AERONAUTICS

America's Jet Age

The decade since first jet plane made its initial flight might be called fastest age in aviation history because of progress made.

By A. C. MONAHAN

➤ THE JET age in American aviation is now ten years old. The Bell Airacomet, America's first jet plane, made its initial flight on Oct. 1, 1942. The decade since then has been called the fastest 10 years in aviation history because of almost unbelievable progress in jet propulsion made in this short period.

It is a long, long step from the relatively simple Airacomet to the giant jet-bombers of today with their six or eight engines. There is little resemblance in the engines used, although they operate on the same basic principle. Design changes in fuselage and wings are as radical as the changes in the engines.

Today's jets that travel with the speed of sound are far different in appearance from the first jet, and still further removed from conventional planes powered by conventional engines. For travel at the speed of sound the body of the plane must be long and narrow, with an extremely smooth outer surface and no protuberances to create drag. Also thin-edge wings are required which can cut through the air with a minimum of resistance.

As is well known, the United States was not the pioneer in jet propulsion. England and Germany both were ahead of America. A jet-propelled British plane flew in May 1941. It was powered by a Whittle engine, designed by Sir Frank Whittle, a British scientist whose engine was ready for use in 1937. The first American jet engines, such as the two built by General Electric that powered the Bell Airacomet, were versions of this British power plant.

Much More Powerful

Jet engines of today which deliver a thrust of 5,000 to 8,000 pounds are five to six times as powerful as earlier types. They are more economical on fuel and have a longer operating life because of improved design and construction and particularly because metal alloys have been developed that withstand better the high temperatures under which jet engines operate best.

An additional help to the jet engine is the so-called after-burner through which discharge gases pass and in which additional combustion takes place to increase the thrust of the discharge. An after-burner may increase the thrust of a plane as much as 50% at times when bursts of speed are needed.

For high speeds in the transonic region and above, it is easily understood that a long sleek plane fuselage is essential, and one without projections which increase drag. Less evident are the structural changes necessary. Planes at superspeeds encounter stresses not ordinarily met.

Then they must be so constructed that they can resist the heat developed by friction as they bolt through the air. Still again, they must be able to carry the necessary radar and other electronic equipment required for high speeds. Automatic flight controls are essential because at great speeds manual control by a pilot is too slow.

Greatest Change in Wing

One of the most noticeable changes in jet plane design is in the wing. The thin forward edge of the wings used is not a prominent feature to the casual observer but the sweptback wing now coming into common use on jet planes is readily spotted. Ordinary wings project out from the body of the plane approximately at right angles. Sweptback wings may project backward as much as 30 degrees from the right angle position. They are used because at high speeds they lessen drag although probably they are not as efficient at take-off as conventional wings.

Another type of airfoil coming into use both in America and England is the so-called delta wing. This lifting surface is the shape of a triangle with three equal sides. The fuselage of the plane stretches along the center of the triangle, projecting some half its length to the front. The lifting surface can be regarded as an extreme sweptback wing but it contributes several advantages to highspeed planes.

In the 49 years since the Wright brothers flew the first man-carrying heavier-than-air plane, remarkable progress in aviation has been made. But in no equal period has such progress been made as in the past ten-year jet age. The big question now is the future of jet propulsion. The speedy jet planes now in combat service in Korea have proved their worth, both as fighters and bombers. The question now is the adoption of jet engines by civilian aviation and how lessons learned in the jet development can be applied to other civil needs.

England seems to be leading the way. A British-built transport powered entirely by jet engines is now in regular service between London and South Africa. A score or more of other jetliners are under construction or order. Some of them will be improved versions of the present plane. A Canadian company has constructed one jetliner which has now been thoroughly tested and is ready to construct others when the rush for war planes is over.

American airplane companies are also ready to build jet-propelled passenger airliners as soon as world conditions become more settled and the demand for war planes lessens. While this country as yet has constructed no jetliners, it has the "know-how," having constructed many giant jet-propelled bombers equal in size to transcontinental airliners.

The primary advantage of jet-propelled airliners is speed. Another advantage is passenger comfort due to the freedom of vibrations coming from reciprocating engines. Jet engines are less costly to keep in operating condition than conventional engines, it is claimed. Jetliners would be cheaper to operate than present transports, others claim, because of a saving in feeding passengers and providing other services in the greatly decreased time planes would be en route.

There are those who seem to think that before jetliners come into wide usage in America, planes equipped with the turbo-prop will be used. Transports so equipped would be in what might be called a medium-speed class. They would be faster than the average airliner with reciprocating engines but not as fast as commercial passenger planes powered by jet-propulsion.

Turbo-prop equipment employs a gas turbine engine to provide power to drive conventional bladed propellers. The turbo-prop is even newer than the turbo-jet, which is the type of propulsion used in jet planes. Its first use is said to be in England in 1945. But even in this short period the turbo-prop has established for itself a very definite place in aviation, both in England and in America.

Now the Turbo-Liner

Turbo-liners, transports equipped with the turbo-prop are already called. What is said to be America's first turbo-liner made its first flight in December 1950. The plane was built in California by Consolidated-Vultee and is a version of the 40-passenger standard Convair-Liner. It is powered with two turbo-prop engines developed by the Allison division of General Motors at Indianapolis.

The plane recently completed the longest flight made by an American turbine-powered transport, flying from California to Indianapolis. There it will be used in a research program to determine the suitability of turbo-props in commercial transports.

Turbo-props, it is claimed, would provide all the advantages of turbo-jet propulsion except the extreme speed. Being a rotary, not a reciprocating, type of engine it would impart no vibrations to planes and would provide smooth riding for the comfort of the passengers. It would provide the well-known efficiency of the gas turbine to aircraft propulsion. Like all gas turbine engines, it has light weight for the power it delivers.

It is only about one-half as heavy as an ordinary engine delivering the same power. This is important in aviation. It permits a plane to carry a heavier pay-load. Also it permits a plane to carry, without overloading, all the radar and other electronic and safety equipment now demanded in commercial planes that fly in all kinds of weather.

The development of the jet engine in this ten-year age of jet propulsion is perhaps responsible for the development of gas turbine engines used in the turbo-prop because both of these types of propulsion are similar in some respects. Both use a type of gas turbine engine.

In the turbo-jet, part of the high-pressure gases generated in the combustion chamber is used to drive a compressor to provide air for combustion. The rest is discharged to the rear to provide propulsion. In the turbo-prop all the gases generated are driven against vanes on a shaft to cause rotation of the shaft, at one end of which are conventional blades to provide propulsion.

The development of the turbo-prop during this age of jet propulsion may carry over into a wide usage in surface propulsion. Gas turbine engines have been widely used in stationary installations for many years. Now they are in experimental use in vehicles of various types.

Gas Turbine Locomotive

A gas turbine locomotive was relatively recently put into regular service on an American railroad where it is undergoing severe testing. A coal-burning gas turbine locomotive is under development. It would use for fuel very finely pulverized coal instead of oil. Its development is sponsored by a group of eastern coal-carrying railroads. The objective is a locomotive with the efficiency and economy provided by the gas turbine, which would use America's most abundant fuel and be independent of possible shortages in fuel oil.

The world's first merchant ship powered with a gas turbine engine has recently made a round trip from England, where it was built, to the Caribbean area. Small boats using this type of propulsion are in experimental use by American armed forces. The British vessel is a 12,500-ton tanker with one of its four diesel engines replaced by a gas turbine. The test trip was made using the gas turbine only. Many marine engineers seem to be of the opinion that gas turbines will some day be the preferred power for ocean vessels because of the efficiency and smoothness with which they operate.

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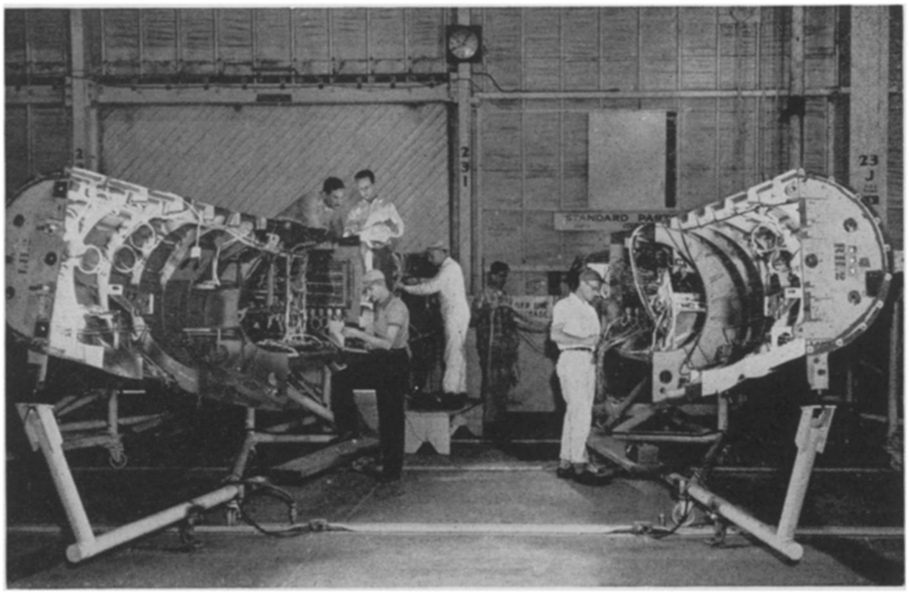
A Scottish-owned research ship, the Calamus, is being equipped with a *television* apparatus powerful enough to see life on the ocean floor at experimental fish-breeding grounds.



JETS ON THE HALF SHELL—To speed up production of the Scorpion, assemblers work on halves of the fuselage separately, installing plumbing, wiring and other equipment.

PHYSIOLOGY

Dextran Consumed in Body

Burning in body traced with radioactive dextran obtained by fermenting radioactive sugar. Discovery reassures doctors about using it as plasma substitute.

➤ FAVORITE AMONG blood plasma substitutes today is dextran, the chemical produced by bacterial fermentation of sugar.

Dextran gains this place as a result of new evidence that it is burned in the body like other sugars and starches. This was discovered through studies with radioactive dextran made at the request of the Surgeon General of the Army and under the direction of the subcommittee on shock of the National Research Council.

The fact that dextran is handled in the body and eliminated like carbohydrates makes medical men a little happier about using it. They do not like to inject something into the blood stream which is going to stick around in the body for a long time unless they can be sure it is perfectly safe.

Another of the new plasma expanders, called PVP, short for polyvinylpyrrolidone, is not metabolized in the body, as dextran is, and almost half of the original amount of PVP injected remains in the body. No one knows whether, over a long period, this will or will not be harmful.

Civil Defense authorities are stockpiling PVP for use in case of a national emergency, while the Department of Defense is stockpiling dextran and has cornered the entire supply for this year and most of next year's.

Dextran is not considered an ideal plasma substitute, or expander, because it does sometimes cause mild reactions. The cause of these is not yet known. The fact that it comes from sugar and is burned in the body and eliminated like sugars does not, however, mean that it gives any appreciable amount of nourishment to the patient.

This and the other plasma expanders, such as PVP and a special gelatin, are valuable in treating shock because they restore the volume of blood circulating through the body, though they do not have the