AERONAUTICS

Coast-To-Coast in Two Hours

Commercial aircraft will fly at three and four times the speed of sound by 1966. The problems preventing the design of airplanes to fly this fast have been overcome.

By A. L. BAUN

➤ IN LESS THAN eight years, by 1966 at the latest, the air traveler will fly commercially from Los Angeles to New York in under two hours. This means that he will fly at twice the speed attained by the U. S. Air Force Major Adrian Drew, official world speed record holder, who in a F-101A Voodoo jet flashed over the Mojave desert at 1,207 miles per hour.

Startling as this prediction may appear, a commercial aircraft application of speeds between Mach 3 and 4 by 1966 is achievable. Mach 3 and 4 is three and four times the speed of sound, which is 761 miles per hour at sea level.

At last, the aerodynamic and thermodynamic problems which have stymied structural designers striving to design an air frame capable of flight at speeds above Mach 3 have been solved. One obstacle remains to be solved: the propulsion engineer has yet to devise a means for accomplishing runway ignition of the pure ramjet engine.

Turbojet and Ramjet

Universal among propulsion engineers is the belief that because of present turbine-blade metals limitations, a substantial increase in turbojet thrust can only be accomplished by increasing the size of the engine. And increased size means decreased efficiency. A practical way to increase thrust of the turbojet would be to increase heat release rates (thrust is dependent upon heat release) by burning greater quantities of fuel without increasing the size of the engine.

But here the propulsion and metallurgical engineers are blocked, for if they increase the heat release rates of our present turbojets, turbine blade distortion becomes excessive. Eventually the metals limitation problem will be solved by some yet unknown metallurgical alchemist, but it is unlikely that this rare-metals Merlin will arrive for a good many years.

The aircraft that will fly commercially from Los Angeles to New York in less than two hours by 1966 will not be powered by turbojets. They will be powered by pure ramjets burning high-energy chemical fuels.

Simplicity in itself, the pure ramjet to the propulsion engineer is nothing more than a stovepipe through which a flow of fuel and air is directed and ignited. As a propulsion device, the potential of the ramjet far outstrips the conventional turbojet both in effectiveness and reliability. Its speed is limited only by the quantity of fuel that can be forced through the injector nozzles and by the air driven past the intake spike. The ramjet has no moving compressor or turbine blades to swell and shatter when heat release rates become excessive.

In ramjet engine operation, air enters at the front of the engine and flows over an inlet spike where it is compressed. (Generally, the spike is made of highly polished metal and is shaped like an oversized football.) After the air is compressed, kerosene, flowing under pressure through fuel injector nozzles, is mixed into the air flow. A small fraction of this mixture is routed past a "flame holder" where it is ignited by glowing gases in a protected mixing cavity.

The bulk of the mixture, ignited by the gases in the "flame holder," is burned in the engine's combustion chamber. The resulting high-speed propulsion jet is directed out the especially shaped exhaust nozzle at the engine's rear. The faster the engine moves forward, the greater the ram effect through the engine and the higher the thrust or performance of the engine. Without a large volume of air flowing into the front of the engine, no thrust is produced.

Why, then, are not pure ramjets installed on our commercial aircraft when as early as 1948 an airborne pilot turned off the jet power of his F-80 airplane and flew with the power provided by 30-inch ramjets mounted on the plane's wing tips?

Unfortunately, the pure ramjet has yet to be successfully ignited on the ground at speed zero. The ramjet must still be boosted beyond its critical ignition speed by a carrier aircraft or by some other propulsion system. However, within three years, runway ignition of the engine will undoubtedly be accomplished. Present advances toward attaining runway ignition of the ramjet engine are classified by the military.

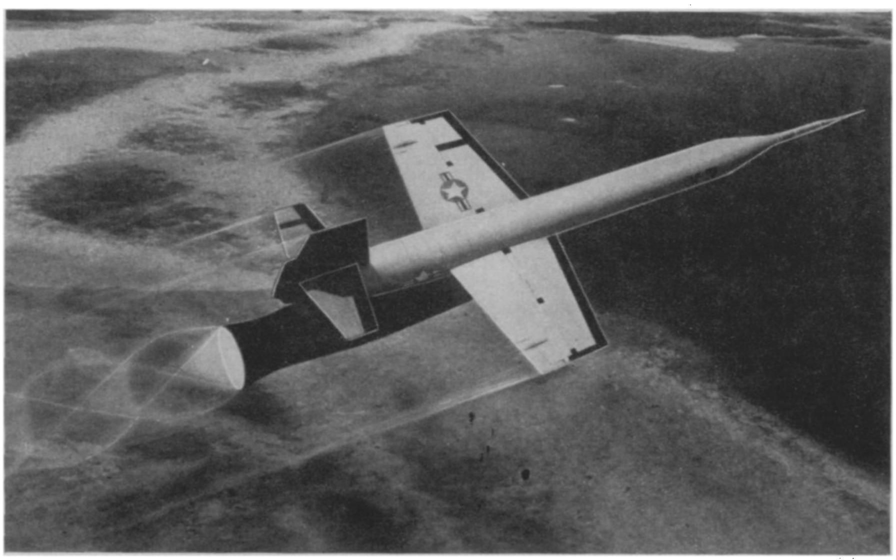
Foreign Nations Advance

The French are well-advanced in ramjet engine development. They have flown several models of the LEDUC manned ramjet aircraft which have been air-launched from conventional aircraft and ground-launched by employing turbine power to accelerate the ramjet to the required engine operating speed.

The British have exhibited a small supersonic ramject, the Bristol THOR, which is approximately 16 inches in diameter and produces approximately 15,000 pounds of thrust at a speed of Mach 3. Already, experimental bypass type engines have been runway ignited and flown by the military in Europe. The turbojet cuts out and the bypassed ramjet cuts in when the required ignition speed is reached.

In the United States, many successful flights of full-scale, ground-boosted and air-launched pure ramjet engines have been accomplished. These flights, in the majority, have been conducted by Lockheed Missile Systems Division of Sunnyvale, Calif., the foremost developers of test vehicles for ramjet engine flight testing.

Since 1947, Lockheed has been engaged in the development of a flying test bed for various ramjet engines capable of self-sustained flight at supersonic speeds and at extreme altitudes. Known as the X-7A,



RAMJET FLIGHT—For more than 10 years, Lockheed Aircraft Corporation scientists and engineers have tested ramjet engines in a vehicle known as the X-7A. These same ramjet engines promise to power commercial planes from Los Angeles to New York in two hours by 1966. This is an artist's conception of the X-7A in flight.

the Lockheed vehicle is air-launched, boosted to flight speed by a solid propellant rocket, and recovered without damage by means of parachutes and a ground-penetrating nose spike. These flights have provided supersonic free flight operational and performance data of great value to engine manufacturers who design and develop supersonic ramjets.

By-products of the Lockheed program have been significant contributions to high-speed parachute deployment, and transonic and supersonic aerodynamic data which are of value to air frame manufacturers and the armed forces.

Military Planes Proposed

Recently, three major American aircraft manufacturers, North American, Boeing, and Convair, presented preliminary proposals to the Air Force for a manned ramjet-powered bomber capable of operating at an altitude close to 100,000 feet, at a range of 10,000 nautical miles, and at a speed in excess of Mach 4. All three companies are experienced in the flight application of either turbojets or ramjets. North American built the NAVAHO powered by Curtiss-Wright ramjets, Boeing fabricates the BOMARC powered by Marquardt ramjets, and Convair is the producer of the B-58 HUSTLER bomber powered by General Electric turbojets.

In all likelihood, ramjet engines similar to the ones now being developed by Marquardt Aircraft Corporation of Van Nuys, Calif., and test flown with the Lockheed X-7A vehicle will power commercial aircraft by 1966.

Probably, these commercial aircraft, structurally resembling our most advanced fighter-bombers, will utilize twin engine installation slung beneath an air frame which has been plastic coated to reduce skin heating and erosion.

The air traveler in these aircraft must be willing to subject himself to impressive G-forces upon take-off if he wishes to whistle from the Pacific to the Atlantic in less than 120 minutes.

Science News Letter, June 14, 1958

PUBLIC HEALTH

Infants Should Have Polio Shots Early

➤ TINY BABIES should have their first Salk vaccine shot at the same time they receive their anti-whooping cough shot, the medical director of the National Foundation for Infantile Paralysis said.

Recent studies have shown that polio vaccine can safely be given simultaneously with other vaccines for infants. The combination offers safe, effective immunity, Dr. Thomas M. Rivers reports in the *National Foundation News* (May).

"Doctors usually start two- and three-month-old babies on DPT, a triple vaccine against diphtheria, pertussis (whooping cough) and tetanus," he said, "because whooping cough can kill the very young."

Smallpox vaccination is often delayed to save the baby discomfort. Since the Salk vaccine is a mild injection with no ill effects, there is no reason to delay polio protection, he said.

Paralytic polio in the very young, while unusual, is extremely tragic. A severe attack may cripple an infant for life. Dr. Rivers cited the case of an unvaccinated 18-week-old baby boy in Houston, Texas, who was stricken with polio last February and is now in an iron lung.

Dr. Rivers based his recommendation on two independent studies by National Foundation grantees. Safe, effective vaccination of two-month-old infants with Salk vaccine in one arm and DPT in the other arm was reported by Dr. Gordon C. Brown, professor of epidemiology at the University of Michigan.

Scientists at the Vanderbilt Well Baby Clinic in Nashville, Tenn., have also studied the effects of double vaccination.

The immunization plan advised by the American Academy of Pediatrics is as follows:

Infants of two months can be given their first DPT and Salk shots together.

During their third month, infants can be given their second DPT and Salk shots together.

At four months, the infant may receive the third DPT shot only; at six months, the smallpox vaccination. The third and last polio shot can be given when the infant is ten months old.

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MEDICINE

Combined Toxoid Fights Home Food Poisoning

➤ ALL FIVE of the known types of botulism food poisoning caused by improper canning techniques may soon be combated by one immunizing toxoid.

Botulism poisoning is caused by a poisonous substance, the toxin formed by a type of bacteria that grows in improperly processed foods. There are five distinct types of this poison.

The disease, although relatively rare today, does still occur in rural districts where home canning is done.

The disease is known to occur in persons who eat contaminated food, with death resulting in approximately 40% to 50% of the cases. In addition, the disease often strikes animals, sometimes in epidemic proportions.

To date, scientists have developed a toxoid which will fight off the poisoning and immunize animals. The next step will be a test of its immunizing power on humans, Dr. George G. Wright, Matteo A. Cardella and Mary Anne Fiock, of the U. S. Army Chemical Corps Laboratories, Fort Detrick, Frederick, Md., said.

Whether the toxoid will be successful in humans is not yet known. However, this is the first time a purified toxoid capable of simultaneously combating all five known types of botulism poisoning has been developed, the scientists reported to the Society of American Bacteriologists meeting in Chicago.

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