quite stable against heating, cooling and aging. There are reports that samples have been carried from Russia to Britain and still retained their anomalous properties at the end of the trip.

Anomalous water is 15 times as viscous as ordinary water and 40 percent denser. When anomalous water is mixed with ordinary water, the anomalous form separates out on chilling or is left behind when the ordinary water is boiled away, thus behaving like a separate substance that is highly soluble in ordinary water.

Some observe that the viscosity can be lowered by running the anomalous water up and down the tube several times. A similar phenomenon occurs with organic polymers that form pseudocrystalline structures that are broken up by the stresses of moving along the tube.

Normal water expands sharply as it is cooled through its freezing point. For anomalous water an analogous expansion occurs at temperatures between minus 40 and minus 60 degrees C. But on reheating, the material's behavior lags behind, and the corresponding decrease does not occur until the temperature reaches minus 30 to minus 15 degrees C. This behavior results in a difference between the temperature at which the material freezes and that at which it melts on reheating.

Observers disagree on whether anomalous water freezes. Some say it does; others says that chilling makes it form a glassy state rather than a crystalline solid.

The difficulty in determining just exactly what are the properties of anomalous water is that the capillary tube method yields amounts measured in millionths of a liter. Testing is thus very difficult.

A group under Dr. Brian Pethica at British Unilever Laboratories in Port Sunlight, England, is now trying to find a way to produce anomalous water in quantity. The group has tried condensing it in quartz powder and glass wool, but the latest report is that the problems are still to be solved.

J. L. Finney of Birkbeck College, London, who works under the direction of Dr. J. D. Bernal, has also been trying to increase production. He would like to use X-ray diffraction to study the structure of the liquid but feels he needs at least milliliter (1/1,000 liter) amounts to do it.

Very little has yet been published on the subject. Possibly the only public paper is Dr. Derjaguin's "Effect of Lyophile Surfaces on the Properties of Boundary Liquid Films," published in 1966 on page 110 of volume 42 of Discussions of the Faraday Society. There are some U.S. Navy preliminary reports, for internal consideration only.

ORBITING ASTRONOMER

Up and working at last

United States attempts to launch a satellite carrying telescopes for astronomical research have not been a tale of unrelieved success (SN: 11/16, p. 491).

The first attempt two years ago ended in a power failure. The second took on the character of a cliff-hanger as its launch date was repeatedly postponed. Toward the end it ran close to dates when its launch would have conflicted with preparations for that of Mariner Mars, which is tightly constrained in its launch window. There were fears that the Orbiting Astronomical Observatory would be bumped off the pad.

But, almost at the last minute, it went. Orbiting Astronomical Observatory A is now in orbit 480 miles up. It is working and communicating.

The OAO-A2 carries two experiments designed to observe ultraviolet light that is blocked by the earth's atmosphere. One was designed by scientists at the Smithsonian Astrophysical Observatory in Cambridge, Mass.; the other by researchers at the University of Wisconsin. Each experiment will work during alternate weeks of the flight. The satellite will be turned end over end between weeks to point the working experiment outward.

The Smithsonian experiment, called Celescope, consists of four large-aperture television cameras, each of which observes a different wavelength band. It expects to chart radiation from about 700 stars a day in these four bands. By mid-June, if the satellite lasts that long, Celescope will have catalogued up to 50,000 stars.

Instead of scanning the sky, the Wisconsin experiment will concentrate on one star at a time, averaging one per 100-minute orbit. It should obtain spectra and other information of much greater precision than could be gotten from the surface of the earth.

Up to now, it has taken 15 years and about 40 sounding rocket flights to obtain approximately three hours of ultraviolet data from some 150 stars. From the OAO-A comes twice that much information daily, and from fainter stars.

The experiments will also look at interstellar gas and dust and several planets in the solar system.

This and future Orbiting Astronomical Observatories are tools of a program to investigate astronomical objects at wavelengths unobservable from the ground (SN: 8/24, p. 188). Another satellite, Radio Astronomy Explorer A, which has been up for nearly half a year, is investigating radio bands blocked by the atmosphere. Future looks at infrared, X-rays and gamma rays are planned.

One of the most significant aspects of the OAO satellites is that they are planned not just as specific experiments, but as general observing facilities. Some three months ago, the space agency placed notices in several astronomical publications to inform interested scientists that a limited amount of time on OAO-A2 would be available to guest observers for their own researches. Almost 30 letters of interest were received from scientists at universities and in industry, of which NASA has so far replied to 19. These replies in turn have produced four formal proposals for experiments, all of which will be considered by OAO officials in mid-January. Selected experiments and observations could begin as early as the following month, assuming that OAO-A2 looks healthy enough to first give its principal researchers what they need.

Future observatories, presently scheduled for late 1969 and 1970, will make increasing amounts of time available to outside scientists. At present, OAO officials are seeking agency and budgetary approval for a Guest Observer Satellite, OAO-D, to be launched in the early 1970's, on which almost 75 percent of the observing time would be available to the astronomical community at large.

SONIC BOOM REPORT

Routes vs. sales

The boom of the supersonic transport has been the barb in most discussions of its future. The plane, as yet unborn, nevertheless has been cast as a breaker of window panes, a destroyer of national monuments and a disrupter of peace and solitude.

As a result of the advance unpopularity of the big plane's big shock wave, the Federal Aviation Administration, charged with developing the SST, long has held that the aircraft probably will be restricted to overwater routes. Maj. Gen. Jewell C. Maxwell, SST development director for the agency, says the FAA hasn't looked at a plane designed for overland flight since the early days of the program (SN: 3/16, p. 254).

Nobody connected with the program says outright that the FAA will not permit overland flights, however, nor has the agency gone very far out of its way to reassure people on the question.

Sonic boom opponents, as a result, are assuming that it is entirely possible that overland flights, if forbidden at the start, will soon be allowed. Uneasy, they reason that once the planes exist the pressure to fly cross-continental will be irresistible.

Moved by this unease and by a desire to be prepared when the time comes,

Interior Secretary Stewart L. Udall last December launched a study of the possible effects of commercial supersonic flight. The study group was to consider aircraft noise and sonic booms as a new form of environmental pollution, their effect on man and other organisms, and their effect on archaeological and historical structures.

The group has now reported. Among its recommendations:

- Nonmilitary supersonic flight be regarded as experimental at this time.
- Supersonic flight over populated areas be allowed only on an experimental basis while a full study of boom effect is made.
- Immediate large-scale experiments be carried out with existing supersonic planes to simulate intercity SST operations.
- A Presidential committee be established to hold hearings in all regions of the country likely to be affected by supersonic overflight.

Among other conclusions the report notes that if overland flight is forbidden, the "development and use (of the SST) would face a serious handicap." This, among other things, prompted a rapid reply from the FAA:

"The Secretary of Transportation (Alan Boyd) and the administrator of the Federal Aviation Administration have said publicly and repeatedly that commercial flight at supersonic speeds over the United States will not be permitted if the consequences of the sonic boom generated by such flights are judged to exceed public acceptance or to threaten the natural environment.

"All decisions regarding the economic feasibility of a U.S. SST have been based on the assumption that flight of the SST will be confined to overwater routes."

A Boeing Co. spokesman says development costs of the aircraft ($945 million for the Government, $271 million for the manufacturers, principally Boeing and General Electric, and $60 million for the airlines) will be recovered if 300 planes are sold. He says the sale of 500 planes by 1990 is expected even if overland flights are forbidden. Boeing says 1,200 planes might be sold if there are no route restrictions.

The report says little about some of the things the study group was originally convened to study. Land-dwelling wildlife is expected to make a "quite rapid" adjustment to sonic booms, and aquatic life is not expected even to notice them.

There may be structural damage to some historical and archaeological buildings and sites, such as the Mesa Verde cliff dwellings, but this could be minimized by rerouting aircraft.

The direct effects the report predicts "sometime after 1975" include an estimated 20 million to 40 million Americans under the expected flight paths being subjected to between 5 and 50 booms per day, depending on location. Another 35 million to 65 million would get one to 50 booms per day of lower intensity. At their worst, the report says, these booms would be as annoying as a large truck traveling at 60 miles per hour passing within 30 feet of the hearer.

TURBOCAR

Not dead but sleeping

It has been almost 15 years since Chrysler Corporation announced the first successful road-testing of a gas turbine automobile in this country. Since then, the turbocar has not seen the commercial light of day. It is far from dead, but its life may be more limited than its boosters once proposed.

This month, at a meeting of the American Society of Mechanical Engineers, some of the most prominent men in the field of turbine engines deliberated on the status, and the fate, of the gas turbine. It is moving, they agreed, toward the trucking and heavy equipment industries and to a lesser extent the military, but not toward the family garage.

Even so, it will take until the mid-70's before the turbine is a marketable commodity.

"The gas turbine of the present and the near future," says Dr. Bruno Eckert of Daimler-Benz AG in Unterturkheim, Germany, "will not be able to replace the Volkswagen engine from the economic point of view."

In the United States, most automobiles makers are in agreement. Ford is primarily working on turbines for trucks, acknowledging the difficulty of developing a turbocar.

General Motors is concentrating mainly on turbine engines for heavy-duty vehicles. Arthur Underwood, manager of the General Motors Research Laboratories, states flatly, "the gas turbine engine has no chance in passenger cars."

It is not simply such economical engines as the Volkswagen model that edge out the creation of a salable turbine-powered automobile. The mechanical engineers admit that perhaps if the automobile industry could start from scratch, the race might be closer.

But the industry cannot, and the long-term economics of the situation are a barrier to the jet-powered car, one that will not be breached for many years, if ever.

And it is precisely economics which bid fair to outweigh such advantages as a more powerful engine pound for pound, clean exhaust gases (little pollution), little maintenance, cheap fuels,