PRESS RELEASES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

For Release
Monday, July 14, 1958

SUPERSONIC TRANSPORT POSSIBLE, NACA SAYS

Research scientists of the National Advisory Committee for Aeronautics today indicated long-range transports capable of flying 2,000 miles an hour can be developed.

Progress made in solving some of the problems involved in the design of such aircraft, which could fly from New York to San Francisco in 90 minutes, was reviewed at the Inspection of the NACA Ames Aeronautical Laboratory.

Through cooperative effort of the aircraft industry, the military services and the NACA, supersonic flight has been made routine in fighter and research airplanes. Now it appears possible to extend these gains to provide transports and bombers capable of flying large loads over intercontinental distances at three times the speed of sound.

The NACA speakers said this achievement could be made through research to improve efficiencies in aerodynamics, structures, and propulsion. Aerodynamic efficiency is obtained by shaping the airframe for sufficient lift with least possible drag, while propulsive efficiency requires an engine, intake and exhaust system with the highest thrust at lowest fuel consumption. An efficient airframe structure gives the lightest weight at greatest strength to provide the largest proportion of payload in the gross aircraft weight.

Research efforts of all NACA laboratories and field stations, which have helped to bring such gains in the past, have convinced scientists that the extension of supersonic speeds to the heavy transport of long range capability is possible to provide through solution of design problems.

Knowledge of the many elements of supersonic flight applicable to the heavy aircraft is continuing to be gained by the NACA team. A part of the information is being applied to the North American B-70, the new chemical bomber under development for the Air Force.

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DATA USEFUL IN DESIGN OF SPACE VEHICLES
OBTAINED THROUGH ROCKET MODEL RESEARCH

Relatively simple, inexpensive solid fuel rockets are being used to launch instrumented research models hundreds of miles above the Earth and to speeds as high as 11,000 miles an hour in the search for scientific knowledge needed for future space vehicles. The technique of obtaining design data by means of the readily available, low-cost rockets was described today by scientists of the National Advisory Committee for Aeronautics at the Triennial Inspection of the NACA Ames Aeronautical Laboratory.

NACA has fired more than 3,000 rocket-propelled models since 1945 to supplement the agency's research in wind tunnels, specialized laboratories, and in piloted aircraft. The research models, having from one to five rocket stages and instrumented to telemeter to ground receiving stations information on aerodynamic heating, stability, and other flight characteristics, are launched at the NACA Pilotless Aircraft Research Station, Wallops Island, Virginia. More than 100 multistage research rockets are fired at the center each year.

Established 13 years ago to obtain aerodynamic data at transonic and low supersonic speeds, the station is now being used almost exclusively on hypersonic and space flight problems. NACA research models have flown higher than a million feet above the Atlantic Ocean and at speeds of 16 times sonic velocity -- more than 11,000 miles an hour. Five-stage rockets have accounted for the top speeds achieved.

Work is under way by NACA scientists aimed at increasing the speed of simple research rockets to satellite and perhaps escape velocities in the not-too-distant future.

NACA's technique for obtaining data at Wallops Island is to propel a research model to the highest speed desired, then record scientific information with suitable instrumentation. The rocket may be carried within the model, or it may be an external booster which drops away or remains attached after it has stopped thrusting. In simpler tests, the rocket itself serves as the basic vehicle and is equipped for flight by the addition of stabilizing fins at the rear, with the test model and its instruments attached to the nose.

Exhibited for the first time at the Inspection was a five-stage rocket assembly, 55 feet long weighing 7,200 pounds. The rocket motors employed were not developed for research purposes. They were obtained as off-the-shelf items; thus eliminating the necessity for NACA to expend major effort in the design and development of new propulsion systems.

NACA is believed to have been the first organization in the world to fire five-stage rockets. The first of nearly a dozen five-stage rockets was launched at Wallops Island in the autumn of 1956. The rocket displayed at Ames has an Honest John rocket motor as its first stage. The second and third stages are Nike boosters. The fourth stage is a Recruit, and the fifth stage in the research model itself is a Thiokol T-55 rocket.

NACA uses a variety of research techniques to study problems associated with space flight. One method, using five-stage rockets, is to fire the first two rocket stages during climb, propelling the model to an altitude of about 100,000 feet. The last three stages are then ignited in sequence as the model descends. This simulates the entry at high velocities of a ballistic missile into the atmosphere. Valuable information on aerodynamic heating is obtained in this manner.

In addition to providing high velocities, multi-staging gives the NACA freedom in the choice of flight-path and altitude and makes it possible to perform a variety of specific tasks with little or no change in hardware.

NACA is able to send out multi-stage systems along various flight paths without resorting to complicated and costly automatic guidance and control systems. The same effect is obtained by changing the initial launching angle and the time of firing the different stages. This means that the most complicated tool to be added to the system is a simple timer.

Most research models flown at Wallops Island do not represent any specific flight vehicle; they are usually research shapes of unconventional design. But there are instances where dynamic scale models of vehicles still in the design stage are tested to disclose opportunities for improvement before full-scale vehicles are built.

Use of comparatively inexpensive and easy-to-build models to correct design flaws make a pilot's first flight safer and sometimes prevents accidental destruction of multi-million-dollar prototypes. Scale models have proved to be ideal for revealing advance information on whether a particular flight vehicle will realize performance goals. NACA scientists sometimes find it desirable as a result of such flight tests to recommend design changes and then fly an inexpensive rocket model to determine quickly whether the modification remedied the deficiency.

Once a rocket model is flying freely, a telemetering system in the nose relays data to recording apparatus at Wallops Island, where the telemetered information is supplemented with records made in tracking the research model through photography and ground radar. Characteristics of the air through which a test model flies are determined either just before or immediately after the firing by means of sounding balloons.

As in wind-tunnel and laboratory research, the information obtained in rocket launchings is analyzed by scientists and incorporated in NACA technical documents. Many of the findings of recent years are applicable directly to the attainment of space flight.

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
AMES AERONAUTICAL LABORATORY
MOFFETT FIELD, CALIF.

For Release
Monday, July 14, 1958

NEW RESEARCH TOOLS SPEED AMES SPACE STUDIES

New research equipment going into service at the NACA Ames Aeronautical Laboratory designed to operate at the extreme speeds required for studies of satellites and space craft was disclosed today at the Laboratory's 1958 Inspection.

A huge light-gas gun capable of firing research models at 16,000 miles per hour into a 500-foot long pressurized range was shown to more than 500 guests at the Inspection. They also saw a new shock tunnel in which air flows at temperatures up to 12,500° F can be generated as well as a special application of the particle accelerator designed to study the effects of ionization, a phenomenon occurring during atmosphere entry.

The new light-gas gun, 200 feet long, is connected with a pressurized, specially instrumented firing range to form what is known as the Hypervelocity Ballistic Range. It is primarily intended for studies of aerodynamic heating at realistic atmosphere entry speeds. The gun operates on the principle of using helium, a light-weight gas, to propel the test model rather than conventional gunpowder. Much higher speeds are possible with this technique. Models 3/4 inch in diameter can be launched by the new apparatus. In the instrumented range are located spark stations for making shadowgraph pictures of the test objects in flight. Electronic timing equipment records the deceleration of a model under test.

The shock tube is a laboratory device to provide high speed air flows at high temperatures. The Ames Laboratory shock tube consists of a combustion chamber 25 feet long by 27 inches in diameter. It will be filled with a mixture of hydrogen and oxygen in helium which will be ignited to produce temperatures up to 4,500° F and pressures up to 15,000 pounds per square inch. This hot, high-pressure gas is then suddenly released into a pump tube 40 feet long and slightly over six inches in diameter. The pump tube is filled with air which is rapidly compressed by the shock wave created by the gases rushing from the combustion chamber to high temperatures (12,500° F) and high pressures (15,000 psi). The air is then expanded through a conical nozzle 7 feet long into a test section 1 foot high by 1 foot wide. The test section is long enough to accommodate models up to 18 inches in length. It terminates in a vacuum tank to receive the hot, high-pressure air after it passes over the model.

A laboratory device of this kind is most useful for studies of aerodynamic heating rates as they affect hypersonic vehicles, but it can be used to measure pressures and aerodynamic forces on models.

The ion accelerator is a member of a large and familiar family of laboratory devices known as particle accelerators. It is capable of creating and focusing on a target a beam of ions so that the reactions of the target under impact can be studied. An atom which has been stripped of an electron is called an ion. It possesses a positive electrical charge. Under the high-speed conditions of atmosphere entry, energy levels high enough to rip electrons from air molecules occur and it becomes necessary to know what effect the resulting ions may have on the materials from which space craft are constructed.

The new machine at the Ames Laboratory was constructed under contract by the Stanford Research Institute, Menlo Park, Calif., at a cost of $130,000. It is capable of generating the types of ion beams of primary concern to space technology. A second machine is now under construction by Stanford Research Institute.

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
LEWIS FLIGHT PROPULSION LABORATORY
2100 BROOKPARK ROAD
CLEVELAND 35, OHIO

For Release;
Monday, July 14, 1958

SPACE CRAFT PROPULSION SYSTEMS
DESCRIBED BY NACA SCIENTISTS

Intensive studies of propulsion systems for satellites and space craft were reported today by scientists of the National Advisory Committee for Aeronautics. Most interest is centered on three types of space propulsion systems, the chemical, nuclear and nuclear-electric.

In the presentation at the Inspection of the NACA Ames Aeronautical Laboratory, scientists said the most important characteristics of rocket powerplants for space are its specific impulse and its thrust-to-weight ratio. Specific impulse is the amount of thrust obtained from each pound of propellant used per second. Thrust-weight ratio is the measure of the engine weight against the power it produces. The objective of propulsion research is to obtain systems of sufficient power, high efficiency and good reliability.

Chemical rockets, such as those used in current missiles, produce thrust from the burning of propellant (fuel and oxidant) and ejecting the resulting hot gas through a nozzle. In contrast, a nuclear rocket obtains heat energy from a nuclear reactor which heats a gaseous propellant to a high temperature for ejection through a nozzle. The nuclear electric rocket converts energy from a nuclear reactor into electricity, which then forces small ionized particles rearward.

Chemical rockets have relatively low specific impulse but high thrust-to-weight ratios. High specific impulse and low thrust-weight ratios are characteristic of nuclear and nuclear-electric systems.

NACA conducts its propulsion research at the Lewis Flight Propulsion Laboratory in Cleveland, Ohio. Problems of chemical rockets being investigated at Lewis include the development of new high-energy propellants and components for their most efficient handling, as well as materials from which rockets and their components may be fabricated.

Major problems of nuclear rockets which NACA scientists at Lewis are working to solve include nozzle design; selection of materials and design to minimize weight, particularly shielding weight; and the establishing of reliability.

The reactor in a nuclear rocket is composed of plates containing the fissioning material and moderators which slow down the neutrons generated in the fission process. In an effort to reduce reactor weight a search is being conducted for better moderator materials.

Since the weight of the reactor and its shielding is heavy, only a moderate thrust-to-weight ratio can be obtained from this type of rocket. On the other hand, high specific impulse can be obtained because light weight propellants such as hydrogen may be used and no oxidizer is required for the combustion process.

In contrast to the chemical and nuclear rockets which impart velocity to their propellants by converting thermal energy to kinetic energy, nuclear electric propulsion systems accelerate the propellant by means of electrostatic or electromagnetic forces. Lewis scientists are investigating several types of these mechanisms.

In addition to the reactor and shielding weight, nuclear electric propulsion systems must contain the heavy equipment needed to convert thermal energy from the reactor into electrical energy. Thrust-to-weight ratio of these systems is very low.

Along with the problems found in nuclear rockets, nuclear electric rockets pose the additional need of finding means for lighter weight conversion of thermal energy into electrical energy and to providing cooling for the magnetic field, electrodes, and energy source.

Because the ejected plasma and ions from these engines are light and may be accelerated to extreme velocities, these engines have a high specific impulse and warrant further investigation.

A space vehicle taking off from the Earth must overcome a strong gravitational force and a high thrust to engine weight is essential. Characteristics of a chemical rocket make it best suited for this purpose.

A vehicle operating in satellite orbit or traveling from one planet to another is floating in space due to the combination of gravitational and centrifugal forces acting on it. In this case the craft's motor doesn't have to support or lift the vehicle weight so its thrust can be small. Thrust-to-weight ratio is of secondary importance.

Nuclear and nuclear-electric rockets use propellant sparingly and would be better suited for distant space flights than the fuel-hungry chemical rockets, but due to their low thrust-to-weight ratios would power vehicles on journeys which start from a satellite orbit.

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Special Assignments:

M. J. Hood - Technical presentations

D. S. Wentz - Brochure
Technical Editing for the Layman
Press Releases and Briefing
Press Room Operations

M. St. John - Invitations and Acceptances
Travel and Motel Reservations
Registration and Badges
Guest List
Auditorium Seating and Decorations
Luncheon Arrangements

J. P. Houston and J. S. W. Davidsen - General Planning and Coordination with the Director's Office of:
Memorandums
Personnel Assignments
Transportation
Timing and Routing
Seating and Supplies (Mr. A. Volkman)
Electrical and Telephones (Mr. S. Hanscom)
Refreshments (Mr. R. Igler)
Social Hour Coordination
Premises Inspection
Employes Inspection

H. J. DeVoto - Visual aspects of presentations involving:
Consult on General Decor and Presentation
Supervise Chart and Exhibit Design
Coordinate Brochure Format, Layout, Illustrations and Printing with Mr. D. Wentz