the eye of the visitor at the Army's aerodrome at Langley Field, Va., but research which keeps those planes in the air and makes them continually better and faster is the more important scientific function.

In giant wind tunnels that can swallow an army pursuit plane and drive an airstream at it with staggeringly high velocities, the research scientists of the National Advisory Committee for Aeronautics are learning new facts which will soon be applied to military and civil aircraft.

Just a few samples are:

(1) A new type engine cowling which may yield additional miles per hour of air speed.

(2) New type wing section which will not go into a dangerous roll at stalling speeds.

(3) Diesel engines which weigh no more per horsepower developed than does a standard aviation internal combustion engine.

(4) Improved hull design for seaplanes which provides faster takeoff.

(5) Studies of airship structural faults.

(6) The magnitude of hitherto unforeseen forces which an airship may encounter in landing and takeoff.

The list might be continued almost indefinitely but the visitor on a hurried tour of the N.A.C.A. laboratories needs ever to keep the broad improvements in mind and avoid becoming lost in detail.

Major new device now available for research at Langley Field is the world's largest high speed wind tunnel, just completed at a cost of several hundred thousand dollars. Driven by a great 8,000-horsepower motor and fan, air can be rushed at large models of aircraft, or whole propellers, with speeds which approach the velocity of sound. High speed wind tunnels have existed before but their size permitted the use of only toy-like models two feet across at the most. N.A.C.A., in fact, has two such tunnels. But now models of eight-foot wing span can be sent through their research paces in the new structure.

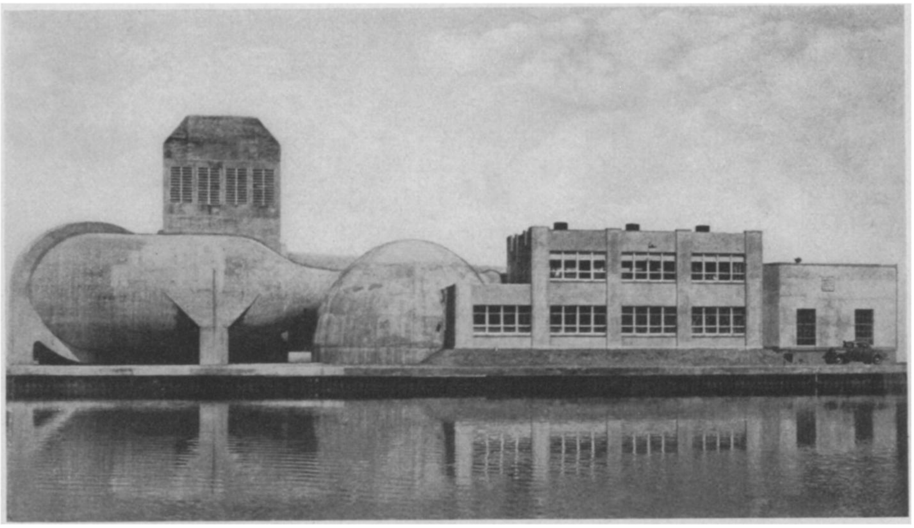
Advantage of using large scale models lies in the fact that what scientists find out on tiny models may not be true on a real plane in actual flight. The uncertainty of this occurrence—which scientists call the scale effect—is a problem which research is continually trying to solve. The new wind tunnel shown to military and civil aeronautical engineers at the recent N.A.C.A. conference is expected to provide new insight on aircraft research never before possible to attain. The very fact that the air speeds are higher than the world's record speed of aircraft and swifter also than the velocity attained in the hazardous power test dives is only one point indicative of the usefulness of the new development. Air stream velocities of over 500 miles an hour are possible in the device.

Particularly vital in connection with the present trans-Pacific oceanic seaplane flights and the imminent establishment of a similar service over the Atlantic, are studies at the half-mile long towing tank at the Langley Field Laboratories.

Here the visitor mounts the electric towing mechanism from whose bottom surface hangs a six-foot model of a seaplane float exact in every proportion with a real seaplane hull. The sweep of the bow, each and every rivet on the outer surface and the angle of the step, all are properly to scale.

At a signal the overhead towing car starts down its track. Slowly it starts at first like a real seaplane in takeoff. Then its speed increases to 30 and 45 miles an hour. The hull tilts back on the "step." The waves become larger and finally the measuring instruments tell that the hull (providing wings were attached) would take off in flight. And all the while the visitor keeps peering at the swiftly approaching end of the tank to see if he, personally, is going to crack up. But the brakes are applied in time and the hull is then returned for another run.

Maybe a similar hull, except that the rivets are flush with the surface, is next put through its paces and the scientists can measure the lessened amount of friction, and the much shorter takeoff distance required to permit such a hull to take the air. (Turn to page 362)



N.A.C.A. Photo.

GIANT WIND TUNNEL

Giant high speed wind tunnel at the research laboratories of the National Advisory Committee for Aeronautics at Langley Field, Va. In the beehive-shaped domed structure in the center is the test chamber where eight-foot models of aircraft can be tested in an airstream having a velocity well over 500 miles an hour. Size of the unit is shown by the adjacent two story building and the automobile seen at the lower right. Made of steel and concrete, the walls of the tunnel and the test chamber are two feet thick. In use the dome must withstand an external air pressure having a total force of 1,500,000 pounds.

culties encountered in the making of the Organospheres, thus having provided organic chemists and teachers with an effective tool for research and demonstration work.

But how, one may ask, do scientists know how large the atoms are? This is accomplished with X-rays by examining the reflected pattern produced when a beam of X-rays is shot into a crystal of the substance in question. In addition, the models themselves may furnish considerable information as to the sizes of real atoms. For, if certain molecules are known to exist and to behave in a certain way, the models may show that this behavior is only possible when the sizes of some of the atoms lie within narrow limits.

In this way, Dr. Steiger was able to assign to the hydrogen atom attached to an aromatic ring a radius of 0.00000000173 inches (0.44 Angstrom units). Several months later, an English scientist, Dr. P. L. F. Jones, obtained exactly the same value by a more direct method.

Dr. Steiger is now engaged in research to prove that several rather simple compounds must be mixtures of optically active modifications because they are not at all symmetrical in structure as is generally believed.

Science News Letter, June 6, 1936

From page 359

Over in the engine research laboratory the visitor stands speechless in the face of roaring engines. Here is the newest thing in Diesel engines, which weighs no more per horsepower developed than do the best internal combustion engines now in use.

Study Diesels

In the not-too-far distant future it may lead to the design of Diesel engines for airplanes and airships; the latter if the nation decides to go into the business of building them again. In the meantime the research engineers of the N.A.C.A. are studying Diesels from all possible angles to be ready if and when matters of policy are decided by government officials at Washington.

Typical of the advanced research is the world's only glass engine cylinder, whose walls are accurately ground to within a ten-thousandth of an inch, into which the scientists can peer and watch what really happens when the air and fuel surge into the firing chamber. Slow motion "movies" of these cylinder eddy currents are made when the engine is turning over at 1,500 revolutions per minute. Actual firing of the charge does not occur, but already much has been learned about the proper design of fuel nozzles and other problems.

To Prevent Roll

A new type of airplane wing section has been developed which avoids the hazards of wing-tip stalling when a plane tries to climb too fast. In the ten-foot diameter wing tunnel the N.A.C.A. scientists show the visitors visible proof of this development.

Tiny silk threads are mounted on the upper wing surfaces of an airplane model. In level flight the airstream flows smoothly over the wings and the threads lie flat. Then a concealed robot pilot mechanism within the model tilts the plane upward as in a steep climb. Immediately the threads near the wing tips start to flutter, showing that lift has been lost on those surfaces.

The torque created produces a roll which the controlling ailerons on the wings may not be able to counteract. The visitor shudders and is glad the model is not a real plane with him in it.

But then the new type N.A.C.A. wing is placed on the model and the same experiment performed. This time stalling, as shown by the fluttering silk threads starts near the body of the airplane instead of near the wings. Instead of rolling round and round the model merely oscillates slightly and only a vigorous push on one wing sets up the roll. As soon as the robot pilot in the model restores the controls to the normal position the plane comes out of its rolling flight.

Highly technical but vitally important for still higher airplane speeds are studies of what aeronautical scientists call "skin friction." This is the resistance of an airplane's surface even after all protruding parts have been suitably streamlined. Skin friction depends on the presence of a turbulent flow of air across the wings instead of a smooth flow. If the turbulent flow could be overcome on the wings of a large modern transport plane, the drag of the wings, which is ordinarily about 550 pounds, could be reduced to 100 pounds drag instead. The gain in speed, greater pay load and all the other factors whose improvement would come with reduced "skin friction" drag, offer a major airplane research objective.

Using model cross-section of wings and smoke, N.A.C.A. scientists are now studying the particular conditions which turn the smooth flow into the dragging turbulent flow. Here again wind tunnel research is vital.

So multitudinous are the research projects at Langley Field that the visitor is truly amazed. The significance of much of the work cannot immediately be grasped. Some of it, of military necessity, cannot be shown. But from it all one goes away with a wholesome respect for little-mentioned research which has aided materially in bringing American aviation to its present high stage of development and which—skill and appropriations permitting—will continue to keep it there.

Science News Letter, June 6, 1936

MEDICINE

Process for Making Milk Safe for Allergy Patients

A MILK which sensitive, or allergic infants and grown persons, who break out into an eczema-like rash every time they drink ordinary milk, could imbibe without any ill effects is described in a patent (No. 2,036,404) granted to W. O. Frohring, of Shaker Heights, Ohio.

The milk is pleasant, appetizing and agreeable to take, especially when sweetened with sugar, says the inventor, who has assigned his patent to the S.M.A. Corporation, producers of special baby milks.

Whole-milk, skim-milk and cream, he claims, may all be made non-allergic by his unique method. The non-allergic milk can take the place of egg yolk in making mayonnaise, states the patent, and egg-allergic persons who are sensitive to mayonnaise made with egg yolk can eat to their hearts' content of the non-allergic product.

Proteins contained in milk, such as casein, albumin and globulin, are blamed for inducing symptoms in allergic infants and adults. Giving milk a special heat treatment, the inventor has found, seems to eliminate or reduce the allergy-inducing tendencies of these proteins.

In applying this heat treatment, ordinary pasteurized milk is first poured into containers which are then sealed to keep air out. The sealed milk is then heated to a temperature of between 240 and 242 degrees Fahrenheit for about two hours. That is all there is to the process. The treatment kills spores and bacteria, and more important, without any apparent breakdown of the proteins, it changes them so that the milk becomes safe for milk-allergic persons to drink.

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