ASTRONOMY

What Makes Up a Comet?

Comets are born with hearts of "ices" of gases, a new theory holds. As this solid nucleus approaches the sun, the heat turns it into a huge gaseous cloud.

➤ A COMET is formed from a heart of "ices" of common gases, starting in the outer reaches of the solar system, an astronomer proposed.

Dr. Fred L. Whipple of Harvard College Observatory suggested that this solid nucleus, or heart, is turned into the huge cloud of gas, which makes up the head of the comet, by heat as it approaches the sun. Dr. Whipple's answer to a baffling riddle of the solar system—What is a comet?—was given to the American Astronomical Society meeting in Ottawa, Canada.

The "icy" solid heart from which the comet head is formed would not be large. Its diameter would be four miles, at most, and more likely about a half mile. In addition to water in its solid form, ice, Dr. Whipple believes that the solid forms of the gases ammonia, methane, carbon monoxide or carbon dioxide and carbon nitride are in the comet nucleus.

In addition to the "ices," the heart probably contains some bits of solid matter similar to meteors, or shooting stars. And there is a layer or shell of this matter outside the nucleus, through which the evaporation of the "ices" takes place.

The famed tail of the comet is known to be caused by the pressure of the sun's radiation which sweeps back gases and dust of the comet's head.

To have an "icy" heart, the comet nucleus must begin its lengthy travels far out in the solar system, practically out in interstellar space but still within the gravitational pull of the sun. Some comets are known which probably take millions of years to complete one journey around the sun. Others which have much shorter periods, such as those in planet Jupiter's comet family, may have been captured by the planet's gravitational pull, Dr. Whipple explained.

As the comet moves through the solar system, it gives off some of the gases, and this accounts for changes in its path, or orbit. Also lost are some of the bits of meteoric matter which cause the showers of shooting stars when these solid pieces of a comet strike the earth's atmosphere.

Under Dr. Whipple's theory, the ovalness, or eccentricity, of a comet's orbit would increase or decrease, depending on whether the comet's rotation was in the same or opposite direction as its path around the sun. If it is the same, the emission of gases would be backward, and the orbit's eccentricity would increase.

Thus, a well-known comet, Encke, has been observed to be decreasing its eccentricity, so it is believed to be rotating in an opposite direction from its path.

Dr. Whipple calculates that this comet has to lose only one five-hundredth of its mass each time it passes near the sun to account for the observed change in path. He estimates that comet Encke will last for about 2,000 years more.

Dr. Whipple's theory of what makes up a comet, agrees with another new theory of how a comet starts. An English astronomer, R. A. Lyttleton of Cambridge University, recently proposed that the comet nucleus is formed by dust and gas pulled together by the sun's gravity.

The English astronomer suggested that this takes place 20 to 1,000 times the distance from the sun of the earth. Dr. Whipple's theory favors the longer distance.

Science News Letter, July 2, 1949

AERONAUTICS

Non-Protruding Antennas

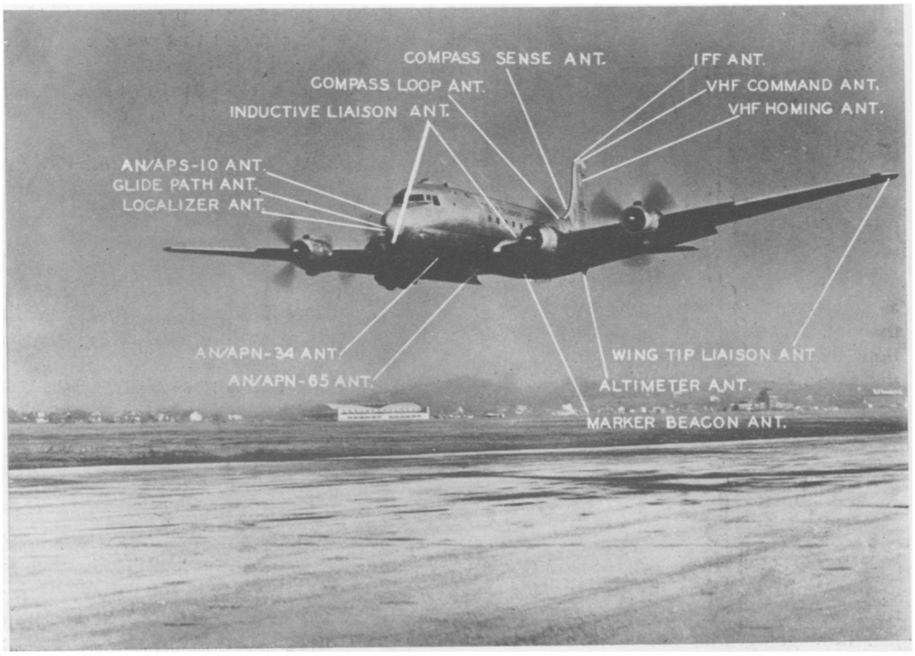
➤ SOME of the steps taken by the U. S. Air Force to eliminate drag on speedy planes caused by protruding radio antennas were revealed at the Wright-Patterson Air Force Base in Dayton, O. Over 600 horsepower is saved for propulsion purposes in some of the larger planes which may have as many as 15 receiving and sending antennas.

The new antennas, of which there are several types, are hidden in the skin of the plane or buried beneath the skin. In addition to being positioned where they cause no drag as protruding antennas do, they are safe from icing, precipitation static, the sealing out of moisture, and danger of breaking off at high speeds.

Flush-mounted antenna is a general term that applies to the new types. One is a pick-axe shaped antenna which rides inside the aircraft tail, protected by a plastic radome. A slot type is a slit in a thin metal sheet set in the airplane surface and covered with a dielectric material.

One of the latest developments in the field of zero-drag is the use of all or part of the airplane fuselage itself as an antenna. This technique has been necessitated by the use of low radio frequencies which require antennas sometimes as large as the aircraft they serve.

The solution of this problem came by isolating a small portion of the plane, for example a wing tip, and then feeding voltage across the plastic-covered isolating section, thereby exciting the entire wing.



15 BURIED ANTENNAS—Several hundred horsepower are saved by this new mounting of antennas under the aircraft skin. The former exterior mounting of antennas caused a drag on speedy planes.

Utilizing the same principle in an isolated tail cap, the fuselage can be energized to act as an antenna, Air Force scientists explain. The wing can also be energized by inserting an exciter coil close to it in the fuselage and electrically inducing energy over into the wing structure.

The importance of flush-mounting can perhaps best be seen in a C-54 cargo plane which has been outfitted with 15 dragless antennas of all types. Two of these antennas are in the wings, three in the nose, four in the tail, two in the dorsal fin, and four in the fuselage. These include antennas for the marker beacon, Command very high frequency (VHF) set, identification equipment of the automatic IFF (Information, Friend or Foe) type, VHF homing device, loran (long-range navigation equipment), radio compass, and altimeter.

Science News Letter, July 2, 1949

ENGINEERING

Gas Turbine Locomotive

See Front Cover

➤ THE wraps have been removed from America's first gas turbine-electric locomotive which was demonstrated to a group of railroad men, engineers and scientists in Erie, Pa. Its primary power is its gas turbine engine, a powerplant already widely used in stationary installations and coming rapidly into use in speedy airplanes.

The gas turbine engine is somewhat similar to the better-known steam turbine, but it utilizes high pressure jets of gas delivered against vanes on a shaft to cause speedy revolution of the shaft. The type used on airplanes, together with the means of propulsion, is often called the turbo-prop to distinguish it from the turbo-jet used in direct jet propulsion. In the turbo-prop the gas engine drives conventional propellers geared to the shaft to which the vanes are fixed.

This new gas turbine-electric locomotive shown on this week's cover of the SCIENCE NEWS LETTER is a product of the American Locomotive Company and General Electric. The turbine drives the electrical equipment that provides the operating power. The electrical system is not new except for minor details. Similar systems are in use on diesel-powered locomotives. The gas turbine, developed for this particular application, differs in certain respects from other types.

Basically all gas turbines are much alike as far as general principles go. Air is drawn through a compressor into several combustion chambers where fuel is injected and the mixture is burned. Burning of the fuel raises the temperature of the compressed air. The resulting gases are then expanded and move at great speed against the turbine buckets, or vanes, turning the shaft. Derived shaft power drives the load and the power plant compressor rotor.

The new Alco-G. E. unit delivers 4,500 horsepower. The locomotive has completed many road tests since November, 1948, and now will go into freight service on the Union Pacific for additional tests.

"Much remains to be done, even though it has completed certain road tests and performed very creditably," the group was told by Charles E. Wilson, president of General Electric. "But we certainly can assure you of one important thing: if the gas turbine-electric locomotive has possibilities as a major factor in railroad motive power, engineers of the General Electric Company and the American Locomotive Company will find that out!"

"The locomotive of the foreseeable future is the diesel-electric," the group was told by Robert B. McColl, president of Alco. "Today we are proud that we are furnishing the railroads in ever-increasing quantities with this efficient form of motive power." But he indicated faith in the new gas turbine type.

The present gas turbine locomotive burns low grade bunker oil for fuel. It exerts about twice as much horsepower at the rails as a diesel-electric locomotive of comparable size. Its power plant was described as at present much less efficient than the diesel engine. But with improvement in design and the use of better alloys its efficiency can be raised.

Science News Letter, July 2, 1949

AERONAUTICS

German Wind Tunnels

➤ WIND TUNNELS of German origin at the White Oak Naval Ordnance Laboratory near Washington, already employed but just now going into official operation, are expected to play an important part in the development of American aviation and particularly in the perfection of guided missiles.

These tunnels were captured by the American Army in Bavaria late in the recent war, dismantled and shipped to this country and reerected at the White Oak site with the help of German technicians from the Bavarian group brought over for the purpose. They are the same tunnels in which the famous German V-2 rocket was developed.

The former German aerodynamics facilities, together with improvements developed at White Oak, were described by Dr. Raymond J. Seeger and Lyman C. Fisher of the Naval Ordnance Laboratory. They spoke as guests of Watson Davis, director of Science Service, on Adventures in Science, heard over the Columbia network.

Scientists at the White Oak Laboratory have recorded air speeds with the use of these tunnels more than five times faster than the speed of sound. Roughly it was equivalent to 3,960 miles an hour, Dr. Seeger stated. And, he added, that they envision even greater speeds will be possible when new ballistics ranges are completed. He expressed confidence that speeds up to 8,000 miles an hour are within reach, and stated that scientists at the laboratory predict figures as high as 12,000 miles an hour.

The new ballistics ranges were described by Mr. Fisher as unique. There are two of them. One is operated at atmospheric pressure, while in the other the pressure can be controlled to simulate a wide range of flight conditions. They will be used for basic research and also to check the information obtained in the wind tunnels, he said. In a wind tunnel, the model under test remains in one place and the air passes around it. In the ballistics range, the model is actually fired through the air.

A unique feature of these former German wind tunnels is the way air is forced through them. In most tunnels the air current comes from huge fans blowing the air into and through them. In the White Oak installation, the air current is the result of suction. A 52-foot steel sphere is employed. Vacuum pumps remove the air from the sphere. A valve is then opened, and air rushes through the tunnel into the sphere.

The air can be pumped out of the sphere in about ten minutes. It is refilled with air sucked through the tunnel in about 40 seconds. Forty seconds is, therefore, the testing time. To measure all the positions a missile will actually endure in flight means the running of many separate tests.

But what happens in this very short period can actually be noted through a specially designed optical system, which means that in a sense the wind can be seen, and high-speed photography makes pictures for later study. In studying the pictures, such things as temperature, humidity and the position of the missile undergoing test must all be considered.

Science News Letter, July 2, 1949

Scanning radar, to detect approaching aircraft in the skies, can be given a far greater range than the ground-based equipment now has by mounting it in patrolling aircraft.

Strawberries have a higher vitamin C content than any of the other fruits commonly grown in northeastern states .